UNIVERSITY OF LEICESTER

RECOGNISING AND RECONSTRUCTING PREHISTORIC LANDSCAPES: A NEW CASE STUDY FROM EASTERN CUMBRIA

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For Mum and Grandad
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CHAPTER 1

INTRODUCTION

This research looks at the practical problems of integrating palynological and archaeological data in the context of landscape archaeology. The research concentrates on the differences in spatial scale of the two data sets and the difficulties these create for data integration. Using a case study from eastern Cumbria the research focuses on the recognition and reconstruction of prehistoric landscapes.

1.1 History of landscape archaeology

Landscape archaeology in Britain began to develop in the 18th century when both archaeologists and geographers were employed by the Ordnance Survey for cartographic recording. Antiquaries such as John Aubrey and William Stukely were also active in recording archaeological sites in the landscape at this time, particularly around Wessex. The nature of the work ensured that archaeologists began to concern themselves with wider landscape issues as opposed to single sites which had previously been the case.

It was not until the early twentieth century, however, that landscape archaeology developed into its own multi-disciplinary subject, employing techniques generated in the fields of archaeology, anthropology, history, environmental sciences, physical, historical and human geography. As a result of this development there has been a change in emphasis, in methodological terms, from traditional site-based archaeology, where excavation played a central role, to landscape studies where the spatial context of archaeological remains, and consequently field survey techniques, play a more dominant role.

1.1.1 Problems with landscape archaeology

As with any multi-disciplinary subject, there are inherent difficulties in the application of techniques used in landscape archaeological studies. The involvement of many specialists and the scale of the projects tend to make them expensive and different data sets are often ready at different times. The cost alone can lead to short cuts and the tendency to employ data derived from other projects which may not necessarily be compatible and, therefore, comparable. The practical integration of data for the purpose of analysis and interpretation is, arguably, one of the most difficult aspects of landscape archaeological projects. Even where the same basic methodological techniques are employed in two separate research projects, the extent to which the data sets are comparable will be dependent on the cultural and natural processes involved in the preservation, destruction and recovery of the data. Where attempts are made to integrate data from different research projects, there is a risk of entering circular arguments. For example, if a palynologist uses archaeological evidence to interpret the pollen data there is the possibility of an archaeologist then using that interpretation as evidence for an alternative explanation for the original archaeological data. It would appear that the largest obstacle to understanding the similarities and differences in field data is the common failure of archaeologists and other specialists to be explicit about their field and analytical procedures. As with most disciplines, the problem of practical integration is reduced when all the information has been gathered under the same research design.
Another difficulty in the analysis and interpretation of different data sets is that of spatial scale. The geographical area represented by each data set may vary quite considerably. This is particularly evident in the integration of, for example, archaeological data and palynological data, where it is very difficult to establish whether a vegetation history derived from palynological investigation actually relates to the area under archaeological investigation. This is due mainly to the natural dispersal mechanisms of pollen. Pollen can be transported very long distances by wind, water, insects, or animals and the source of pollen at a particular sampling site is often difficult to establish. In effect, fluctuations in a particular pollen type at a particular site could relate to changes in the vegetation cover some distance from the area under archaeological investigation. It is the problems of integration and spatial scale, particularly with regards to palynological and archaeological data that forms the focus of this research.

1.2 Pollen analysis as a landscape tool

Pollen analysis was first used in the 1920s to investigate the vegetational histories of deep deposits. Over time, pollen records accumulated and began to document changes in vegetation cover since the last ice age over widely distributed areas. Much of this analysis was directed at climatic reconstruction, and for many decades the interpretation of pollen diagrams was conducted with a strong climatic emphasis. The strong influence of climate on global vegetation patterns undoubtedly justifies this basic approach, but complications such as local soil influences, the impact of human cultures, the slow response of vegetation (particularly forest) to climatic change, and the effect of chance elements in determining the pattern of plant arrivals at a site, must all be borne in mind when using pollen data in reconstruction. However, pollen records have been used as a relative dating tool for climatic changes which were assumed to be fairly uniform over wide areas.

In the 1940s the pioneering work of Iversen, a Danish palynologist, identified the potential anthropogenic influence on vegetation (1949). Since then, pollen analysis has played a major part in the current understanding of the environmental setting, economy, and way of life of prehistoric human cultures. The detection of human modification of the environment may even provide evidence of a human presence before traditional archaeological evidence has been located (Edwards, 1996). The precision with which human influence can be detected from the pollen record is greatly facilitated by the practice of agriculture on the part of the cultures being studied. In agricultural communities one expects to find elements of destruction of the natural vegetation, the introduction of crop species, the presence of weed species associated with arable and pastoral activities (Behre, 1981), and the recovery of vegetation following the abandonment of the site, often in different proportions to the original vegetation cover (Delcourt, 1987).

The recognition of pre-agricultural activities on the basis of pollen data is far more difficult. In this case pollen evidence has to be placed alongside additional information from charcoal and inwashed soils, for example, in order to reconstruct local human influence (Moore et al. 1991).
The interpretation of results must include an assessment of biasing factors such as differential pollen productivity of plants, the differential preservation of pollen of different species, and different dispersal mechanisms. There is also the need to consider the taphonomic variables affecting the deposit from which the pollen was sampled. An important consideration has to be the nature and size of the sampling site. Jacobson and Bradshaw (1981) recognised that the size of the site will determine the level of regional, local or extra-local pollen rain entering the site which in turn will influence the interpretation of that data.

It is almost twenty years since Jacobson and Bradshaw noted that the judicious selection of sites for palaeoenvironmental and palaeoclimatic studies would permit palaeoecologists to answer specific research questions that go beyond primary descriptions of past vegetation (1981). Their work identified the relationship between basin size and pollen source area and predicted the proportions of local, extra local and regional pollen sampled by basins of different sizes. Their experiments were based on lake sites with surrounding woodland, but more recent experimental work by Bradshaw and Webb (1985), Bradshaw (1988; 1991), Sugita (1994) and Calcote (1995) on contemporary small hollows and forested sites has substantiated Jacobson and Bradshaw's findings. In 1988 Bradshaw concluded that "the only way to increase spatial precision is to sample sites that collect pollen that has mainly dispersed only short distances from its place of production" (1988, 726). In a later discussion Bradshaw (1991) uses a contemporary example from Killamey National Park, in south west Ireland, where two periods of woodland disturbance were followed by recoveries of woodland, albeit with modified composition. These phases were found to be clearly evident in the palynological studies of small, local, sites, but were not apparent in the regional pollen diagrams. Bradshaw concludes that a stable regional vegetation conceals the dynamism of the individual woodland stand (1991). Significantly, with regard to archaeological landscape studies, it is often such local and extra local effects of change on the vegetation cover that interest the researcher.

Despite the widespread acceptance of this research among palaeoenvironmentalists (cf. Moore et al., 1991), the results have received little attention from archaeologists involved in the interpretation and integration of palynological data. "Palynologists are usually aware of it, but we do not always remind ourselves that the users of pollen data may be less acquainted with the technicalities of inference" (Edwards 1991, 58). Schofield notes that the integration of palaeoecological information and surface artefact scatters would be made considerably easier if such information related directly to the precise study area under consideration (1991). In this sense the potential of such a technique has been recognised by archaeologists but has not, as far as can be ascertained, been widely accepted, despite the very clear implications for archaeological landscape studies. It is proposed here that, if it can be shown that pollen data relates to the same geographical space as the archaeological evidence, the process of integration will not only be easier but the potential of this integration considerably more productive in terms of the information recovered. The two types of data are more likely to complement each other, to the point where the vegetation history data could ask very specific questions of the archaeology and vice versa, enabling a more focused and detailed analysis.

It is suggested that pollen sampling sites which attract considerable quantities of regional pollen rain are unsuitable for integration with 'on-site' archaeological remains where the investigation is primarily concerned
with the local and extra-local vegetation cover. In contrast, a pollen sampling site dominated by pollen from the local area will have little to contribute to the understanding of the human/environment interaction of communities living some distance from the sampling site.

At the same time, however, there is clearly a need to address the problem of spatial scale, so that the full potential of available information can be realised. This research proposes a methodological approach to the collection of archaeological and palaeoenvironmental evidence which should ensure that the resulting data is mutually compatible in terms of spatial scale. The research focuses on the prehistoric periods from the mesolithic to the pre-Roman iron age.

### 1.3 The study area

The palaeoenvironmental record for Cumbria as a whole is relatively well documented. In 1970 Pennington was able to draw on more than sixty pollen diagrams for her synthesis of the vegetation history of north-west England (Pennington, 1970). This number has increased by at least twenty since that date and the region remains the most fully investigated by pollen analysts in Britain. The prehistoric periods feature most prominently in this evidence. Although both climatic and anthropogenic influences on the vegetation are recorded from the late glacial to the post-Roman period, it is the later periods which suffer with regards to detail. This has been corrected to some degree by the work of Barber et al. (1993), Dumayne et al. (1995) and Dumayne (1993a, 1993b, 1994), but the imbalance still exists.

The distribution of pollen core sites does, however, show a clear spatial bias towards the western side of the county with the greater concentration of sites being located in the Lake District massif and on the coastal lowlands to the north, west and south (Pennington, 1970; Fig. 1, 42). Within eastern Cumbria there has been a number of research projects involving pollen analysis but these, on the whole, have remained unpublished (cf. Chinn, 1990; Pierce, 1986; Webster, 1969). Exceptions to this include work on the Pennine uplands within the Moorhouse Nature Reserve (Johnson and Dunham, 1963), on Cross Fell (Godwin and Clapham, 1951), Knock Ridge (Turner and Hodgson, 1979) and from an archaeological site at Oddendale (Turnbull and Walsh, 1997). Eastern Cumbria is dotted with locations suitable for palynological investigations, so the distribution is more a reflection of where research has been carried out than simply the distribution of suitable deposits. The potential pollen sampling sites in the east of the county provide the ideal opportunity for palynological investigations and could provide a comparative study for the comprehensive coverage of palynological investigations from the west of the county. For the purpose of this research an area of eastern Cumbria was therefore selected. It was felt that a selection of sites from the east of the county would not only help to fill a gap in the spatial distribution of palynological investigations but would also enable the level of intra-regional variation in vegetation cover, which is evident in the west of the county, to be tested in the east.

In sharp contrast to the palaeoenvironmental evidence, and despite a considerable amount of archaeological research having been carried out in Cumbria, it is the Roman period which features most prominently in the
archaeological record. Accordingly, this work has resulted in a very significant bias in our understanding of the archaeology of Cumbria and, in fact, northern England as a whole.

This does not mean that other periods are wholly neglected. Nineteenth century antiquarians provide the first evidence of interest in prehistoric remains in Cumbria. Unfortunately the most prominent record of their investigations lies in the numerous robbed barrows and cairns, only a few of which were recorded in a meaningful form. Greenwell (1877) saw the potential destruction of such 'excavations' and proceeded to investigate and record the burial monuments of Cumberland and Westmorland. His work remains a major source of reference into these monuments and often provides the only testimony to many sites which are now lost in the landscape.

W.G. Collingwood was the first to recognise a need for systematic field work, and through the established Cumberland and Westmorland Antiquarian and Archaeological Society, set up an Excavation Committee. The Committee undertook to survey and excavate sites in the region which were subsequently published in the society Transactions. One such excavation was that of Ewe Close, the most well known 'native' settlement in eastern Cumbria (1908, 1909). These investigations were perpetuated by R. G. Collingwood (1933a and b) when he compiled a comprehensive survey of prehistoric settlement sites near Crosby Ravensworth, which ultimately formed a firm basis for the Royal Commission Survey of Westmorland which was completed in 1936.

Interest in the numerous 'native' settlement sites of eastern Cumbria continued throughout the twentieth century and is marked by the work of Webster (1969), Higham and Jones (1975), Higham (1977) and O'Sullivan (1980). Bewley has renewed the interest by proposing new methodological techniques for analysing the limited evidence available for these sites (1984a, 1984b, 1994).

Since the early 1970s this work has relied primarily on aerial photography, a technique which has not only increased the number of sites recorded (Higham and Jones 1975), but has also advanced our understanding of them (Bewley 1984a, 1984b, 1985, 1994). However, despite this profusion of information, it is the distinct lack of excavated examples which leaves the interpretation of these settlement sites problematic.

A major contribution to the archaeological record in recent years has come from the enormous amount of fieldwork carried out by the Cherry family on the limestone uplands of eastern Cumbria (cf 1987a) and on the coastal plains of western Cumbria (cf 1963, 1969, 1973, 1983, 1984a, 1984b, 1986, 1987a and 1987b). In these areas our understanding of the prehistoric exploitation from the late mesolithic to early bronze age has been substantially increased.

The lack of excavation in the area can be attributed, in part, to the lack of large scale development in the region (Clack and Gosling, 1976, Fig. 10). Contemporary land-use patterns, which consist largely of pastoral farming with small pockets of arable agriculture on the more fertile soils, and mineral extraction, mean that
developments are infrequent and generally on a small scale. The provision of Planning Policy Guideline 16 (PPG16), which is responsible for the majority of excavations elsewhere, is rarely implemented in this area.

Nonetheless, collectively, the research carried out has provided a considerable archaeological data base which is as diverse as the physical landscape it covers. This corpus of information illustrates the numerous records of single finds, artefact scatters, settlements, burial monuments and other ritual monuments of prehistoric date. Some of this evidence has been amalgamated into wider discussions of the archaeology of northern England as a whole (Higham, 1986) and into detailed investigations into particular elements of the archaeological record (cf Bradley and Edmonds, 1993). On the whole, however, the level of understanding, in terms of prehistoric human activity in the landscape, is limited. It is hoped that the focus of this research, on the prehistoric landscapes of eastern Cumbria, will help fill the gaps in the currently-biased spatial and chronological distribution of the archaeological record.

The study area selected is an area of eastern Cumbria which is defined here as the area east of the A6, south of Penrith and north of Orton. North to south the area focuses on the river Lyvennet, a tributary of the Eden, which runs from Crosby Ravensworth Fell (NY612107) northwards to meet the Eden just south of Temple Sowerby (NY612271). The Eden cuts through the study area diagonally south-east to north-west en route to the Solway Firth. Eastwards from the Eden the land gradually rises, through the piedmont foothills of the Pennines, towards the steep western slopes of the Pennine uplands which form the eastern boundary. The total area of the region is approximately 500 square kilometres. The area encompasses a sample of the diverse east Cumbrian landscape from the Pennine uplands in the north east to the broad, flat valley of the river Eden in the centre and the karst scenery of the limestone ridge in the south.

1.4 Aims of the research (Fig. 1.1)

In summary, the overall aim of this research is to investigate the problems of data integration and spatial scale in archaeological landscape projects, particularly with regards to palynological and archaeological data. It is proposed that, if it can be shown that pollen evidence relates to the same geographical space as the archaeological evidence under investigation, the process of integration will not only be easier but the potential of this integration will be considerably more productive in terms of the information recovered. On this basis, it is suggested that pollen sampling sites which attract considerable quantities of regional pollen rain are unsuitable for integration with 'on-site' archaeological remains where the investigation is primarily concerned with the local and extra-local vegetation cover. In contrast, a pollen sampling site dominated by pollen from the local area will have little to contribute to the understanding of the human/environment interaction of communities living some distance from the sampling site.

Using a case study from eastern Cumbria, the research builds on existing evidence to enhance the level of understanding of prehistoric landscape development from the mesolithic to the iron age. It is hoped the study area will help to fill gaps in the spatial and temporal distribution of the existing archaeological and palaeoenvironmental records.
Although the methodology is devised on the basis of the hypotheses proposed above, it is also aimed at testing the patterns evident in the spatial and chronological distribution of the existing archaeological and palaeoenvironmental record. Of particular importance is to test whether these patterns are a 'true' reflection of human activity areas or the result of differential preservation, destruction and recovery of data. It is also important to establish whether the intra-regional variation evident in the vegetation history and archaeological landscapes from the west of the county, are also apparent in the east.

1.5 Thesis structure
To provide a context for this research, Chapter Two provides a detailed but necessary synthesis of the currently available literature relating to the archaeological and palaeoenvironmental history of Cumbria from the upper palaeolithic to the iron age. Chapter Three addresses the problems encountered in the integration and understanding of the archaeological and palaeoenvironmental evidence and the effects these may have on the interpretation of the prehistoric landscape. Chapter Four then describes the physical characteristics of the study area in terms of the geology, geomorphology, drainage and soils. In Chapter Five the methodological approaches employed both in the field and the laboratory are outlined, whilst Chapter Six focuses on the physical results of the palynological investigations. The findings of the archaeological fieldwork and its basic interpretation are described in Chapter Seven. Integration of the archaeological and palaeoenvironmental data is attempted in Chapter Eight and the effectiveness of the methodological approach assessed. Chapter Nine presents the conclusions of this research and a consideration of the implications of the work for the region, and landscape archaeology as a whole. Recommendations for future work are also considered.
Aim

To investigate the problems of data integration and spatial scale in the context of archaeological landscape projects

Objectives

Through the integration of primary archaeological and palaeoenvironmental data, this research aims to enhance the understanding of the prehistoric landscapes of Eastern Cumbria.

Archaeological

Questions posed by the existing archaeological and palaeoenvironmental record

Are the patterns of both spatial and chronological distribution evident in the archaeological record a true reflection of human activity areas or the result of differential preservation, destruction and recovery?

Suggested methodological approaches to their solution

Investigate new or ‘blank’ areas to test the spatial distribution of the archaeological record.

Investigate at least one well-researched area to test the strength of the existing record.

Sample all physical zones in the landscape to test the intra-regional variation in settlement opportunities.

Sample sites to reflect local and extra-local vegetation history.

Sample all physical zones in the landscape.

Palynological

Is the intra-regional variation which is evident in the palaeoenvironmental record in the west of the county also evident in the east?

Integration

How can palaeoenvironmental data be fully integrated with the archaeological record?

Sample sites to reflect local and extra-local vegetation history.

Sample all physical zones in the landscape.

Select data sets that relate to the same geographical space.

Target areas which show a good archaeological record or offer the facility for new archaeological investigation.

Establish absolute chronologies by radiocarbon dating.

Fig. 1.1 Questions posed by the existing archaeological and palynological records and suggested methodological approaches to their solution.
CHAPTER 2

EASTERN CUMBRIA IN ITS WIDER CONTEXT

2.0 Introduction
This chapter reviews the available published sources relating to the prehistory of Cumbria. It provides a synthesis of the current state of knowledge from both an archaeological and palaeoenvironmental point of view. The level of detail in the chapter is reflected in its length but this was considered necessary to provide the context for the archaeological and palynological work which forms the focus of this research. Where evidence from Cumbria, for any particular period, is scarce, discussion based on material from other parts of the northern counties will be used to highlight current ideas.

The chapter is arranged in chronological order which not only helps to identify continuity and change through time but also pinpoints any biases in the temporal distribution of the research. The cultural chronology is based on that of Bradley (1984) but is cross referenced with Godwin's pollen assemblage zones for Britain (1956). Although Godwin's pollen zones are now rarely used in the interpretation of pollen diagrams, the correlation of these with the cultural chronology is important to the understanding of past research. With regard to the palaeoenvironmental evidence emphasis is placed on radiocarbon-dated pollen cores but mention of other, relatively dated, cores is necessary to illustrate the variability of the data.

Within this chapter radiocarbon dates have been quoted from the original texts with no attempt being made to standardise their presentation. Where dates have been extrapolated from their original context in order to explain other incidences, they have been written in the form of 'c.3000 BC' but have not been formally calibrated. The reason for this is discussed in more detail in Chapter 3.

2.1 The late upper palaeolithic landscape - Pollen zones II and III
The earliest evidence of human occupation in Cumbria comes from Kirkhead Cave in south-west Cumbria on the west shore of Morecambe Bay. The site has been the subject of numerous investigations dating from the late 19th century (Bolton, 1864, 1869) but most recently by Salisbury (1986, 1992). During the early excavations an enormous number of artefacts (now lost) was recovered but the limited recording of stratigraphic detail has left the chronology of the cave's occupancy difficult to interpret, although it is evident that the site had been used from early prehistoric times to the present day. Unfortunately, at this time, the stalagmite floor of the cave, believed to have formed during the climatic amelioration at the end of the last ice age (Salisbury, 1992), was removed, which in effect destroyed an important dating marker. Later investigations by Ashmead (1969, 1974) and Wood (1974) had to rely on typological analysis of tools and faunal associations as dating evidence. From these fairly small scale excavations Ashmead recovered twenty flint blade tools and a fragment of a Megaloceros sp (Irish Elk) antler which yielded a radiocarbon date of 10,700 ± 200 bp.
This implies a phase of occupation during the late Allerød interstadial (Fig. 2.1), a period when the vegetation was dominated by tree *Betula* but when high values of *Salix, Juniperus*, and herbaceous plants such as *Plantago* ssp., *Thalictrum* ssp. and *Filipendula* ssp. confirm an open woodland environment.

In Lowland Lonsdale, on the opposite side of the Kent estuary to Kirkhead, Oldfield has shown that this was a period of open water conditions (Oldfield, 1960, 212) and evidence of a wetter climate at this time is also recorded in areas of the Cumberland Lowlands (Walker, 1966) and Lakeland Haweswater. Pennington suggested that all ice and permanent snow must have disappeared from the Lake District at this time (Pennington, 1970, 56). Release of water previously tied up in ice would obviously contribute to the wetter ground conditions, particularly in lowland areas.

The onset of renewed instability of soils, which reached its maximum development in pollen zone III (Mackereth, 1966), can be seen to coincide, in the later part of the Allerød, with vegetation changes. The effects of falling temperatures were first recorded at the higher altitudes and in basins such as Blea Tarn and Windermere which include areas of different altitudes (Pennington, 1970). At these upland sites the changes in vegetation manifest themselves as a mixed pollen spectra of tree *Betula* pollen with that of open habitat species and with those which tolerate low temperatures. Chemical analysis of zone III sediments from Blea Tarn has shown that there was more severe periglacial erosion in the area than had occurred since full-glaciation (Pennington, 1970, 57). However, in Lowland Lonsdale, although there is some evidence of increased solifluction, these changes are less clearly defined and the transition from zone II to zone III is marked only by a slight increase in *Salix* and *Juniperus* shrub communities at the expense of *Betula* (Oldfield, 1960, 213). It would appear therefore that the open woodland environment of zone II was able to persist with little change, in these relatively sheltered lowland areas, throughout the Post-Allerød cold climate of pollen zone III.

This open forested landscape would provide an ideal environment for elk and corresponds with the conventional theory that the species was only found in Britain during pollen zone II. Gale and Hunt (1985), following their somewhat contentious study of the stratigraphy of Kirkhead cave, suggest that the *Megaloceros* species was able to migrate back to Britain during the later part of pollen zone III when conditions were rapidly ameliorating, towards the end of the Devensian glaciation. If, as the vegetational history record suggests, this lowland area remained little changed during zone III, there would be little reason for the animals to leave and the area may in fact have provided a haven from the severe conditions prevailing in the uplands. Since the inundation of the Irish Sea basin around 10,000 years ago, there is no evidence to suggest the Irish elk was an inhabitant of Britain. This, combined with the published criticism of Gale and Hunt's work (Salisbury, 1986, Tipping, 1986) supports the theory that Kirkhead cave was occupied during pollen zone II.

More recently late upper palaeolithic artefacts have been found at Lindale Low cave, 10 kilometers north of Kirkhead cave, on the north shore of Morecambe Bay (Salisbury, 1988). The flint artefacts, including
Fig. 2.1 Correlation of British and local pollen zones relative to the Blytt-Sernander sequence of Holocene climatic episodes and archaeological phases. Local zones (a) Cumberland lowlands (Walker, 1966), (b) Scaleby Moss (Godwin et al. 1957), (c) Valley Bog (Chambers, 1978). See tables 2.1, 2.2, 2.3 for details.
backed blades, are characteristic of the late upper palaeolithic and were recovered from beneath a stalagmite floor which extended over the whole cave and provided a sealed archaeological context. The site is now considered the most northerly Pleistocene exploitation site in Britain and together with the evidence from Kirkhead extends the known distribution of upper palaeolithic sites from north Lancashire into Cumbria.

Whether these caves were used all year round is difficult to determine, but Campbell suggests that Kirkhead was used by Late Upper Palaeolithic hunter/gatherer communities for the summer exploitation of horse and reindeer (Campbell, 1977). Certainly the location of the sites would make them ideal bases for the exploitation of both the Lancashire Plain and the Irish Sea Plain which would have extended, at that time, as far west as the Isle of Man.

The Younger Dryas glaciation (Fig. 2.1) saw drastic changes in the vegetation of Cumbria and particularly the Lake District uplands. At Scaleby Moss (Godwin et al., 1957) the breakdown of established plant communities was apparent before 8878 BC ± 185 BC (Q144), the date given to the beginning of pollen of zone III. At Blea Tarn the deposition of solifluction silts, formed in a period of severe winters, led Manley to suggest that between fifty and a hundred years of cold summers and heavy winter snow fall was sufficient to re-establish glaciers in the high corries and valleys of the Lake District (Manley, 1962).

In areas which were not directly affected by the ice at this time, a very distinct characteristic is recorded in the pollen spectra. The dominance of *Artemisia* is recorded in all basins and at all altitudes and is taken to reflect a true change in the composition of the vegetation rather than a problem of differential pollen preservation. Walker divides zone III into two Cumbrian zones, C7 and C8 (Walker, 1966). Pennington suggests this division corresponds with evidence from the Lake District with an early phase dominated by *Empetrum* and a later phase which displays an absolute minimum of trees and maximum occurrence of *Artemisia* (1970, 57).

### 2.2 The mesolithic landscape - Pollen zones IV - VIIa

An ameliorating climate brought this last glaciation to an end around 8,300 BC when warmth-demanding trees were able to spread across previously uninhabitable places. *Juniperus* was the first to colonise the open landscape followed by *Betula*, until closed *Betula* forest was established over the whole area up to an altitude of 760m (Pennington, 1970, 8). It was only above the tree line and along the coast that shade-intolerant species were able to survive, but in areas where solifluction continued to be active it has been shown that some late-glacial herbaceous species survived well into zone VIa (Pennington, 1964).

The rapid amelioration of the climate meant an increase in moisture and with it came the subsequent spread of *Corylus, Ulmus* and *Quercus*, which took place soon after the immigration of these trees into eastern England. *Pinus* on the other hand behaves quite differently in the north west than it does in south and east England. The *Pinus* curve is the most variable feature of the north-western pollen diagrams during the early post glacial period and has led to the suggestion that Pine was edaphically rather than climatically controlled (Oldfield, 1965, 258). The fact that it is recorded in relative abundance at some sites suggests it
was not climatically controlled. Where it is present in quantity its maximum comes in the later part of Zone VI, much later than the *Pinus* stage in south and east England and after the expansion of *Ulmus* and *Quercus*. This is obviously a regional phenomenon, for in Upper Teesdale *Pinus* was an important component of the post glacial forests (Turner *et al.*, 1973), whereas west of the Pennines *Quercus* made a greater impact.

The tree for which north west England does appear to have been at the climatic limit is *Tilia*, which does not appear anywhere in the region until the end of zone VI, and then shows a clear limitation to the limestone areas around Morecambe Bay where it still grows (Walker, 1955).

Another general feature of the highland zone of Britain is the persistent abundance of *Betula* as the dominant tree in the pollen rain through most of the Boreal. This is in contrast to its behaviour in south and east England, where it is suggested that *Corylus* prevented the regeneration of *Betula* forest. In the north west the *Corylus* maximum of zone VI implies that the two species were able to thrive simultaneously.

During zone Vlc there is some evidence for a reduced precipitation rate at some sites in the Lake District (Blea Tarn, Low Tarn, Burnmoor Tarn and Brant Rake Moss) and this is considered to represent the Boreal/Atlantic transition in the pollen profiles. This corresponds with recorded reductions in water levels from other parts of the country (Godwin, 1956, 32). This dry phase was not evident in lowland Lonsdale where the *Pinus* forest of zone Vlc was replaced by deciduous woodland during the Atlantic period (zone VIIa). In the Cumberland lowlands Walker suggests that water levels in fact rose as *Betula* was replaced by *Alnus* in hollows and valleys during the Boreal/Atlantic transition. The evidence of *Alnus* wood found in valley peats and a considerable increase in *Alnus* pollen suggest that the species must have predominated in valley mires and as hillside *Alnus* woods on flushed soils of the Lake District at all altitudes up to 370m (Walker, 1966).

The well drained lowland soils and the deeper soils of the uplands, which remained as free-draining brown earths, were occupied by oak and elm throughout the Boreal and Atlantic periods in the Lake District (Pennington 1970, 63). The more base-demanding *Ulmus glabra* (elm) contributed a higher percentage of the pollen rain at the higher sites of the Lake District than in either the valley deposits or in lowland Cumberland, suggesting that steep and eroding slopes maintained a higher base-status in soils than the more subdued topography of the drift-covered lowlands. However, Mackereth has shown that zone VIIa was a period of rapid leaching and that by the end of this period many of the soils of north-west England, except on the limestone, must have been approaching the limit for regeneration of elm. This high rate of leaching is correlated with a low erosion rate, which leads Mackereth to conclude that a stable continuous forest cover must have occupied the drainage basins of all the Lake District lakes so that erosion was minimal during this period (Mackereth, 1966). Evidence of a closed forest canopy is substantiated by the rare occurrence of Ash (*Fraxinus*), a light-demanding species which probably only colonised natural clearances created by the death of large trees.
With the continuing improvement in climate throughout the eighth millennium BC came a rise in sea level and subsequently the inundation of the Irish Sea basin. The effects of marine transgression on the western coast have been studied in North Lancashire by Tooley, who recorded that the Mean High Water of Spring Tides rose rapidly from below -15m OD in c.9000 BP to reach OD c.6500 BP and continued to rise to its present level of 4m OD (Tooley, 1974, 1978). These figures have led Bonsall to conclude that the evolution of the Eskmeals foreland started with rapidly rising sea levels during the early Holocene followed, after 6,000-7,000 BP, by a relatively stable possibly slightly declining sea level (Bonsall et al., 1990).

The marine transgression which laid down estuarine clay below the mires of south-western Westmorland is thought to have come to an end by early Atlantic times, with no evidence of subsequent Atlantic or Sub-Boreal transgressions (Smith 1959).

The rising sea levels eroded the land link with the continent in the North Sea basin in the 7th and 6th millennia BC, defining Britain as an island by 5800 BC at the latest. The greater oceanity of Britain was probably responsible for the increasingly wet conditions of the 6th millennium and the resulting changes in vegetation. Peat formation was already occurring on poorly drained uplands by c. 5,500 BC (Johnson and Dunham, 1963, 145) and near the west coast at Brant Rake Moss Sphagnum peat appears before the beginning of the Atlantic period (Pennington 1970, 65). However, on the whole it is the Atlantic phase which is characterised by localised peat formation particularly in inflow drainage hollows such as the Solway mosses and on, for example, the poorly draining upland plateaus. The impact of peat development is still restricted until 3,000 BC, when the development of blanket peat speeded up and replaced woodlands in areas such as Upper Teesdale (Turner, 1973, 328).

The rapid amelioration of the climate and improved habitat must have been attractive to at least small scale hunting/gathering groups, but archaeological evidence for human occupation of Cumbria between c.8,300 BC and c.5,000 BC remains elusive. It is possible that the coastal lowlands which were being exploited in the late upper palaeolithic (Bolton, 1864; Campbell, 1977; Morris, 1865; Salisbury, 1986, 1988, 1992) continued to be important during the early mesolithic. The vegetation history of the lowlands north of Morecambe Bay certainly suggests that this area was little affected by the glacial conditions which prevailed in the Lake District massif at this time (Oldfield, 1960). It is likely, however, that the increasingly wet conditions of the sixth millennium BC which resulted in the inundation of the Irish sea basin, have rendered the archaeological evidence inaccessible.

2.2.1 Mesolithic archaeology

It is c. 3,500 years after the recorded use of Kirkhead Cave that we find evidence of further human occupation in Cumbria. The evidence in general comes in the form of surface artefact scatters and hence brings with it all the interpretational problems associated with such assemblages, notably the restrictions placed on dating flint scatters (Schofield et al., 1991), the difficulty of provenancing artefacts (Bowden et
A chronological framework which distinguishes between early mesolithic broad blade and late mesolithic narrow blade industries has been developed, and since the 1950s has been supported by radiocarbon dating. In the north, the earlier broad blade industry has been placed within the 8th millennium BC (Jacobi, 1975, 1976) but the very subtle differences which divide the two industries are difficult to implement when finds occur as mixed assemblages as they often do in the north.

Although not unknown, very few typically early assemblages have been recorded in the northern counties and no industrial sites have been investigated to a standard which allows discussion (Higham, 1986, 20). In Cumbria it is only the later, narrow blade, industries which are represented in the archaeological record. These assemblages, where dated, are very late by comparison to the east of the country where, at Filpope Beacon in south-east Durham for example, the earliest narrow blade assemblage known in Britain is dated to the first quarter of the 7th millennium (Jacobi, 1976). It is possible that some at least of the microlith assemblages from Cumbria are earlier but these tend to lack the association with organic material necessary for radiocarbon dating.

Another difficulty in distinguishing between the early and late industries is created by the type of material used in the production of tools. In the absence of locally available, good quality, flint resources Cumbrian mesolithic communities readily made use of pebble flint, chert and volcanic tuff. The physical and chemical properties of these materials make the production of precise tool shapes more difficult than with good quality flint and although general characteristics of the tools may be identifiable to the mesolithic, the diagnostic attributes may not be sufficient to allow distinction between early and late assemblages. The short supply of raw materials also meant that people were more economical with the available resource and would utilise what would otherwise be considered waste flakes.

In terms of the number of mesolithic sites in Cumbria, figures have increased considerably since 1977 when the Council for British Archaeology compiled a Gazetteer of mesolithic sites in England and Wales. The general patterns of distribution have, however, changed little since 1976 when Clack and Gosling carried out an assessment of the archaeological resource in Northern England (Fig. 2.2).

Investigation of the coastal raised beaches which stretch for about five kilometers south of the river Esk has provided the most substantial evidence of mesolithic occupation. In many respects both the archaeological and environmental evidence from this area is comparative with other areas of Britain. It shows a late mesolithic preference for coastal locations where diversity of resources is at a premium, with easy access to upland, lowland, river and coastal areas. Bonsall suggests that the river valleys would provide natural route ways for animals travelling between upland and lowland zones and predicts that this particular area would have attracted the largest winter populations of Red Deer during the mesolithic (1981,
During the summer months salmon would have provided a highly predictable resource which was relatively easy to catch and, it is suggested, they would have provided a sounder basis for a mesolithic economy than any other single resource (1981, 468). On the basis of this evidence Bonsall proposes that the Eskmeals sites were components of an economic system which involved year round occupation, an area where mesolithic groups could obtain regular food supplies throughout the year, without the necessity of making frequent moves or of travelling long distances. There would, perhaps, be seasonal shifts in subsistence emphasis with fishing being the main summer activity and more emphasis being placed on land game and waterfowl in the winter months.

In other respects, the Eskmeals sites provide quite different evidence to other 'traditional' mesolithic sites in Britain. Pollen analysis from the site at Williamson's moss provides evidence for very early human interference with the vegetation. The elm decline at this site has a mean radiocarbon age of 3600 BC, one of the earliest known dates for this important event in the British Isles (Bonsall et al., 1990, 199). This date corresponds closely to the anthropogenic construction of wooden platform structures on the site and the first appearance of the characteristic clearance indicator, Plantago lanceolata. It certainly appears, although it cannot be confirmed, that these clearances are associated with microlithic industries found in the area adjacent to the pollen core site. If this is the case then an event which traditionally marks the beginning of the neolithic can be seen to be in progress at least in the late mesolithic and implies late mesolithic animal manipulation.

This type of evidence emphasises the futility of the period divisions based on subsistence strategies and artefact assemblages. In the coastal areas of Cumbria there is a considerable amount of evidence for continuity in the use of sites from the late mesolithic to the bronze age. In the areas which were settled early in the late mesolithic, continued clearance is often recorded late into the neolithic. This point is highlighted by the fact that the radiocarbon dates of the mesolithic sites at Eskmeals are closely comparable to the earliest date of the waterlogged site at Ehenside Tarn, which is assigned to the neolithic on the basis of its artefact assemblage. The structural remains at both sites are similar; if anything, the latter site left more ephemeral traces. Apart from the pottery, almost the only feature to distinguish these two occupations was the presence of group VI axes at Ehenside Tarn (Bradley and Edmonds, 1993).

Evidence of mesolithic activity areas further inland is scarce but some late mesolithic sites are being recorded. Excavations carried out in Levens Park, near Kendal, between 1968 and 1971 recovered a deposit of worked flint and chert dating to the late mesolithic period (Turnbull and Walsh, 1996, 17). The material consists of an assemblage of microliths, tools, cores and waste flakes which, on preliminary analysis, has been placed in the later mesolithic 'narrow blade' groups of the Pennine area which include rod and geometric forms. The assemblage, which is believed to represent a mesolithic settlement site of considerable potential importance, was found beneath a bronze age burial cairn but no evidence of neolithic activity to suggest landuse continuity between these periods was found.
2.3 The neolithic landscape - pollen zones VIIa and VIIb

The neolithic in Cumbria, as with most other areas of Britain and north west Europe, is traditionally seen as a period in which radical changes are evident in every aspect of the archaeological record. Subsistence patterns change with the introduction of agriculture, social structure alters as groups become sedentary, large ritual monuments are constructed, technology advances with the introduction of pottery and new stone tools, and human interference with vegetation makes a marked impression on the environment. Traditionally these changes are explained as an influx of people from the continent bringing with them the 'neolithic package', everything they required to settle and farm the newly colonised landscape (Case, 1969). This explanation was based primarily on the fact that radiocarbon dates for neolithic monuments on the continent were earlier than those in Britain. However, as more and more evidence comes to light and more dates are available, there is little left to substantiate this argument. In many areas of Britain, recent research has shown that acculturation and adaptation by the local populations is a more feasible theory.

It has already been shown that coastal locations selected by mesolithic societies remained important and attractive until at least the late neolithic. Changes in technology are seen in the development of new stone
tool types and the introduction of pottery is evidenced on some sites, but these new innovations appear to exist side by side with microlithic forms which are traditionally thought to be earlier.

One of the biggest problems in understanding the neolithic is the lack of 'domestic' sites identified and investigated in Britain as a whole. The inclination towards the study of 'ritual' monuments has dominated research. This bias is partly due to opportunity. 'Ritual' monuments are generally of considerable size and have, unlike settlement sites, survived the destructive nature of later land-use practices. Contributing to this inequality is the desire to understand the change in social structure which brought about the construction of elaborate monuments in the neolithic. Prior to the neolithic period there is no archaeologically-visible evidence to suggest that ritual practices were a major concern in the lives of mesolithic or earlier communities.

Domestic sites, on the other hand, tend to lie in lowland areas and leave more ephemeral traces, so the preservation and recovery of the sites are greatly affected by later agricultural practices. This inevitable bias in our understanding of the neolithic makes it difficult to appreciate the everyday activities of people and continues to embellish the exceptional and, probably, selective behaviour of small groups within these societies. In order to understand the links between the domestic and ritual spheres of human activity more evidence is required.

Despite the overall dearth of evidence from the area, Cumbria has featured quite prominently in discussions of neolithic trade and exchange. The existence of the Langdale axe 'factories' to the south of the central massif has attracted the attention of academics for nearly fifty years. Axes made from the Borrowdale Volcanic series of rocks have been found in many areas of Britain including the south. The form and distribution of these artefacts and their common association with large and elaborate monuments have fuelled discussion about various aspects of neolithic life establishment of exchange networks (Bradley and Edmonds, 1993); stone tool technology (Edmonds, 1995); subsistence and settlement (Fell, 1972).

With regard to palaeoenvironmental evidence, the neolithic is extensively represented in Cumbria as in other parts of the country. The interest in this period has been, until quite recently, powered by the desire to explain the transition from hunter/gatherer subsistence patterns to the adoption of agricultural practices. Difference in subsistence strategies has, in many respects, come to symbolise the difference between mesolithic and neolithic societies. Traditionally, the elm decline which marks the transition from pollen zone VIIa to zone VIIb, is interpreted as evidence for the first anthropogenic influence on the environment. The synchronicity of this event over large areas of Britain has been used to support the idea of neolithic colonisers coming to Britain with the knowledge and equipment required for the clearance of woodland and the subsequent cultivation of cereals. It was argued that the spread of this 'culture' was rapid and indiscriminate, leaving in its wake, amongst other things, diagnostic evidence in the form of the elm decline. This theory has once again been overthrown by the increasing number of dated pollen diagrams which record pre elm decline clearances. Although these early clearances are generally on a smaller scale,
they illustrate the capabilities of mesolithic societies and negate the idea that forest clearance was entirely under the jurisdiction of neolithic society.

At many Cumbrian sites the elm decline is not evident as a single episode. Around Morecambe Bay, Oldfield has been able to distinguish a primary elm decline affecting only the percentage of tree pollen contributed by the elm, from a later phase where Plantago lanceolata and the expansion of grass pollen indicate real clearance of the forest (Oldfield, 1963). In north and west Cumberland a similar sequence is recorded which, in the later phase, indicates forest clearances of considerable size (Walker, 1966). At Barfield Tarn, in the south-west, pre elm decline clearances are radiocarbon dated to 3390 ± 120 BC (K1057), but in the uplands Pennington records similar clearances around Blea Tarn from c.3700 BC (Pennington, 1975). Clearer evidence of mesolithic disturbance has been recorded at Ehenside Tarn (Walker, 1960) and Williansons Moss (Pennington 1970; Bonsall et al., 1985), suggesting that mesolithic communities were influencing forest composition both in the uplands and the coastal areas during the fourth millennium BC.

The second episode of forest clearance, certainly in the lowlands, is often associated with grains of cereal pollen and pollen of weeds characteristic of cultivation. At Barfield Tarn a change in the core stratigraphy at this point from lake mud to pink clay has been interpreted as re-deposited boulder clay from the steep slopes which surround the tarn (Pennington 1970). Pennington goes on to suggest that the local settlement before 3000 BC was sufficiently dense to break up the natural vegetation cover and allow severe soil erosion, lending support to the theory that cereal cultivation was being practised. At Ehenside Tarn the pre elm decline clearances were maintained throughout the neolithic, initially for the purpose of pasturage but later for the cultivation of domesticates.

During this second phase a clear distinction can be noted between land-use patterns in the uplands and those of the lowlands (Pennington, 1975). In Great Langdale the 'real' elm decline is accompanied by a fall in deposition rates of Pinus and Betula indicating the clearance (by fire) of light upland forest probably for pasturage. Sites on the coastal plain record a fall in the deposition rate of oak at the same time or very soon after the elm decline and coincide with the appearance of cultivated cereals, indicating clearance of oak woods, for the purpose of agriculture. The occurrence of charcoal in these horizons implicates the use of fire in the process. The intermediate area, defined as the lower slopes of the Lake District valleys, shows no evidence of reduced rates of oak deposition and suggests these areas of woodland were not being exploited at this time.

Pennington’s analysis of the length of time represented by the early neolithic episode of disturbance (1975, 84) shows that at Blea Tarn, in the uplands, the period of declining tree pollen and that of maximum deposition of pollen of grasses and Plantago lanceolata, lasted about 500 years in total. Charcoal samples from this site, (4680 ± 135 bp (BM281) and 4474 ± 53 bp (BM676)), represent the beginning of replacement of previous vegetation by bog (1975). The pollen profile shows there was no regeneration of the forest after this time. At Ennerdale the decreased deposition of oak pollen was over soon after 2800bc.
At the coastal sites where no radiocarbon dates are available, the date for the end of the regional change in pollen deposition at Ennerdale agrees well with the terminal date of c. 2700 BC suggested by Cherry (1969) on the evidence of lithic assemblages from Williamsons Moss.

In summary, the evidence suggests that forest clearance began in the oak and elm woodland of the coastal lowlands during the fourth millennium (Walker, 1966), for the purpose of grazing animals or as a result of collecting leaves and branches for animal fodder. The maintenance of these clearings varied from site to site: at Bowness Common Walker suggests that ferns and shrubs began to colonise the clearings just two or more centuries later closely followed by forest regeneration. Some clearances, however, seem to have been maintained for considerable periods of time, the most substantial and long lived being in the south and south west of Cumbria. At Ehenside Tarn, for example, there is little evidence of abandonment from the fourth millennium BC to the late neolithic (Walker, 1966). Here, a slow change in subsistence strategies is recorded as areas of land, initially used as pasturage, were turned over to cereal cultivation later in the neolithic. Away from the coast, in the north and east of Cumbria, lesser, later, clearances are recorded but comparative studies with areas such as the Eden Valley must be considered against the shortage of evidence available for this area.

In the upland valleys, with the exception of Great Langdale, evidence for forest clearance is limited before 2000 BC. At Great Langdale, however, the small scale clearance of Betula and Pinus woodland is evident from early in the fourth millennium. Clearance continued until a little before 2000 BC, with its peak of intensity around c. 2500 BC; this is in contrast to the lowlands where the impact on the environment decreased by the middle of the millennium (Pennington 1970; Walker 1965). The extension of upland grassland, with weeds characteristic of clearance, was so widespread that by the end of the third millennium total deforestation was imminent. Stratigraphic evidence from Blea Tarn and Angle Tarn indicates that increased soil erosion, consistent with the effects of forest clearance, was exacerbating any natural deterioration of the soils that had already occurred (Pennington, 1970). The forest was unable to regenerate and this episode culminated in the beginning of peat formation and the development of the landscape now visible in the area today. In other areas of upland the vegetation escaped the effects of forest clearance until much later.

During the late mesolithic/early neolithic, a transhumance strategy was probably adopted by pastoralists who moved animals from the lowlands where they were grazed in the winter to the uplands in the summer, clearing significant areas of woodland as they went. In some respects the adoption of a transhumant subsistence strategy can be seen as a natural progression for these people, building on the knowledge they or their ancestors had accumulated from the hunting of migratory species for several millennia before. The evidence certainly suggests that these people had begun to control their environment to suit their own subsistence strategies.
Later, clearances in certain areas of the lowlands became more permanent as cereal cultivation was adopted, but this appears to remain fairly small in scale and animal husbandry must have continued to play an important if not dominant role.

The extent of palynological investigation in both upland and lowland areas of the Lake District has resulted in a well documented vegetation history. The exclusivity of Langdale as the only recorded area of upland forest clearance during the neolithic is, therefore, unlikely to be the result of biases imposed by the distribution of research. It has been claimed that the areas of upland activity recorded in the vegetation history relate directly to areas of stone axe production, although pre-elm decline clearances are earlier than any occurrence of Langdale axe production so far recognised (Bradley and Edmonds, 1993). This relationship has been confirmed by pollen samples taken from stratified contexts in Langdale Combe where at least two, and possibly four, episodes of clearance are recorded. Two episodes, which involve the reduction of shrub pollen, were probably the result of neolithic activity and first occurred just after the elm decline which has an estimated date of 3800 BC.

Fig. 2.3 Location of the main places and areas mentioned in relation to Langdale axe production. (After Bradley and Edmonds 1993, 70, Fig. 4.1).
At Stake Beck a series of pollen samples was taken from sediments which contained an axe-finishing site. The analysis revealed a regular alternation between periods of more open conditions and phases in which the vegetation cover had increased. The presence of charcoal seemed to indicate that the vegetation was being modified by burning, perhaps on a regular basis. A similar sequence was recorded at Loft Crag, where two samples were collected from beneath a dump of stone knapping debris.

The use of volcanic tuff for tool production has been recorded at Eskmeals and on the limestone uplands of eastern Cumbria in late mesolithic contexts where locally available pebble tuff was utilised. The technological skill required to work the material into usable forms was therefore already available. It is suggested that the small pebbles of Langdale rock found on the coast originated from the Cumbrian massif and would have been transported to the lowlands via streams. The parent rock would have been discovered by following these streams back to their source (Bradley and Edmonds, 1993, 141), precisely the routes proposed by Bonsall et al. for the movement of migratory herds from upland to lowland areas (1990). This theory correlates with the evidence for the earliest workings at Langdale and, could explain the exploitation of outcrops at Dungeon Ghyll, Troughton Beck, South Scree and Loft Crag and possibly Scafell Pike and Glaramara too (Bradley and Edmonds, 1993).

Exploitation of the volcanic tuff for stone axe production began in the fourth millennium BC. Production and procurement at this time were small scale and informal. Roughouts were produced from scree material before being moved to lowland sites for polishing and grinding. The vegetation history shows that woodland clearance around the upland sites was being maintained and implies that axe production at this time was carried out whilst practising subsistence activities. Debitage found at two excavated 'finishing sites' certainly suggests that these sites had doubled as temporary bases for hunting or summer grazing (Bradley and Edmonds, 1993).

Later production at Pike 'o' Stickle is quite different. Here, all stages of production took place at the source and a more regular routine was followed. There was a reduction in the number of errors and production, and output was increased.

Changes in production are matched by changes in both procurement and the location of sites. Stone was now being quarried at previously unused sites (Bradley and Edmonds, 1993). The quarry sites were often in remote locations where fuel for fire setting and hammer stones for quarrying and axe production would need to be brought up from the valleys. It was now the case that axes were being made in places where it would be feasible to control access to the raw material: '...these exposures could hardly be discovered by chance, and those working the material would have required a detailed knowledge of how those locations were to be reached around the face of the mountains' (Bradley and Edmonds, 1993, 142).

Results of petrological analysis of the hammer stones found at the quarry and production sites (Bradley and Suthem, 1990) were compared to the distribution of roughouts, and other Group VI products. This led Bradley and Edmonds to conclude that the most likely source of axes found at sites on the coast was Scafell
Pike, one of the simpler, early groups of site (1993, 142). The Eden Valley was probably supplied by Glaramara and Langdale. Glaramara was a small scale production site but at Langdale production has been shown to have increased or at least changed in character later in the fourth millennium. It has been suggested that this reflects not only that different groups of people were controlling different production sites but also that there was a growing importance of the Eden Valley at this time.

Other 'new' technologies also start to make an appearance in the archaeological record during the neolithic period. Pottery is one of these and although rare in the north, pottery of neolithic date has been found on both sides of the Pennines. The appearance of pottery in the last few centuries of the fourth millennium BC is contemporary with the development of exchange networks, which leads Higham to suggest that pottery may have derived from the same exchange process and specifically that at least some of the pottery found in the northern counties originated from neighbouring communities in Yorkshire and Ireland (1986, 62). The earliest dated examples come from Thirlings, Northumberland, where at least twelve pots were recovered from a pit radiocarbon dated to 3280bc. The sherd were largely of Grimston/Lyles Hill ware. This is the most common style of early neolithic pottery found in Britain and is thought to have been modelled on earlier leather or wooden vessels. In general pottery of this type is associated with sepulchral monuments and more specifically, in the north, with cremations. Another less common pottery type of heavy, simple rimmed bowl or cup has been found in Crosby Garrett, Cumbria and Houghton le Spring, Tyne and Wear, associated with inhumations (Manby, 1970,17). With the exception of very few sherd pottery from domestic contexts are rare.

Where domestic pottery has been found, the styles have become established and relatively uniform by the end of the fourth millennium BC and continue in stability until the middle of the third millennium. During this time there is evidence of regional variations that imply local manufacture on both sides of the Pennines. Although, as Higham suggests, this indicates a stable society with specific criteria for ceramic production, the use to which it was put is not yet known (1986, 63). During the second half of the third millennium new styles of pottery derived from the Grimston/Lyles Hill series appear in the archaeological record. A variety of decorative techniques developed and the pottery industry may have altered in its organisational structure. Peterborough Ware, a decorated, fine fabric vessel, has been found as part of numerous artefact scatters in the limestone uplands of eastern Cumbria (Cherry and Cherry, 1987, 76) and on sites at Brougham, Warton and St Bees Head. Peterborough ware is also known from sites in Northumberland.

Material from Northumberland in particular shows similarities to the Scottish tradition of manufacture in the later neolithic, implying that cultural links with the Milfield basin, for example, may have been strongest to the north. Grooved Ware, which originates in Scotland, is found in large concentrations in the south and east of England, but also appears, in small quantities, on a number of sites in the north at this time. Examples have come from the Milfield Basin, Northumberland and from Walney Island, Cumbria but the work of Cherry and Cherry has again significantly extended the known distribution of this pottery in Northern England (op. cit.). In the south of England the largest assemblages of Grooved Ware pottery have
been found on sites which had special roles in ritual and ceremonial activities and certainly some of the main assemblages from this area are found in large henge monuments. Even when found on domestic sites, the pottery is generally buried with formality.

In the north, although a number of styles has been recognised, most are represented by only a small number of vessels and in some cases sherds. The total number of find spots is very small but is increasing all the time. Despite the dearth of evidence there are some signs of a local pottery industry. The cultural parallels of the vessels found are consistent with importation of at least prototypes to the area. Recent finds of pottery in conjunction with flint and stone artefact scatters suggest that pottery may have been a more important element in domestic equipment than the number of find spots suggest (Cherry and Cherry, 1987, 76). If this is so, pottery may have been both an important product and a significant element in exchange systems (Higham, 1986, 64).

Evidence for neolithic settlement sites is, on the whole, scarce but there is some evidence to suggest that the settlement history of the Eden Valley was different from that of the coastal areas. Most occupation areas are identified purely from artefact scatters in ploughed fields and although scatters can indicate the vague location of the sites it is difficult from this type of evidence to recognise spatial patterns within and between settlements. It is usually impossible to characterise the relationship between sites or to identify whether they are contemporary or the result of successive occupations over a longer period of time.

There are, however, two or three excavated sites which provide an insight into the structural nature of neolithic occupation areas. What is interesting about this limited evidence is the variability in the scale, construction and complexity of these settlements. The recently excavated site of Plasketlands, on the coastal lowlands of the Solway plain, has produced new and interesting evidence (Bewley, 1993). The site was originally identified by aerial photography as a large ditched enclosure with pit alignments leading off to the south. On excavation the site revealed a series of large post holes which had originally contained large oak posts. The excavations were fairly small scale and did not reveal the direct relationship between the ditched enclosure and the timber-built structure, but the latter appeared to represent a second phase of construction. Two of the post pits provided radiocarbon dates ranging from early to mid fourth millennium, the earliest dated neolithic contexts in Cumbria.

Plasketlands would be within easy reach of marine, woodland and wetland resources as well as areas suitable for arable agriculture and grazing. On the strength of this, Bewley suggests that the site was probably that of a neolithic settlement and as such represents the earliest defended settlement in Cumbria (1993). It is a much more substantial structure than other recorded neolithic settlements found further south on the coastal plains at Eskmeals (Bonsall et al., 1985; Cherry and Cherry, 1986) and Ebenside Tam (Darbishire, 1873), where brushwood platforms provide the most durable structural evidence. It is possible that these different sites were part of a developing system of settlement hierarchy. However, on a basic level the location of the site provides further proof that coastal lowlands remained important during the early neolithic.
Within the Eden Valley there is very little in the way of 'domestic' evidence to determine the location of the settlements themselves or the morphological characteristics of the neolithic homestead. Survey of the limestone uplands of eastern Cumbria has, however, revealed a number of flint assemblages with both late mesolithic and early neolithic affinities associated with small amounts of pottery (Cherry and Cherry, 1987, 70). These sites are considered to be settlement sites of people following a late mesolithic tradition, who gradually, and possibly selectively, adopted neolithic technology. This obviously implies a settlement continuity very similar to that observed on the coastal plain at this time. However, by the late neolithic a certain amount of change is apparent in the raw materials used for tool production. On 'sites with late mesolithic affinities chert is predominant, but there is a considerable amount of mainly grey chalk flint and some pebble flint and pebble tuff. On sites with later neolithic/early bronze age affinities, the principle raw material is chalk flint, with much less reliance on chert and virtually no pebble flint or pebble tuff' (Cherry and Cherry, 1987, 71). The grey chalk flint is thought to originate from a source in the chalk and boulder clay deposits of the Yorkshire Wolds. The occurrence of early and late technological styles within the same assemblages perpetuates the idea of a settlement continuity, but the change in the procurement of raw materials implies a change in the social requirements of the communities occupying the area. The evidence points to an increase in the social interaction between communities in the Eden Valley and those in the north east, a network which becomes more apparent later in the neolithic.

Although physical evidence of domestic settlement is difficult to locate the archaeological remains of large and diverse 'ritual' monuments of neolithic date are testament to the exploitation of the Cumbrian landscape at this time. One such monument class is that of long barrows, of which eight are recorded, two from the lakeland massive and six from the Eden Valley. Precise dates for these sites are unavailable but should not be later than 3500 BC.

At Raiset Pike, Crosby Garrett, a trapezoidal mound was excavated in the late nineteenth century (Greenwell, 1877, 510). Here, the earth and stone mound was constructed on the cleared, natural land surface over a series of deposits. The disarticulated skeletons of 6-7 adult males were recovered from an area defined by a hollow and a large standing stone. The bones were encased in charcoal and a mass of calcined deposits which were later reinterpreted as the remains of an earlier mortuary house (Ashbee, 1970, 53). Beyond the standing stone more bones were discovered in what Greenwell considered a secondary deposition (1877). All were burnt, disarticulated and thought to be principally from the skeletons of children. Whether the secondary deposition is evidence of two phases of construction is unclear, but the western end of the mound was constructed of larger stones than the east.

The publication of a drawing of Raiset Pike by the late seventeenth century antiquary Thomas Machell (Clare, 1979, 144-146) shows two distinct oval mounds joined by a small amount of stone. The idea that the long cairn originally consisted of two earlier oval mounds is substantiated by the existence of a transverse hollow extending the full width of the cairn which is evident to the present day (Masters, 1984, 62). Another oval cairn was recorded by Greenwell in the parish of Crosby Garrett (1877, 389; CLXXIV).
Here scattered and disturbed bones, both burnt and unburnt, were recovered in the southern half of the cairn. Distinct inhumation burials of two adult males were also located, one associated with a bone pin and two boars tusks and the second with an antler mace head. The disturbed nature of the mound makes the original form difficult to determine, but its recorded oval shape suggests an early prototype of the long barrow (Bradley and Edmonds, 1993).

The inclusion of both cremated and unburned remains of no fewer than a dozen interments in the oval barrow at Crosby Garrett has neolithic affinities comparable to Raiset Pike. Cremation of neolithic burials is not common in the north but is almost entirely absent south of Yorkshire, where most comparable sites are located (Higham, 1986). In this sense Raiset Pike and Crosby Garrett show traits typical of the region, but in other respects the evidence is unusual. Within the primary deposits only adult males are represented, but within the secondary deposits children predominate. This representation is comparable to that at West Kennet long barrow (Piggott, 1962, p79) and Fussells Lodge long barrow (Ashbee, 1966) in the south of England, indicating further that a network of long distance social interaction was already established.

A second monument type believed to be predominantly of neolithic date is that of stone circles. In Cumbria these virtually ring the high ground, but the density is greater in the Eden Valley where the monuments are generally built on a much larger scale (Bradley and Edmonds, 1993). The largest in Cumbria, and considered one of the earliest in Britain (Burl, 1976, 89-92), is that of Long Meg and her daughters. The site is located on the edge of a sandstone terrace above the east bank of the Eden. The outlying stone is a red sandstone block crudely decorated with circular marks and a cup and ring. Aerial photographs have shown that Long Meg and her daughters respect the position of an earlier enclosure which shows similarities in form and position to enclosures surrounding 'great barrows', common in the Yorkshire Wolds and to enclosures surrounding henge monuments in the Vale of York (Bradley and Edmonds, 1993, 161). Other impressive examples of stone circles include Castlerigg and Swinside, which are also believed to be early in the sequence. Some confirmation of date has come from a radiocarbon date of c.3275 BC from the Lochmaben Stane, the only survivor of an oval ring on the north side of the Solway Firth. Burl suggests the remote setting of this stone circle implies it was later than rings at the heart of the Langdale 'industrial area' (1994, 10).

By the late third millennium henges become apparent in the archaeological record. In Cumbria all known examples are located east of the Lake District uplands. Mayburgh which is the largest of these examples, is circular and measures 90m internally. It is defined by a stone and earth bank which stands up to 7.3m in height with a single entrance to the east. Without an inner ditch the site does not strictly qualify as a henge monument, but the use of imported stone for the construction of the bank opposes the need for a quarry ditch on the site. Antiquarian accounts of Mayburgh record the former presence of settings for stones within the monument which would be consistent with the suggested classification (Topping, 1992, 260). Although there are no direct parallels on the British mainland, Mayburgh is broadly comparable to much larger earthen enclosures found in Ireland, particularly those situated in the east part of county Meath and more notably those in the Boyne Valley which occur amongst the megalithic cemeteries at Dowth,
Knowth and Newgrange. Here, association with similar sites suggests they could have formed a complex, in a fashion which might also be the case in Penrith (Topping, 1992).

The very different site of King Arthurs Round Table, just a few hundred meters away from Mayburgh is, at first sight, well preserved, although the bank and ditch are obscured by modern roads on the north and east of the site. In the nineteenth century attempts were made to landscape the monument, so the present condition of the site may not reflect its original form. Evidence of extensive recent recutting was identified by Bersu during his excavations in 1940 (1940, 184-185).

The monument is elliptic in shape and approximately 90m in diameter, with a ditch and external bank. According to early records two opposing entrance causeways could be found to the north and south. The northern entrance was marked by two standing stones, but detail of this entrance has now been lost by the construction of the modern road. Excavations early this century uncovered little internally except a poorly preserved trench that contained cremated bone (Bersu, 1940, 197; Collingwood, 1938, 20). Recent geophysical survey at the site was greatly affected by the eighteenth and nineteenth century disturbance (Topping, 1992).

A third site, known as Little Round Table, lies approximately 150 meters south of King Arthurs Round Table and survives as an ephemeral earthwork. Records of the site date back to 1725, when Stukeley documented an enclosure surrounded by a bank and external ditch which enclosed an area approximately 90 meters in diameter. Later documentation records a site 70 meters in diameter with an enclosing bank and an entrance to the north north east (Pennant, 1790). Geophysical surveys carried out by the Royal Commission in 1988 confirmed elements of these records (Topping, 1992); an enclosure 90m in diameter which correlates with Stukeley estimations, and a curving ditch with a rounded terminal and a well marked entrance as depicted in Pennant’s illustration (op. cit.).

The three henges were constructed in a rich lowland and riverine environment, largely devoid of orthostatic stone, where, it is suggested, a substantial population had developed by the later third millennium (Higham, 1986, 74). Too little is known about these sites to classify them as a ‘true ritual complex’, but the Penrith sites may have something in common with other major concentrations of henges in Britain: Thornborough in North Yorkshire; Milfield Plain in Northumberland; and the Dorchester complex, all of which are located in riverine settings. Such groups may have created localised or regionally-based ritual foci.

The location of the Penrith sites, within 155 meters of each other on the narrow interfluve of the River Eamont and its tributary the River Lowther, suggests a command of access to long established routes. Routes emerging from the north-east Lake District, from Shap, from the Upper Eden valley and from the Petteril Valley to Carlisle and the Solway, all converge upon Penrith and upon the comparatively low ground of the Middle Eamont where these earthworks were constructed.
The Penrith sites are all very different in character and may reflect different ritual emphasis. Topping suggests the height of Mayburgh's bank, and the single entrance through it, implies a greater exclusivity in functional terms. The activities taking place in the interior were possibly more secretive and had to be hidden from view, unlike those that took place at the comparatively open site of King Arthur's Round Table where two entrances would allow the possibility of linear movement through the site and therefore offer greater accessibility (1992, 263).

Unfortunately the limited evidence does not allow a conclusive interpretation as to their function, but the implication that henges were used as regular meeting places for scattered communities remains a strong theory. Bradley and Edmonds suggest that it is through the gatherings that took place at such sites that Group VI axes first changed hands and began the journeys which took them to various parts of the country (1993). Both Mayburgh henge and Castlerigg stone circle have been directly associated with Group VI axes (Burl, 1976, 60) and it is seen as no coincidence that these monuments are established in areas where axes from the main Langdale production sites were polished (Bradley and Edmonds, 1993). An association between henges and polished stone axes has been revealed during excavation of various sites (Darvill, 1987, 88). In fact the association was considered so strong that Burl suggested the monuments were used by an 'axe-cult' (Burl, 1976, 80).

Bradley and Edmonds have used the number and distribution of 'ritual monuments' (long barrows, henges and stone circles) to substantiate the theory that the Eden Valley increased in importance during the neolithic period (1993). They propose that this was due to the importance of the valley as a main communication route. The valley certainly occupies a prime location for access to some of the major routes both eastwards across the Pennines and north to south through the Howgills.

In summary, the early neolithic period was host to what appears to be a population of transhumant pasturalists who lived in semi-permanent settlements close to the coast and on the limestone uplands of eastern Cumbria and who exploited a large range of resources. Vegetation history evidence shows these people cleared the landscape of woodland either through the use of fire or axes for closer control of animals and in some cases the cultivation of cereal crops. The use of the Lake District uplands in the summer months for the grazing of cattle possibly led to the identification of the source and subsequently the exploitation of Volcanic Tuffs for the production of axes.

Initially axe production was carried out in a casual fashion, but later developments saw the growing importance of the Langdale area for axe production. Good quality stone, which required special tools was quarried and greater importance was placed on the finished form of the axe. The whole process of axe production including finishing, and polishing was carried out at the source; there is a move to more inaccessible sites higher up the mountains. It is suggested that people were now coming to these areas for the sole purpose of making axes. There is evidence to suggest that different communities were utilising different sources, and that some sort of control over the raw material was enforced. From the evidence of hammer stones it is suggested the larger, Langdale, sites were supplying communities in the Eden Valley.
and the growing importance of this area is highlighted by the density and variety of monuments constructed at this time.

A network of interaction which probably extended from Cumbria northwards into south west Scotland, west to Ireland, and particularly east to the Yorkshire Wolds, is fairly well established.

Bradley and Edmonds (1993) have argued convincingly that the change in the production of Cumbrian axes was to satisfy the demand imposed by social groups outside the immediate area. Group VI axes appear to have attained symbolic significance in areas where social differentiation was becoming increasingly important. By the end of the early neolithic, the demand had increased to such an extent that the scale and orientation of exchange networks were forced to change accordingly.

Towards the end of the neolithic a wide range of complex artefacts was available. Stone axes were included, but polished flint axes of several kinds took on some of the social roles which had previously belonged to stone axes. With the introduction of Grooved Ware pottery around 3000 BC came a renewed interest in the axe trade. Grooved Ware appeared on sites which had special roles in ritual and ceremonial activities and certainly some of the main assemblages from the south of England are found in large henge monuments. Even when found on domestic sites, the pottery is generally buried with formality.

The direct archaeological evidence is limited, but it seems as if none of the stone sources continued in operation in the second half of the third millennium BC. The advent of the first metal axes had a drastic effect on the systems of exchange and consumption that had developed over the previous years. The work at Langdale has not shed any light on the processes that bought stone axe production to an end (Bradley and Edmonds, 1993). It was not among the sources that produced perforated tools during the bronze age, and there are no indications from artefacts or the pollen record that the area was of any significance for several hundred years. Bradley and Edmonds suggest that the exchange systems of the later neolithic are characterised by a growing instability and by an ever more urgent quest for novelty. The introductions of metals and other material items from outside the country altogether may simply have continued that process.

2.4 The bronze age landscape - Pollen zone VIIb
The bronze age is once again a period of considerable change, typified by the development of permanent settlements, the transition from stone to metal tools and large scale division of the landscape in the form of linear boundaries. Burial monuments become more diverse in form and burial rites place increased emphasis on the individual.

Traditionally the changes in the archaeological record have been explained by way of 'invasion'. It was suggested that people coming from the continent introduced new bronze working technology, beaker pottery, horse riding and alcohol to Britain. Important to this argument was the recognition that the 'invaders' were physically different from those buried in neolithic long barrows and chambered tombs. However, many of the traditions thought to have been introduced by these 'Beaker' people have since been
found to have been indigenous to later third millennium communities in Britain. Furthermore, recent studies have suggested that the physical differences could be ascribed to gradual generic changes in a single population.

Although many still support the invasion theory, it is now generally accepted that the number of people involved and the overall effect of these on the native population is considerably less than previously thought (Higham, 1986, 85). Some critics of the theory offer the alternative explanation that beaker pottery developed and spread as a result of trade and exchange, a process which was already well established (cf Bradley and Edmonds, 1993). Others accept a combination of the two theories, suggesting the movement of people as well as the diffusion of ideas and ultimately objects (Bewley, 1994, 65).

As in the neolithic, the majority of evidence relating to the bronze age, particularly the early phases, comes from the study of burials and monuments. Knowledge of the settlements and the subsistence strategies which supported these societies is relatively poor. Where evidence does exist, there is marked regional variability. In the south for much of the period 2500 -1500 BC, small isolated farmsteads are the main form of settlement, whereas in the far north of Scotland nucleated settlements are well known (Darvill, 1987, 104).

2.4.1. Vegetational History

In the uplands of the Lake District, Pennington has identified episodes of forest modification during zone VIIb at four of the six tarns investigated (1965). These are mainly evident as a fall in oak pollen, accompanied by a small increase in the percentage of grass and grassland herb pollen. It is suggested, from the absence of cereal or weed pollen, that this phase represented a pastoral landuse in the uplands, with the reduction of trees and an increase of grassland resulting from the over grazing of animals (1965, 241). Contemporary with these changes is the appearance of Calluna and Cyperaceae pollen which suggests the development of acid soils and podsol was already underway. Pennington suggests that clearance was serious and was followed by erosion phases (op. cit.), but at Devoke Water the clearance phase, which occurred in the first half of the second millennium BC, is followed by a period of forest regeneration indicating that the soil degradation was not evident over the whole area. However, the climatic deterioration of the first millennium BC, and specifically the increased rainfall, was very erosive on the already deforested areas. It is argued that the areas which had suffered deforestation during the neolithic and then later in the bronze age, specifically those areas around Devoke Water, Seathwaite Tarn, Goatswater and Blind Tarn, suffered increased erosion. The erosion is evident from the Calluna horizon and its association with an inwash of sand, stones and highly organic soil humus. Pennington suggests that much of the moor land visible today is probably the result of 'unchecked erosion since the forest cover was completely removed by the long bronze age upland settlement' (1965, 242).

At Langdale where, during the previous two millennia, the vegetation history was quite different from other upland areas of Cumbria, clearance activity continued into the second millennium. Wood from the base of the peat at Red Tarn Moss was dated c. 1940 BC (Pennington, 1970, 71) and this seems to relate to the
major deforestation horizon, associated with a substantial and permanent increase in the pollen of grasses, sedge and *Calluna*. This resulted in the development of open moorland over extensive areas and is accompanied by an increasing inwash to the tarns of a more acid type of humus. This episode corresponds to renewed output from the Langdale axe factories (Bradley and Edmonds, 1993).

At Valley Bog in the Pennine uplands, Chambers identified a period of woodland clearance which is indicated by high levels of Gramineae and *Plantago lanceolata* pollen. The clearance phase is dated to c.1300 BC and, although a few grains of cereal pollen were recorded, has been attributed to the grazing of domesticated animals (1978, 279). Over time *Betula* woodland again began to thrive, suggesting the grazing pressure had been lifted and at least some areas of forest were able to regenerate. Similar evidence for clearance has been found in the Cow Green region of Upper Teesdale (Turner *et al*., 1973).

In the lowlands, Walker recorded the maintenance of neolithic forest clearance for the purpose of small scale cereal cultivation at least until c.2000 BC (1966, 199). However, from this date there is evidence for widespread forest clearance for the cultivation of cereal. The exact time at which this occurs varies from site to site but there is a renewed impetus during the period 1750 BC to 1400 BC, when it is suggested that a new economy, more sedentary, and utilising cereals, became widely established (*op. cit.*). Around Ebenside Tarn renewed clearance activity is dated to c. 1600 BC and includes high levels of cereal pollen which, it is suggested, is consistent with a mixed farming economy (*op. cit.*). At Bowness Common, to the north of the Lake District, grass replaced forest and shrubs in a clearance episode that lasted throughout the millennium but which from c. 1700 BC included the introduction of cereal and weeds of cultivation. At Oulton Moss two periods of forest clearance have been identified; the first, instigated c. 2000 BC, was followed by a temporary and partial reforestation at c.1500 BC. The second phase of clearance at the end of the millennium was associated with the first appearance of cereal pollen and charcoal. A similar situation is recorded around Scaleby, with the second phase beginning c. 1400 BC (Walker, 1966, 200).

In lowland Lonsdale, Oldfield identifies a period of extensive forest clearance which, although not radiocarbon dated, is argued as being of bronze age date (1960, 216). It is interesting that, according to Oldfield, throughout lowland Lonsdale any evidence for climatic change has been obscured by changes considered to be the result of anthropogenic influences. However, Smith identifies a recurrence surface in the Lonsdale raised bogs which is interpreted as being indicative of increased rainfall and a period when the peat did not grow (Smith, 1959, 124). This period is associated with a corduroy road which was located and documented early this century (Barnes, 1904). Although now lost, the road was recorded specifically in relation to the peat stratigraphy (Munn Rankin, 1910, 1911) and from photographs (Tansley, 1939) can be directly related to the recurrence horizon. Smith suggests that "...the trackway in the Lonsdale mires was built in response to increasing wetness of the bog surface" (1959, 126) and suggests a date towards the end of the bronze age. Another example of a timber trackway was found laid across the peat at Stakes Moss on the west side of the Kent estuary (Barnes, 1904). The association of this trackway with a bronze spearhead substantiates the idea of an increasingly wet climate in Cumbria during the later Bronze age.
In summary, it appears that clearance activity spread initially across the better drained soils around 2000 BC, with the impetus renewed about the middle of the millennium when cereal pollen is first widely identified. The effect of the clearances was to accelerate deforestation beyond previous levels and into areas not previously affected. The extent of the clearances introduced fundamental and permanent changes in the vegetative balance.

Between c.1250 and 800 BC the climatic conditions worsened, but despite this, there is still evidence of forest clearance in some areas for the first time. In Upper Teesdale high levels of pollen from grasses and grassland herbs alternate with forest species on the better drained soils and indicate a series of short term clearance episodes. At Cow Green reservoir woodland had already been extensively lost by c. 1200 BC, but elsewhere in Upper Teesdale mid to late millennium clearances have been recorded (Chambers, 1978, 275).

In Cumbria woodland was cleared in the south west uplands, in the valleys of the central Lakes and on the fringes of the Eden Valley. At Seathwaite this episode was dated to c.1080 BC (Pennington, 1970, 72) and wherever it occurs is marked by a decrease in oak forest and an expansion of grassland. No cereal or weed pollen was found, which leads Pennington to conclude that the episode represents a pastoral landuse in the uplands, in which much of the replacement of trees by grassland could have resulted from the grazing of many animals, with the consequent failure of tree regeneration (op. cit.). At Devoke Water, a significant fall in the organic content of the sediments was interpreted as evidence that increased erosion of mineral soils accompanied forest destruction. Over wide areas the consequence of these clearances was a spread of moorland vegetation on increasingly waterlogged and podzolized, acid soils incapable of supporting natural vegetation (Higham, 1986, 82).

2.4.2 Bronze age archaeology

When compared to earlier periods, the bronze age is well represented in the archaeological record of Cumbria (Fig 2.4). Examples of burial monuments, ritual monuments, domestic settlements and those associated with land-use patterns combine with numerous artefact scatters to provide an impressive collection of data for the period. However, cairns, barrows and cists, denoting burial, are by far the most numerous (Clack and Gosling, 1976, 23). As in the neolithic, settlements are few although some sites traditionally ascribed, on morphological grounds, to the iron age, are now thought to have their origins in this period (cf Bewley, 1992a).

Although there is a considerable amount of evidence relating to the bronze age in Cumbria, very little survey or excavation has been carried out. This obviously causes difficulties in the interpretation of the data and, as a consequence, places considerable reliance on the extrapolation of information from other areas. The majority of detailed information about the period in the northern counties originates from the east of the Pennines where survey is more advanced and excavation far more common. A detailed synthesis of the evidence has been produced by Higham (1986) and much of the information discussed here draws on his earlier work.
The evidence as a whole provides a fairly diverse and widely distributed set of data, but generally support the idea that there was a substantial growth in the population particularly between c. 1800 and 1200 BC (Higham, 1986, 82). The distribution of evidence indicates that communities were showing preferences in the selection of habitat with emphasis on the well drained lowlands and particularly the central Eden Valley and Plain Furness. East of the Pennines monuments can be found at an altitudinal range up to 472m, but on the west the limit of the evidence rarely exceeds 274m OD (op. cit.).

The presence of a substantial population during the bronze age is supported by the comparatively high density of burial monuments recorded on the margins of the valleys and on the fell sides. A more recent discovery of a bronze age cremation cemetery at Ewanrigg, Maryport, suggests that burial also extended into the valley bottoms (Bewley, 1986) but such burials are less likely to survive due to the pressures of modern land use patterns.

Many of the large ritual monuments, constructed during the neolithic period, continued in use in the early bronze age. By the end of the second millennium BC, however, these are virtually abandoned and the earlier concentrations of settlement appear to have broken down. Both the archaeological and palaeoenvironmental evidence suggests that there was a movement of people into previously unused areas of both the uplands
and the lowlands. This is particularly evident on the fells of south west Cumbria and on what are now considered marginal lands of the Upper Eden Valley. A common explanation for this movement is that the increase in population put pressure on the primary resources in the well drained lowlands and therefore led to the exploitation of less favourable areas (Bradley, 1978).

Although the vegetational history data indicates woodland clearance, and artefact scatters support the suggestion that the population was moving into previously unused areas, the settlement sites themselves have remained elusive. Where they have been found few are accurately dated. Once again the situation is worse in Cumbria than it is on the east side of the Pennines where a number of excavated sites has been radiocarbon dated (cf Young and Simmonds, 1995). The first indisputable habitation site to be excavated was that of Green Knowe, Peebleshire (Jobey, 1980), where groups of terraced platforms supported unenclosed, timber houses and were associated with cairns and linear banks. Evidence for three phases of hut construction indicates the longevity of occupation, which is borne out by radiocarbon dates which show that the structures span a period of 400 years from c. 1200 bc. These unenclosed settlements were later found to be quite common on the open moor land between 210m and 380m OD in Northumberland and on the slopes of the Cheviots. A small number has also been found on the lowlands.

Excavations on a number of sites in the north east have served to show the variety in form of bronze age settlements, but a common feature of the excavated examples is the indication that timber buildings were gradually replaced by stone in complex and long lived settlements. An example comes from the excavated areas on Black Law at Houseledge (Burgess, 1981).

A correlation of dates of unenclosed settlement sites has recently been published and shows them to span from very late in the third millennium BC until the beginning of the Roman period, with the majority of dates falling between c.2000 BC and c.500 BC (Young and Simmonds, 1995, 6). It is not yet known, however, which groups of sites were in contemporary occupation (Higham, 1986).

It is argued that communities were occupying less hospitable locations than at any later stage of human activity in the north. Settlements survived several generations and are associated with pottery usage and manufacture, and saddle querns which indicate grain preparation. It is suggested these unenclosed sites were permanent and perennially occupied and the common association with stone clearance implies agricultural activity leading to land improvement for cultivation.

The settlements are commonly found in physical association with small, non-geometric fields, the boundaries of which generally consist of linear cairns. These are not thought to have been effective as barriers to animals and on this basis are understood to have had an arable connection. The site at Hallshill, Northumberland confirmed an arable connection when excavated houses revealed emmer wheat, barley, oats, flax and agricultural weeds (Gates, 1983).
Although a number of examples is known from Cumbria, very few have been excavated. Near Coniston, groups of terraced hut circles were first described in the nineteenth century (Cowper, 1893, 406). Here the hut circles form three separate groups within a complex of multiperiod field systems, cairns and settlements. In 1933 Collingwood suggested that some at least of the numerous settlement sites around Crosby Ravensworth, Cumbria, were bronze age in origin. Despite this argument, these types of settlements have repeatedly been described as being of Romano-British date (cf Bewley, 1994). Part of Collingwood's argument was based on the spatial relationship between these settlements and bronze age barrow groups. It is suggested that the barrow groups represent the burial ground of the communities living in the settlements at that time (1933, 218). Since Collingwood's work various field systems and cairnfields have been recorded in the vicinity of several of these settlements and help to substantiate Collingwood's argument (cf Cherry and Cherry, 1987; Turner, 1984).

Higham's (1986) work in Eskdale has also been directed at a number of settlements. Among these are enclosure settlements at Waberthwaite Fell and Barnscar which are thought to belong in an early to mid bronze age context. Many of the enclosure elements are incomplete and some are groups of disjointed walls which perform no enclosure function but, it is suggested, did serve as linear clearance cairns for the disposal of surface stone, or perhaps as wind breaks (op. cit.). The availability of stone would have made its use as a building material a natural progression from timber, particularly if deforestation was a common product of activity around the vicinity of settlements.

The archaeological and palaeoenvironmental records indicate that the settlements were supported by a mixed economy. Pastoralism seems to have played a major part, but with some small scale cereal cultivation taking place. Hand cultivation seems the most likely strategy, particularly in the small enclosed areas associated with hut sites in the border counties (Higham, 1986). In addition to grain found at Hallshill, Northumberland (Gates, 1981), evidence for arable agriculture comes from grain impressions on pottery from two burials in Northumberland. Both examples were found on food vessels and one, from Newton, was associated with a radiocarbon date of c.1685 bc and has been identified as bread wheat (op. cit.).

In the uplands the most common and extensive remains relating to the bronze age are cairnfields, some of which are associated with other settlement activity (cf Jobey, 1981 and Richardson, 1982) and others which are not (cf Ward, 1977 and Young, 1992). Cairnfields tend to be situated at selected altitudes on comparatively level ground and on well drained soil. Examples are rare on limestone fells, although examples have been recorded on limestone at Crawley Edge, Co. Durham (Young, 1992) and on the limestone uplands of eastern Cumbria (SMR no. 4309).

In basic terms cairns were created by the collection and piling up of stones, the most obvious incentive for which was to clear the soil of stone for cultivation purposes (Higham, 1986, 92), but as Higham points out the amount of cereal pollen recorded in pollen diagrams does not equate with the extensive remains of cairn fields. Some excavated examples have shown cairns to be burial monuments (cf Jobey, 1981; Walker, 1965), but the large majority appears as unstructured heaps resulting from clearance. Fleming (1971)
suggests that cairnfields are likely to be multi period in origin and although some may be for burial, many of the thousands of cairns on the northern uplands derive from the intentional removal of stone from the surface of fields. Because of the lack of substantial evidence for large scale cereal cultivation, it is suggested that cultivation of cairnfields was not wholesale: instead, it was probably on a small scale and associated with the gradual colonisation of fresh areas and subsequently the extension of cairnfields. Soil exhaustion may have forced rapid abandonment in some areas (op. cit.).

It has been suggested that cairnfields were constructed quite late in upland landuse, possibly following an intense period of pastoralism which was, at least in part, responsible for deforestation (Fleming, 1971). The influx of humus and ultimately base soils in upland sediments (Pennington, 1965, 241), supports the theory that deforestation only marginally preceded soil erosion and, subsequently, the stone clearance which led to the development of cairnfields.

In Northumberland, clearance cairns, created during the first agricultural phase of the site, were followed, very soon after, by cultivation terracing and rectangular fields. At Houseledge, Northumberland (Burgess, 1981), survey of the surrounding area suggested that large scale division of the landscape using a boundary dyke system was carried out in order to separate areas reserved for agriculture and pasture. In Cumbria comparable field systems have been recorded on Crosby Ravensworth Fell and at Shap (Higham, 1978), with the former being associated with pottery of second millennium date (Cherry and Cherry, 1987, 9-11).

That manuring was practised is suggested from the widespread scatter of pottery and flints in some upland complexes including Houseledge (Burgess, 1981) and Blacklaw, Northumberland (Burgess, 1982), suggesting that livestock was kept at the settlement for winter feeding. Pastoralism probably made a major contribution to the economy throughout the second millennium and much forest clearance may have been simply a by-product of overstocking, with domestic livestock managed as a direct food and capital resource (Bradley, 1972). Higham argues that the climatic deterioration of between 1250 and 800 bc would have led to the abandonment of widespread agricultural land on the margins of productivity, and that its subsequent reuse as pasture was an obvious progression (1986, 95).

In summary it is suggested that the strategies were developed and utilised in the lowlands, where they would have been more successful, but progressively moved into less hospitable upland and lowland environments. In the preferred areas of the lowlands, clearance by grazing would be an efficient form of deforestation and consistent with the development of large herds. The subsequent use of the cleared areas for agriculture probably incorporated ploughing and permanent field systems and avoided the problems of erosion faced by similar practices in the uplands.

In addition to arable and pastoral farming, Cherry and Cherry explain that the limestone uplands of eastern Cumbria were naturally capable of providing a range of edible plants (1987, 71) including hazel and plantains, both of which were strongly represented in the post elm decline pollen record at Sunbiggin Tarn (Webster, 1969). The evidence for cereal cultivation around Sunbiggin Tarn has been noted but it seems
unlikely that the shallow upland soils could have sustained continued exploitation (op. cit.). Cherry and Cherry (1987) also suggest that the large number of arrowheads found in the limestone uplands is indicative of a greater reliance on hunting as a means of subsistence in this area. Certainly when compared to the tool kits of comparable date from the west Cumbrian coast, there is a clear difference in their composition. Far fewer arrowheads or serrated blades, and only a small number as stray finds, are found on coastal sites (op. cit.). The coastal environment would have facilitated the exploitation of fish and other marine resources in addition to a range of potential plant foods. The upland environment, on the other hand, would have been less diverse and communities are likely to have placed a greater reliance on hunting.

Excavation of coastal sites have confirmed that shellfish continued to form an important part of the diet during the bronze age. On Walney Island (Barnes, 1956), midden material associated with second millennium pottery included a wide range of shellfish but also the bones of ox. Elsewhere bones of sheep or goat, deer and porpoise were found. Higham suggests that "...human populations in the second millennium acted with a degree of pragmatism in assessing and utilising the resources of their particular territory" (1986, 96).

During the second millennium there is renewed interest in the Langdale axe factories, which probably stemmed from the population expansion not just in the local area but also in other areas where Langdale axes formed a normal part of their tool kit. This suggests that technology of the third millennium continued at least into the early second, utilising similar trade routes. By the mid second millennium the use of volcanic tuffs may have ceased and a 'new' perforated stone axe developed along with the exploitation of new lithic resources and the production of a more specialised range of tools (Bradley and Edmonds, 1993, 187-189). Quartz dolerite began to be exploited and axe hammers and battle axes (known as Group XVIII products) became a specialism. Axe hammers occur widely, with numerous stray finds in local lowlands. The precise source of the dolorite is unknown, although Davis (1983) suggests a source in the Upper Eden Valley. A second source possibly exploited at this time was the micaceous subgreywacke (sandstone) which probably originates from the Lake District and Howgill Fells area (Group XV). It is suggested that local groups had found an alternative to the Langdale Tuffs which were unsuitable for the production of perforated implements. Examples of these found in the West Midlands and a single example from East Anglia suggest there was at least some contact, probably derived from trade, with Cumbrian communities.

Battle axes are comparatively rare in the northern counties compared to east Yorkshire, but axe hammers are numerous with the densest concentration in England being recorded on the lowlands bordering Furness and Morecambe Bay (Higham, 1983, 97). The few examples that have been petrologically identified are from a Group XV source and local production was almost certainly responsible for the majority of these artefacts.

The distribution of axe hammers is comparable to that of polished stone axes, suggesting that if the axes were used in the neolithic for felling trees, then axe hammers were perhaps used as tips of ards, indicating a continuity of landuse from clearing to cultivation on particular pieces of land (Bewley, 1994, 60). Their
frequent discovery in complete isolation lends considerable weight to the view that they might have functioned as the tips of ards, whether or not this was their original function (Bradley, 1972, 201). The discovery of the tip of an axe hammer in an excavated furrow at Gwithian in Cornwall substantiates the idea of their use in this way (Bewley, 1994, 60).

Coastal sources of flint also continued to be exploited at least into the second half of the first millennium, but there was a development of designs, including barbed and tanged arrowheads. Scrapers continued to be made and most types of artefacts cannot be distinguished from earlier types. The importation of high quality flint implements, particularly knives which were regarded as highly valued personal objects, continued, probably from the Yorkshire Wolds (Cherry and Cherry, 1987).

The introduction of metallurgy was a technological innovation in the second millennium BC. Metallic artefacts probably gained importance slowly and within selected groups or contexts, with the earliest objects being treasured possessions. In many instances flint was preferred to metal but flint was difficult to obtain in the north. Developments in production technology eventually produced metal artefacts, which were superior for cutting, sawing and boring and had a wider range of uses. However, flint remained important until well into the first millennium.

In Cumbria it is the Eden Valley which contains the largest number of early bronze artefacts in the county, with a small scattering also evident in the south (Clough, 1969, 25). The styles are comparable to contemporary finds in Dumfriesshire and Galloway which date to between 1650 and 1350 BC (Coles, 1965). Such comparable material suggests that the Solway Firth was an important trade route from which people were then able to explore the radiating valleys. The Eden valley, for example, would have provided easy access to both north and eastern England (Clough, 1969, 25). Trade with Ireland was also growing in importance at this time (Fell, 1940) and the Solway Firth may have provided the initial point of contact for these trade links.

During the middle bronze age the distribution of bronzes is similar to that in the earlier phases but with denser concentrations of objects both in the Eden Valley and on the west coast. Communication networks, particularly along the rivers Derwent and Eamont, were established and, at this time, trade with Ireland appears more routine (Fell, 1940). Contact with the continent may also have been founded by the end of the second millennium (Clough, 1969, 26).

The late bronze age shows "... a tendency towards cultural stagnation" (op. cit.), which is most marked in the west of the county where no finds of late bronze age date have been recovered. Finds, traditionally considered on typological grounds to be of middle bronze age date, in this area remain in circulation until the middle of the first millennium. The Eden Valley again provides the densest concentration of contemporary material which is English in its affinities. In Furness a small, but noticeable, concentration of finds including the Skelmore Heads hoard (Cowper, 1905), appears more exotic by comparison. The
most significant external influence upon the development of Cumbria again emanates from Ireland but by this time it is much weaker (Fell, 1940).

Metal working traditions in Britain generally exhibited a high degree of variability which suggests a highly localised production, possibly as a result of sedentary craftsmen. In the north the situation is different: although various forms are recorded, most appear to be imported either as artefact, artisan or model (Higham, 1986, 101).

Generally, by the second half of the second millennium the development of clay moulds ensured a wider range of objects, particularly weaponry. However, the growth in the number of weapons came late to the north, with most examples, including the large hoards, dating from the end of the millennium (cf Coles, 1965).

The northern counties display a degree of archaism both in the adoption of new weapons and new technology which had developed in lowland England centuries earlier (Higham, 1986). The introduction of bronze and bronze objects throughout the second millennium is on a very small scale and where items have been found to be present there is a distinct bias towards the east of the country. Archaism is noticeable in the northern bronze working traditions by the late second millennium and this is evident in Scotland as well as northern England. The differences between evidence in the north and that in the south of England suggest a breakdown in the exchange of goods and technology at least by 1200 bc. Higham suggests the collapse of the Langdale axe production left no product of general trade value in circulation and that perforated stone products, which might have replaced the stone axes, were readily available from a variety of sources (1986, 102).

There is still some debate about whether metal objects were functional or purely the preserve of the social hierarchy. The increased dominance of bronze weaponry in hoards of the first centuries of the first millennium BC certainly suggest bronze products were goods of high status consumption. If this is so, there is little to support the idea that metal objects improved domestic or farming technology. On the whole metal objects are rarely found in domestic contexts, indicating that the ‘novel’ technology may have played only a very minor role in farming communities well into the mid second millennium.

During the second millennium, pottery is mainly found in graves where vessels are used to contain cremation burials or perishable grave goods with inhumation burials (Higham, 1986, 105). Traditionally there are three recognised types: beaker pottery, food vessels and cinerary urns. Because of the very limited examples from securely dated contexts, the study of these is still based on typology (Abercromby, 1912; Clarke, 1970). Beakers were used as grave goods from the early second millennium BC until c.1200-1100 BC at widely dispersed locations in Scotland (Higham, 1986, 105). Food vessels and cinerary urns were deposited over much the same period although no examples dating to the first few centuries of the millennium have yet been recorded (op. cit.). It is now accepted that all three ceramic traditions were contemporaneous for long periods.
Pottery of food vessel type has been found in late third millennium domestic contexts, which has led some to suggest that food vessels derive directly from neolithic ceramic traditions, particularly Peterborough Ware. There are so few examples of food vessels from non-sepulchral contexts, however, that this is difficult to substantiate (Cowie, 1978). The evidence does imply that there was a continuity in pottery production from which food vessels and cinerary urns derive. Although very few examples of pottery have been found in domestic contexts, it would appear that those found in burial contexts were part of a wider range of domestic pottery. Evidence from the north indicates that the manufacture and use of pottery was common place at least by the last few centuries of the second millennium and possibly before.

Beakers derived from a mainland Europe source and their introduction and acceptance into northern Britain may have been associated with a 'package' of technological innovation and religious or cultural change. Beakers are the least common of the local traditions and in burial contexts are generally in primary locations beneath cairns. As with other ceramic traditions, the vast majority of beakers was probably produced locally, possibly in a domestic manufacturing tradition. In Cumbria, Carlisle and the Eden Valley are strongly represented by beaker material but until Bewley's work in 1987 (1987) no examples had been recorded in the Solway Plain.

It has been suggested that during the bronze age environmental factors may have stimulated population growth but other factors were also significant (Higham, 1986, 107). In the core areas of occupation surplus labour was clearly important and was once again channelled into building monuments of social or religious function.

Although many of the large ritual monuments were constructed in the neolithic period, it is likely that they continued in use, if not construction, into the second millennium BC. Many of these monuments were constructed in rich lowland and riverine environments but other areas have produced comparable monuments. At Shap, Cumbria a stone avenue, which stretched over approximately 3.5 km, was built of glacial erratic boulders. It is not clear if one or two separate alignments of stones were originally present but the site has suffered from post-medieval agricultural improvement and only one stone is now standing (Clare, 1978). The presence of a barrow on Skellow Hill offers a link between the Shap avenue and funerary ritual, a link also common with the reported, but now destroyed, avenues and stone circles at Lacra, Broomrigg, Moor Divock and elsewhere in Cumbria (Higham, 1986, 109). The association between stone circles, avenues and burial monuments is a strong one and had developed by the middle of the second millennium, but in the north of England is only common west of the Pennines.

Small stone circles with central burial cairns occur in many areas of Cumbria, particularly the Eden Valley, west Cumbria and in the major Lake District valleys. It is unclear whether the circle and the cairn are contemporary, particularly since the addition of a cairn to an existing circle or henge is evidenced at various sites including Long Meg (Fletcher, 1958). Flint, jet and a Group VI axe were found at Grey Croft, Seascale (Cherry, 1967) and suggest the use of the cairn in the first half of the second millennium BC, but
the circle may have predated this episode. At Oddendale, Crosby Ravensworth the interior of a stone circle is almost entirely taken up by a cairn indicating a similar phasing, although it is possible that the monument represented a stone-defined, mortuary space pre-existing the sepulchral monument (Williams, 1986). The reuse, or continuity, in the use of ritual and burial monuments is clearly illustrated by a recently excavated site at Oddendale, Crosby Ravensworth, which has shown quite clearly four phases of use spanning a period of up to a millennium (Turnbull and Walsh, 1997, 39). The first phase is represented by a neolithic timber circle, a major ceremonial monument. During the second phase the earlier post pits were capped with boulders, mainly of pink granite, and would have appeared as two concentric circles of low, round boulder settings. During the early bronze age the third phase of construction was marked by a ring cairn of boulders which was built exactly to overlie the inner circle of Phase I and Phase II. The fourth phase comprised a rectangular platform of boulders which was added to the outer edge of the cairn (op. cit.).

Burial is the easiest understood function of ritual monuments of the second millennium. Burial rites were responsible for a range of monuments which were generally lesser in scale, but greater in number than those constructed during the preceding millennium. Until c. 1200 bc burial continued to occur in or under barrows or cairns and a certain degree of continuity is suggested by the reuse of existing burial monuments (Higham, 1986, 101). The number of burials beneath monuments and the tendency for barrows to be grouped have led to the adoption of the term 'cemetery' (cf Bewley, 1986a).

Although most datable artefacts were lost when many of the large cairns and barrows were opened by antiquarians in the 19th century, it is possible, from the surviving material, to identify a greater diversity in the burial rites of the second millennium BC than were present in the third. The group burial practice of the long barrow tradition is absent, but grave goods are found in a wide variety of combinations. During the second millennium both inhumation and cremation were practised and both made use of mounds, but some divergence in grave goods, particularly pottery, is evident.

It is suggested that burials associated with beakers are among the earliest. There are no examples of beakers occurring in a context that is demonstrably later than either a food vessel or cinerary urn (Clough, 1968). The relative wealth of the grave groups associated with beaker burials supports the idea that they represent high status individuals. Graves containing several beakers are not uncommon occurring, for example, at Clifton and Brougham, Cumbria (op. cit.). Most beaker burials come from capped stone cists normally covered in a mound and associated with inhumation burial. Other grave goods are rare but some do include metal work. Also present in a few examples is archery equipment, although in the north this is restricted to barbed and tanged flint arrowheads (Higham, 1986, 111). Whetstones and jet buttons also occur. The relative wealth of the beaker graves supports the idea that these burial practices were specific to the social elite.

Food vessels are found with both inhumation and cremation burials. Most were deposited in cists formed by the excavation of a pit in the lowlands or built of stone where soil was thin. Grave goods are similar to those found in beaker burials but most contain no other artefact. Sometimes they occur in the context of
secondary burials in barrows already covering a beaker burial, but sometimes they represent sole deposition or primary deposition. Beakers and food vessels are generally rare west of the Pennines and absent on high ground. Both are scarce in southern Cumbria where absence of evidence may be interpreted as a resistance to the cultural elements which burials and henges represent (op. cit.).

Cremation was widespread in the second millennium and was present in a variety of different environments. It was associated with food vessels and cinerary urns, but many cremations are totally unaccompanied. Cremation may be seen as a continuation of local neolithic traditions, with the pottery suggesting a similar heritage. Cinerary urns are normally found in a cist or pit, but with a strong tendency towards the reuse of existing barrows (cf Greenwell, 1877, 397 and 399). Where urns are used as a primary deposit, subsequent internments are common. A cairn at Appleby Slack produced three cordoned urns, whilst another at Urswick, Cumbria produced two urns with a pygmy cup and a bronze knife (Fell, 1958).

In some areas substantial cemeteries developed. At Ewanrigg, Cumbria a total of thirty cremation pits, a cist burial and a beaker 'pit' were discovered following a field walking exercise on a field adjacent to a presumed Romano-British settlement. The cemetery was positioned on a natural knoll with the cremations arranged around the cist burial. The beaker burial lay to the north of the main cremation cemetery and took the form of a stone lined chamber. Although disturbance indicated that the burial had previously been investigated, it is thought that it represents the first burial on the site. Radiocarbon dates from twenty of the cremation pits average out to 1650 BC (Bewley, 1987, 230).

In summary, second millennium burial rites are diverse and contained elements developed in the late neolithic and in some cases re-using existing monuments. Many barrows were probably intended for multiple internments or for use as cemeteries and it seems many served the community over long periods. One major development of this time was the inclusion of grave goods and in particular pottery.

2.5 The iron age landscape - Pollen zone VIII

In the north one of the main difficulties in the study of the iron age and Roman native settlements is the very limited amount of material remains. This is particularly relevant in the case of pottery, which has conventionally formed the basis for chronology. In 1976 Clack and Gosling explained that

"In the absence of sufficiently diagnostic artefacts, we are dependent almost entirely upon the gradual accumulation of radiocarbon dates for individual sites, and structural phases within sites, for the construction of a chronological frame work for the later prehistoric settlement of the region, and as a means of relating settlements to one another." (Clack and Gosling, 1976, 24)

In general, although a number of 'new' sites has been attributed to this period since the 1970s, the situation remains unchanged. "In the mean time, it is only possible to analyse sites in their morphological groups, and to point to relationships between these groups where site context or absolute dating permits" (op. cit.).
Further difficulties are created by the fact that, where archaeological evidence is available, it relates almost entirely to domestic settlement and landuse with very few examples of ritual or burial practices. This is in contrast to the neolithic and bronze age periods when settlement evidence is rare and the archaeological record is dominated by evidence of ritual and burial practices. Judging from the conspicuous nature of ritual and burial monuments in the earlier periods and the paucity of such evidence from the iron age, it would appear that practices changed during this time and whatever practices were adopted the evidence for them has remained archaeologically invisible.

Because of the dearth of information relating to the iron age in Cumbria, the following discussion once again draws on evidence from east of the Pennines and from southern Scotland. The synthesis relies heavily on that produced by Higham (1986), which remains the only available summary for the northern counties. Although much of the evidence comes from outside the study area, the synthesis will provide an outline of the social, economic and ritual practices of iron age communities in the northern counties. This in turn provides the context for the archaeological and palynological work which forms the focus of this research.

2.5.1 Vegetation History

The climatic deterioration which began in the late bronze age reached its maximum effect by 800 BC. The impact on northern England was considerable and detrimental particularly in the upland areas and on the exposed western hills, where rainfall was high. In areas of earlier deforestation, soil erosion increased and large areas were reduced to moorland and blanket peat. In Cumbria, particularly in the west, many areas were rendered uninhabitable. In Eskdale it is thought such changes caused "pauperisation, aggression and population loss" (Higham, 1986, 117). This is also indicated in areas east of the Pennines and Cheviots.

The pollen diagram from Bummoor Tarn, in the south west Lake District, includes one of the vegetation changes in north west England which could be attributed to the climatic deterioration at the opening of the sub-Atlantic period (Fig 2.1) (Pennington, 1970, 72). Between c. 1200 BC and c. 500 BC there is a fall in Alnus pollen followed by a rise in grass and Coryloid pollen, indicating the replacement of upland Alnus woods by Molinia-myrica swamps (op. cit.).

In the Cumberland lowlands the only vegetation history comes from Ehenside Tarn (Walker, 1966). Here the balance of clearance and regeneration initiated in the late bronze age period remained virtually unchanged until early in the local pollen zone C21 (c.100 AD (Fig 2.1)). Although there is no indication of a progressive and wide extension to the cleared area around the site during most of this period, there is an increase in cereals and Rumex acetosella which, Walker suggests, may be taken as an indication of intensified agriculture (op. cit., 200).

Turner has argued that on a national scale rainfall fell and the mean temperature increased in the last four centuries BC and into the Roman period (1981, 261). Certainly over much of England there is evidence of increased clearance at this time, but in the north this was late arriving and in some areas such practices remain palynologically and archaeologically invisible until the Roman occupation. At various sites in the
north east, where rainfall was less, clearance episodes have been identified from c. 500 BC, with the majority of examples dating to the last two hundred years BC (Higham, 1986, 118). Clearance of this nature enabled permanent settlement and exploitation of lowland areas, but in the Cumberland Lowlands Walker suggests full scale clearance was at least post conquest in date and possibly attributable to the post Roman period (1966). In the north west Pennington identified a Brigantian clearance episode occurring nowhere earlier than AD 200 and generally in the later Roman and early post Roman periods (1970, 72). Clearance may have been earlier in the Eden Valley but no evidence is yet available for this area.

The uplands were probably largely cleared, beyond reversion, by this time. This would have been the result of a combination of earlier clearances by human communities and climatic agents. At Moor House, close to the summit of Cross Fell, a final clearance is recorded at c. 262-255 BC (Turner, 1981, 270). Much of the upland areas in the north was open but uninhabitable, with impoverished soils and flora (Higham, 1986, 119). In lowland areas many mosses were fully established by this time, rendering a loss of habitat in the Cumbrian coastal lowlands.

Higham suggests that by the end of the first millennium BC only areas of better drained lowland soils were suitable, or indeed available, for agriculture and some of these were still under woodland cover (op. cit.). These reserves were eroding as a result of anthropogenic clearance and, although it is difficult to determine whether any one of the permanent clearance episodes was earlier than the Roman occupation, the impression is of a major clearance episode of late prehistoric date continuing into the Roman period. More recent pollen analytical work in the area of the Hadrianic - Antonine frontier zone has shown that, although in some areas of northern England and southern Scotland deforestation was well underway by the time of the Roman invasion elsewhere large areas of dense woodland survived (Dumayne, 1993a, 1993b, 1994; Dumayne and Barber, 1994; Dumayne et al., 1995).

2.5.2 Iron age archaeology

The reaction of human communities to the increasingly difficult environment was complex and although the archaeological record is limited, two major features are conspicuous. The first is the apparent abandonment of previous areas of activity and the reversion of these to waste or poor pasture. The second is the increase in territorial awareness which manifests as a common and growing investment in physical security.

Iron age and Roman settlements appear as palisaded, defended and undefended complexes, all of which can be found in contexts ranging in date from the late bronze age to the post Roman period (Young and Simmons, 1995, 6). The size and distribution of the settlements are equally as variable. Palisaded or ditched settlements are more common in Northumberland than Cumbria but south of the Tyne the distribution is much less dense. The same imbalance is reflected in the distribution of hillforts.
Palisaded enclosures succeeded, and in part, were contemporary with, unenclosed and platform settlements, but where a site succession has been identified, as on several hillforts, the palisade usually forms the earliest structural phase (Higham, 1986, 120). The construction of palisades by communities which had previously been content to inhabit unenclosed settlements indicates a change in social needs, with a new desire to define the limits of the settlements. This may have been due to social or economic pressures, but the preoccupation of at least the upper sections of society with weapons suggests it represents an increasing desire for physical security. The fact that many of the earliest palisaded enclosures have been found to command defensible sites and underlie late prehistoric hillforts substantiates this idea. Following the population increase of the late bronze age, it is possible that the increased competition for resources materialised as a display of territoriality.

Higham suggests that palisaded sites indicate a change in the economy, in the sense that most upland palisades appear not to be associated with arable fields (1986, 122). On this basis it is implied that the occupants were pastoralists who utilised wooden fences or palisades to control livestock. It is suggested that upland areas were abandoned by bronze age agriculturalists, only to be re-used in a ranching style of herding during the iron age in a system of farming widely paralleled in southern Britain (op. cit.). More recent research in Northumberland, particularly in the Tyne-Forth area, has, however, identified numerous sites of very narrow, ridged cultivation, known as cord rig, associated with late prehistoric palisaded settlements (Topping, 1989). Combined with the many examples of pre-Roman cultivation terraces, it is now apparent that arable regimes also formed a significant part of the economy at this time (op. cit., 161). The iron age and Romano-British settlement at Catcote, Hartlepool (Long, 1988) also provides evidence of a mixed economy. Here ample finds of animal bone, carbonised grain and quern stones all substantiate the theory that the settlement was used by a "self sufficient agricultural community with both stock raising and arable activities" (op. cit., 33). Excavation of the rectilinear, palisaded enclosure at Rock Castle, West Yorkshire, has revealed that spelt wheat and hulled six row barley were the main crops grown and has also yielded evidence for the cultivation of bread wheat towards the very end of occupation (Fitts et al., 1994).

Soon after the middle of the first millennium some of the major palisaded sites were replaced with hillforts. The use of wood continued into the Roman period, but extensive deforestation meant timber supplies were unable to sustain demands. It has been proposed that the gradual abandonment of the palisade as an enclosure system was contemporary with the diminishing timber supplies which left certain areas, particularly in Northumbria, devoid of the necessary building material (Higham, 1986 123). The abandonment of this building technique may have been unavoidable for any community which was determined to stay in the same area.

Around 500 BC hillforts developed extensive defences but the chronology remains imprecise. At Hownam the two phases of palisaded enclosure were superseded by a sheer face stone wall perimeter, then by multivallate defences followed by an undefended settlement later in the Roman period (Piggott, 1947). This succession holds for other sites, but where tested by excavation, there have been fundamental differences in the chronology. Recent excavations at Wether Hill, Northumbria have shown that although one palisaded
site was superseded by the hillfort, a second palisade was in use during the third and fourth century BC, contemporary with the hillfort and the associated cross ridge dyke and cord rig field system (Topping, 1999, 21). As Topping points out, the Hownam sequence did not take account of the possibility that 'successive' constructional techniques could actually be contemporary, a factor demonstrated by more recent radiocarbon dates (op. cit., 19). Instead, Topping argues, site development was more complex, with construction techniques being influenced not only by raw material availability but also driven by fashion and display so that the visual impact of the site became of equal importance to other considerations (op. cit., 21). Brough Law hillfort, for example, overlaps the palisaded settlement on Ingram Hill. "Presumably social constraints dictated why of these two roughly contemporary sites, one enclosure was built upon a hill top in stone while the other was constructed at its foot in timber" (op. cit.).

The larger hillforts probably represent the highest tier in a social and political hierarchy which was typical of the region from the Tyne to the Forth, where they probably acted as tribal centres and defended towns. Far more common in Northumbria are the smaller univallate and multivallate sites, which are comparable in size to many palisaded sites (Jobey, 1965). Some of the univallate sites tend to be sited with less regard for tactical advantage and have weaker defences than the multivallate examples. This leads Higham to suggest that the univallate sites were casualties in the chronological development towards an increasingly defensive model (1986). Sites with multivallate systems of defence tend to show development and where development is evident, it is initially from a less to a more defensive site and most forts ended up as multivallate. At Huckhoe (Jobey, 1959), for example, a multivallate system replaced a palisaded enclosure following the lines dictated by the latter but without an apparent break.

The greatest concentration of hillforts in the northern counties is found in the Cheviots, where their location shows a strong preference for primary spurs overlooking main valleys as at Pawston Hill and Brandon Hill (Higham, 1986, 125). It would appear that the local topography determined the form of the hillforts. In the Cheviots, for example, where ditches would need to be cut into bedrock, stone ramparts are common but in areas where the local conditions allowed, ditches appear as systems of defence. The lack of excavation on the majority of these sites does, however, make it difficult to track the development of fort defences which may well be complicated.

The distribution of at least the small hillforts suggests they were located and constructed with agricultural resources in mind. The pattern of distribution of defensive sites along upland fringes above the River Tweed, the Till, the Coquet and their tributaries suggests the hillforts may have acted as nodal points from which control of river valley resources could be organised, and integrated with upland grazing. The typical small hillfort of northern Northumbria probably played a fundamental role as the permanent home of a social and political elite and their dependants.

Away from the Cheviots the number of hillforts is considerably less, with only a handful of examples known in southern Northumbria. South of the Tyne hillforts are conspicuously absent, with rare examples at Beacon Hill, Heightington, Shackerton Hill, Bishop Auckland or Maiden Castle, Durham City (Clack
and Gosling, 1976, 24). In Cumbria the situation is marginally better. A single oppidum-sized fortification is defined by a tumbled stone wall at Carrock Fell at the unusual height of 650m OD but the lack of hut circles and the exposed location of the site suggests it was never permanently occupied. Below Carrock Fell at Dobcross Hall (Higham, 1981) a univallate enclosure of approximately three hectares appears from aerial photographs to be the centre of several radial ditches, a design with parallels on the southern chalklands. The perimeter ditch was almost 3m deep and 4.2m wide with a near vertical inner face and a possible palisade on the outer side.

In north and east Cumbria defended sites are either very small or are unlikely to be of pre-Roman date, although a supposed hillfort at Swarthy Hill in the Solway Plain has been confirmed as being c.500 BC in date (Bewley, 1992). In Southern Cumbria, four forts have been recorded. Near Whicham, on the coastal plain, a bivallate, near circular site has been identified from aerial photographs; At Skelmore Heads, near Urswick, the site survives as an upstanding monument; in Plain Furness the fort was enclosed by a palisade and later provided with a rampart; and Warton Crag near Carnforth relies on natural defences but has three widely spaced banks on the north side defining a site eight hectares in size. Between them Castle Head, on the east side of the Cartmel Peninsula, is recorded as a small simple defended bluff. Each of these sites was located in a distinct geographical area and occupied what would have been considered a favoured niche in the environment. Whicham is situated in a position to exploit coastal and upland areas, whilst Skelmore Heads and Castle Head occupy relatively sheltered sites on the eastern side of the two principal peninsulas of Southern Cumbria with relatively fertile lowland resources. Warton Crag occupies a site on an important area of limestone terrain. Higham suggests that Skelmore Heads and Warton Crag were at least minor oppida with political significance over a wide area (1986, 130).

Multivallate defences are very rare in Cumbria, Durham and Cleveland and small defence sites of all sorts are only thinly distributed. This is in contrast to the situation in Northumbria, north of the Wansbeck, where it would appear that labour for non-subsistence activities was more readily available. Higham suggests that the population of the area around the River Till:

"coped better with the changing environment of the middle bronze age and emerged in the late prehistoric period with a denser population organised within a more competitive framework than their Cumbrian neighbours" (1986, 130-31).

It appears that outside Northumbria elites were sparse and the distribution of defended sites implies a larger block of land was administered from each. By the second half of the first millennium BC central Northumbria had the appearance of a cultural frontier and northern Northumbria displays a hierarchy of settlement comparable to communities of central, southern and south east Scotland. Cumbria remained relatively undefended, but the absence of the small defended site in the settlement hierarchy may suggest a greater political authority at the tribal level.

Small homestead enclosures are also well documented in Northumbria and, increasingly, in other northern counties, but the main difficulty is distinguishing between late prehistoric and Roman settlements. In
Northumbria two main types have been identified on morphological grounds: curvilinear and rectilinear forms, nearly all of which have been located north of the River Tyne (Clack and Gosling, 1976, 27). Both types contained round houses, but those containing timber huts are generally considered to be late prehistoric in date and those containing stone buildings are assumed to be of Roman date. In Cumbria however, timber houses are present late into the Roman occupation. This is particularly evident in the lowlands, where timber houses were retained in parallel with the stone building tradition of the uplands. Such overlap and the lack of excavation make it difficult to distinguish between the enclosed settlement of the late pre-Roman and Roman periods and introduce obvious uncertainty in any distribution map.

In Cumbria aerial photography has identified a large number of both nucleated and extensive settlements (Higham and Jones, 1975), the distribution of which shows concentrations at the head of the Eden Valley, in the foothills following the coast between the Rivers Eden and Ehen (Collingwood, 1933a and 1933b), on the north west Cumbrian plain and around Wigton and Penrith. Some of these (eg. Old Brampton, Wolsty Hall and Risehow (Blake, 1959) have been shown, through excavation, to have been occupied, or reoccupied, in the third or fourth centuries AD, but no undefended settlements can at present be assigned confidently to the pre-Roman period (Higham, 1986, 133). More recent survey and excavations at Baldhowend, Matterdale have, however, identified a complex of field boundaries, clearance cairns and hut circles dating to the late first millennium BC (Loney and Hoaen, 1999, 25). This suggests that sites traditionally thought to be bronze age in date may in fact belong in a later prehistoric context.

These latest discoveries go some way towards confirming the observations made by Clack and Gosling back in 1976. At this time it was suggested that in some ways:

"...settlements in Cumbria do not conform to the types that have been recognised in Northumberland. Apart from those on the north west Cumbrian Plain, some of which resemble eastern types, the most common class of settlement in the region is distinguished by a series of small field enclosures attached to a central enclosure containing round stone built houses. Several classic examples are concentrated in the Central Eden Valley" (Clack and Gosling, 1976, 28).

A representative of this type is the site at Ewe Close which, following excavation, was assigned by Collingwood (1908, 1909) to the Roman period, but which was later considered to be pre-Roman in origin (Collingwood, 1933b). That any of these sites significantly pre-date the Roman occupation has yet to be demonstrated.

In summary, it appears that pre Roman farmers, particularly those in the north east, occupied enclosed settlements. The form of construction was dependent on the local availability of timber and stone and the nature of the subsoil. The round houses were similar to those that had been built for centuries before, but were often associated with adjacent yards for corraling cattle and areas of arable activity, areas which were defined by ditches, banks or hedges. The farmer probably paid rent in kind to a landlord, but was probably more dependent on herds than grain for a living. Although many settlements appear to have been abandoned before the conquest, other homesteads tended to increase in size and eventually incorporated more or larger
houses. In other instances small groups of enclosed settlements like those on Augertree Fell, Cumbria, may imply population increase and territorial sub-division.

By 0 BC/AD the north eastern counties and possibly the Solway Plain and Eden Valley were becoming increasingly infilled. It is clear that homestead or farm sites were present on all of the better drained, lowland areas, penetrating into the major river valleys. Whether these settlements were occupied by the lowest status group of the population is not clear, but they do represent a numerous, low status, type of settlement that compliments the provision of defended forts and oppida in northern Northumbria and more isolated defended sites elsewhere.

Early interpretation of late prehistoric settlement in the northern counties led to a view of economic strategies dominated by pastoralism. This assumption was based primarily on the fact that grain storage pits, which were considered to be diagnostic of iron age agriculture, were rarely found in excavated sites of this period. This was until evidence of above ground storage was identified (Jobey, 1959) and since then grain has been found on most sites at least from the late pre-Roman period. Quern stones also provide evidence of grain consumption at least from the middle of the millennium into the Roman period and possibly beyond. It is now clear that a mixed economy was practised and that a wide range of habitats was being exploited.

Higham (1986, 138) suggests from the evidence that the late prehistoric economy was based on lowland agriculture and upland grazing, but explains that unfortunately the evidence cannot demonstrate that agricultural field systems were associated with many late prehistoric settlements. More recently, the work of Loney and Hoaen (1999, 25) at Baldhowend, Matterdale, Cumbria has, however, identified a settlement complex which includes field boundaries, clearance cairns and hut circles dating to the late first millennium BC.

Diagnostic artefactual evidence relating to the pre-Roman iron age is rare in the north. With regard to metallurgy the largest hoard comes from Heathery Burn cavern (Britton, 1971; Greenwell, 1892; Harding and Young, 1986) and dates to the middle of the first millennium. Most axes from the hoard were decorated, suggesting that they were produced with more than a functional purpose in mind. The hoard was believed to have belonged to a manufacturer (Greenwell, 1892), although non-metal elements of the hoard make its status doubtful (Higham, 1986, 138). The most elaborate item was a bucket or caldron which was comparable to examples from Hatton Knowe, Lothian and Ravenstonedale, Cumbria, demonstrating a wide, if sparse, distribution of this particular artefact type in the north.

In general, metal work was elaborate and the bias in favour of aristocratic display is conspicuous. The bronze smith's craft was probably a lucrative one. Most of the items produced were aimed at display and ornamentation, with very few items of functional, domestic, equipment being manufactured. It is unlikely that the working farmer benefited from the new technology, which in any case produced a softer and less functional cutting edge than stone.
Once again there is a geographical bias in the distribution of metalwork. The socketed axe gives an example of the basic trends, with the vast majority coming from Northumbria, in particular from the coastal plain and the middle reaches of the Tyne and the Cheviot valleys. This distribution forms the southern end of a concentration spreading across Scotland towards Glasgow and up the east coast. With the exception of Heathery Burn (Greenwell, 1892; Britton, 1971; Harding and Young, 1986) and a handful of stray finds, South Durham and Cleveland are devoid of examples. The only hoards recovered from Cumbria are two from the good agricultural land around Skelmore Head in Furness (Cowper, 1905) from which also derived the only late bronze age sword so far found in the county (Fell and Coles, 1965). Apart from a small number of objects, including the Skelmore Heads hoard, most Cumbrian examples come from the Eden Valley and mainly from the Penrith area.

Such a distribution emphasises the relative affluence amongst the aristocracy of Northumbria in contrast to areas west of the Pennines and south of the Wear. However, even the aristocracy of Northumbria failed to attract the wealth of craftsmanship of east Yorkshire or Lincolnshire. The total absence of socketed axes from the Lake District valleys does not even compare to the distribution of middle bronze age axes and palstaves in the same area and has been used as evidence to suggest a progressive pauperisation of the community even compared to Plain Furness and Eastern Cumbria (Higham, 1986, 139).

Horse harnessing techniques were another characteristic of the period. Again, these was adopted by the warrior aristocracy. Cart or chariot fittings were found in the hoard from Heathery Burn Cavern (Greenwell, 1892; Britton, 1971; Harding and Young, 1986) which, in context with the associated weapons, must be seen as an aristocratic assemblage. In addition to these items of wealth, the warrior elite adorned themselves with a wide range of personal ornaments including bronze and gold amulets, rings, a variety of brooches, beads and other forms of lignite, stalalite, amber, pebbles, shells and teeth. Although the smith's production was dictated by wealthy members of society, some items would be used by other craftsmen, but little was available to the farmer who probably still relied on stone for tools.

The gradual introduction of iron working in the last centuries BC had greater implications for the working farmer. The stronger more efficient equipment could improve output. The discovery of iron working features at, for example, the enclosure complex at Catcotes (Challis and Harding, 1975), and the rectilinear, palisaded enclosure at Rock Castle (Fitts et al., 1994), indicates that at least some farmers were making use of this technology. It would appear that iron smithing was spreading from the south throughout the late pre-Roman period, but the scarcity of iron agricultural equipment from any area other than the military zone suggests the use of iron was never as widespread amongst farmers in the north as it was in the south. There is very little evidence of iron implements being in use west of the Pennines before the conquest. The contrast between east and west is marked before the Roman period by evidence of local coal and ore extraction on at least some of the north Northumbrian homesteads. Although the evidence for late prehistoric cultures in the north indicates relative poverty when compared to other areas, there is still enrichment of craftsmanship and a new range of equipment and ornamentation. Whilst the most elaborate
objects were restricted to the elites, some items of display were reaching the peasant farmer and may have played their part in the take off of permanent clearance and cultivation that typified the ultimate pre-Roman period east of the Pennines.

The identification of craftsmanship indicates the possibility of a simple exchange economy based on markets and special communities. Coinage never became a significant feature in the market or as display items in the same way as it had done in the south and east of England around 0 BC/AD. However, some large sites and some with a diverse range of artefactual evidence stand out from the hillforts and homesteads. Traprain Law, Lothian (Birley, 1956) is one example and Stanwick Camp (Turnbull, 1984) is another. At Traprain Law, late bronze age and pre-Roman iron age metalwork indicates an early phase of the settlement as a distribution centre and manufacturing site with contacts in Ireland and Europe. Its trading survived the Roman period and a lengthy Roman coin series contrasts with the scanty coin evidence from contemporary rural settlements. Further south at Stanwick a reinterpretation of the defences suggests this may have acted as a temporary warehouse in the late pre-Roman period handling the importation and redistribution of fine wares, amphorae their contents and glassware (Turnbull, 1984). The site may have served both County Durham and, to the west over Stainmore, the Eden Valley. In Cumbria Dobcross Hall (Higham, 1981) is the only similar site with Roman coins found close by.

On the whole, specialist trading sites were not widespread in the northern counties and where they do exist they probably represent the first steps towards a market economy. Generally it would appear that society and the economy were controlled by elites who provided the main market for crafts and were responsible for the consumption or exchange of agricultural surplus. Farmers depended upon local contacts with peers and were reliant on local leaders to provided what little security was available.

The bulk of ceramics found on native sites was of local manufacture and was generally uninfluenced by imports. There is a marked degree of uniformity from site to site over several centuries which may have resulted from the constraints of hand building techniques and limited functional uses. In Cumbria local pottery has only been excavated in pre-Roman iron age contexts at Skelmore Heads (Cowper, 1905). Cumbrian farm sites do produce local pottery in the Roman period and it is possible that this reflects the continuation of a pre-existing ceramic tradition in the area.

In summary it seems that in the northern counties in the late prehistoric period there is a social hierarchy with the emergence of a distinct class. Members of this class were in control of surplus wealth and were forming a warrior elite. There is less evidence of specialists in ritual or religion, although religious cults do emerge in the Roman Period. What is noticeable is the change from distinct burial practices of the second millennium BC to archaeologically invisible methods of dispersal. Only near Dalton in Furness, around Skelmore Heads has late bronze age metal work been found in association with an inhumation burial in a cist. A second unaccompanied inhumation on Birkkrigg may be of the same period. Elsewhere there is evidence to suggest that rites that involved cremation deposited under barrows struggled on into the iron age. At Wether Hill (Topping, 1999), a cairn appears to have originated from a horizon later than the
bronze age and was associated with a major phase of activity when the field system, palisaded sites, cross ridge dyke and presumably the hillfort were all in use. A scatter of cave burials has been found but the disarticulated condition of many of these implies abnormal ritual deposition.

2.6 Discussion

The above synthesis provides adequate evidence to indicate that the Cumbrian landscape was utilised throughout prehistory. Although the evidence is limited in certain areas of space and time, there is enough to suggest a certain amount of continuity and change through the six thousands years or so prior to the Roman invasion.

One strikingly obvious observation is the difference in the quality and quantity of data available for each period. The mesolithic period is represented mainly by artefact scatters and some structural evidence indicating settlement along the west Cumbrian coast, but only very limited evidence is available for the exploitation of more inland locations.

The coastal sites remain important throughout the neolithic period, but during this time we see very significant changes in the organisation and structure of human communities. Although settlement sites remain elusive, these processes of change do manifest themselves in the archaeological record as large ritual monuments. In Cumbria at this time the volcanic tuff of the Langdale area is exploited for the production of axes and extensive exchange networks were established. In the later neolithic it would appear that the Eden Valley increased in importance possibly as a result of its position on the main route way through the Pennines to the east, northwards to the Solway Firth and westwards to the Lakeland central massive.

The bronze age is mainly represented by the numerous burial monuments which have come to characterise the period. Again, settlement sites are rare although more are documented for this period than the preceding neolithic. Unfortunately due to the very limited excavation carried out in the area our knowledge of these sites is not much further advanced. What is clear, however, is that the population increased and there was expansion of settlement into previously unfavoured areas considered by many to be poor marginal lands. Evidence of forest clearance for grazing and arable agriculture is widespread. Climatic deterioration towards the end of the bronze age caused soil erosion on many of the upland sites, particularly in areas of prolonged deforestation where the stability of the soil was already in question. It would appear that much of the upland peat visible in the landscape today was already in existence by the end of the bronze age. In terms of the social structure it would seem that an elite class had developed and were responsible for the control of prestige items. The elites manifest themselves in the archaeological record as rich burials with grave groups containing prestige items and items of display and ornamentation.

The iron age in Cumbria is difficult to define. In contrast to the preceding periods there is almost a complete absence of evidence relating to burial practices; instead the record is dominated by settlement evidence. Further problems are encountered by the fact that diagnostic artefacts are rarely recovered even during excavation. For these reasons much of the discussion for this period depends on evidence from the
surrounding counties. It would seem that there is a growing concern for protection as palisaded settlements and hillforts developed particularly in areas of well drained soil. It is also suggested that a warrior elite was responsible for controlling agricultural surplus and that the status of this elite was displayed through the construction of large hillforts and through the prestige items these individuals were able to obtain through the established exchange networks.

However, something which is not immediately apparent is to what extent the patterns in the distribution of sites both within and between cultural periods are a consequence of differential preservation, destruction and recovery. This is something which will be considered in the following chapter.
CHAPTER 3

PROBLEMS WITH THE DATA

The previous chapter demonstrates the quantity of available information relating to the prehistoric landscapes of Cumbria. It also attempts to synthesise this data to show the current state of knowledge and understanding of this information. On a positive note the evidence highlights the fact that the Cumbrian landscape has been exploited by human communities for at least 6000 years and that certain elements of this occupation survive in the archaeological and palaeoenvironmental record. The surviving remains are therefore available for recovery and can contribute to the recognition and reconstruction of the prehistoric landscape (or landscapes) of Cumbria.

From a negative point of view the evidence also underlines a number of problems with the data. These include both natural and cultural influences which have affected the preservation, destruction and recovery of the archaeological and palaeoenvironmental record. This chapter takes a critical look at the data in an attempt to identify the influences in question and the effect they may have had on the interpretation and understanding of the evidence.

3.1 Formation of the archaeological and palaeoenvironmental record

Many researchers have attempted to explain the form and structure of the observed archaeological record and to identify the formation processes which have created them (Ascher, 1968; Collins, 1971; Cowgill, 1970). However, Schiffer (1987) was the first to recognise the need for a study of the formation processes themselves as a means to rectify some of the biases created. Schiffer introduced the idea of predictability into the patterning of the archaeological record. In his excellent discussion about cause and effect he suggests that specific formation processes are determined by specific causes, the effects of which are regular and predictable. Because they are regular the effects can be used to identify the formation process concerned. In Formation Processes of the Archaeological Record Schiffer goes on to illustrate common cultural processes or C-transforms, and non-cultural processes, N-transforms, which create the archaeological record and how these can be identified from the evidence available (1987). Human contributions to the archaeological record (C-transforms) include, for example, the discard of rubbish, loss of items, abandonment of settlement, disposal of the dead and hoarding. Processes of the natural environment (N-transforms) include the weathering of sites and artefacts, the movement of artefacts and sediments by wind or water, the disturbance of deposits by animals, volcanoes and glaciation.

Other scholars have concentrated on the biases created by the methods of analysis employed by the archaeologist. Hamond (1980) considers the biases inherent in archaeological fieldwork and how these manifest themselves in the ever popular distribution map. He reviews the assumptions commonly made by the archaeologist in the interpretation of such maps and identifies four potentially influencing factors ingrained in this technique: the location of archaeologists active in the area; the extent of their fieldwork, this
attenuating with distance; the nature of this fieldwork, systematic fieldwalking being more efficient and effective in the discovery of sites; and the rate of development of archaeological investigation in different areas.

In Schofield's edited volume *Interpreting Artefact Scatters: contributions to ploughzone archaeology* (1991), a whole section is devoted to landscape processes and the effects of natural and cultural disturbance of artefact distributions. Along a similar vein Nigel Mills considers sample bias, and the need for multi-stage strategies in regional analysis and fieldwalking in Britain (1985). In fact it has been convincingly argued that a study of formation processes should be integral to any landscape survey (Young, 1994). It is now rare that a site or project report is published without some consideration given to the formation processes in operation and therefore the limitations of the data available.

Although much of the work on formation processes has been directed at the archaeological record, similar processes affect the palaeoenvironmental record. Hamond's work on distribution maps applies equally to both records (1980), but the 'C' transforms and the 'N' transforms in operation on the palaeoenvironmental record may be quite different to those affecting the archaeological record (cf. Moore *et al.*, 1991).

In the context of Cumbrian prehistory there are a number of apparent patterns in the distribution of the archaeological and palaeoenvironmental record. These are evident in both the spatial distribution and the temporal distribution of the data. It is the intention of this chapter to identify some of the processes involved in creating these distributions.

### 3.2 The spatial distribution of the archaeological and palaeoenvironmental records of Cumbria

Perhaps one of the most obvious patterns is the spatial bias towards the western side of the county. With regard to the palaeoenvironmental record, and specifically pollen data, this is clearly illustrated by Pennington (1970, 42, Fig.1). An obvious explanation for this may be that the distribution reflects the 'real' distribution of deposits suitable for pollen analysis. In reality this does not appear to be the case. The study of place name evidence from Ordnance Survey maps indicates that suitable deposits are available to the east of the county. For example, names such as Temple Sowerby Moss, Cliburn moss, Melmerby Mire, Long Mire and Morland Moor all make reference to sites of waterlogged deposits and visits to these sites, carried out as part of this research, have confirmed that deep deposits suitable for pollen analysis do exist in these areas. It is clear, therefore that the distribution of the palynological record is the result of a cultural process and reflects the choice of the researcher rather than a physical constraint due to the distribution of suitable deposits. Whether such a choice was made on the basis of the research objectives or by sheer preference on the part of the researcher is irrelevant in this case. The fact remains that palynological investigations could be carried in the east of the county. This is not to suggest that natural processes have not influenced the distribution of deposits but rather that the current distribution of the palaeoenvironmental record is a reflection of the distribution of research.
The spatial distribution of archaeological evidence is slightly more difficult to explain in as much as anthropogenic activity plays a far more influential role and introduces a less predictable process to the distribution. The first stage of anthropogenic activity to make its mark on the creation of the archaeological record comes in the process of deposition. How has the item entered the archaeological record? The final stage of human intervention is that of the archaeologist during the process of recovery. What complicates the situation is that there may be any number of intermediate periods of human intervention which affect the spatial distribution of archaeological remains. This is particularly likely in areas where settlement continuity is indicated.

What needs to be established is whether the distribution of the archaeological record reflects the 'true' distribution of human activity in any one particular period or whether it is simply a distribution of areas which have been subjected to archaeological research. Of course to add to the complexity of the situation is the question of whether any 'natural' processes have been responsible for obscuring or destroying parts of the 'true' distribution, rendering them invisible archaeologically.

It is inevitable that, in such a diverse and dramatic landscape such is Cumbria, some natural processes will have affected the recovery of material. The presence of alluvium, for example, in several of the lowland river valleys is likely to have obscured elements of the archaeological record. Likewise, blanket peat in the upland areas of both the Pennines and the Central Lakeland has been developing since the bronze age, if not earlier, and continues to the present day (Johnson and Dunham, 1962; Pennington, 1970). Clearly any prehistoric remains will have been covered by the peat and rendered invisible to the archaeologist except in areas where peat erosion is active.

The inundation of the Irish Sea basin in the sixth millennium BC will have had a similar effect in the sense that it will have hidden any archaeological evidence in the area. Although some patterns in the distribution of the archaeological record are likely to have been created by natural processes, not all biases can be attributed to such processes. Where these particular processes are involved they are relatively easy to identify and to take into account, but some natural processes can be quite subtle and very localised in extent, so it is vital that consideration is given to these on a project by project basis (Allen, 1991).

Cumbrian archaeology in general has received attention from a number of scholars, particularly over the last century, but when compared to other areas of the north, the county has been somewhat neglected (Clack and Gosling, 1976). Even within Cumbria biases in the distribution are evident. The physical attraction of the Lake District has, in the past, been favoured by those involved in research. This may be the result of the ever expanding tourist industry, particularly in the Lake District where archaeological investigations within the National Park tend to attract financial and academic support. As already mentioned, development of any description is rare in Cumbria, so the amount of work carried out under the jurisdiction of Planning Policy Guidelines 16 (PPG16) is minimal. In Eastern Cumbria only two projects in the five years between 1991 and 1996 come to mind, namely an archaeological evaluation prior to the construction of the Kirkby Stephen Bypass (Lambert, 1993), and secondly the excavation of a timber circle prior to the expansion of Hardendale
quarry (Turnbull and Walsh, 1997). The lack of development is a double edged sword in terms of the archaeological record. On the one hand it helps to preserve the archaeological evidence, but on the other it restricts the recovery of evidence and the potential for excavation. Obviously these social and political influences have an affect on the distribution of archaeological remains.

However, it is clear from the previous chapter that patterns are appearing in the distribution of prehistoric remains. In general terms the distribution resembles that published by Clack and Gosling in 1976. Over the last fifteen years the number of known sites has increased but this has tended to increase the density of the existing distribution rather than change the actual pattern of distribution.

In summary, the distribution shows that mesolithic occupation areas tended to be located on the coastal lowlands around Eskmeals (Bonsall et al., 1990), St Bees and Walney Island (Barnes, 1956; Cherry, 1963, 1969: Cherry and Cherry, 1973, 1983). The same areas remained important during the neolithic but 'new' areas such as Langdale and the Eden Valley became prominent places. During the bronze age period, sites are still concentrated along the west coast but areas of occupation move further inland particularly to the west and south west of the central Lake District. Within the central Eden Valley the density of sites increases. The iron age is less well documented and although areas of distribution are similar to preceding and succeeding periods the density of the distribution is greatly reduced.

A continuity in settlement could be argued particularly for areas along the west coast and in the central Eden Valley. It is clear that both of these areas remained important throughout prehistory, but it is not yet apparent whether these areas were exclusive and actively sought for settlement by human communities. It may be no coincidence that both the coastal plain and the central Eden Valley have been the focus of work by the Cherry family since the 1960s (1963, 1969, 1973, 1983, 1984, 1985a, 1985b, 1986, 1987, 1995). The Eden Valley has also benefited from the work of Higham and Jones (1975).

It is suggested here that the distribution of prehistoric remains has been greatly influenced by the distribution of archaeological research within the area. However, there are patterns of occupation emerging and these may well prove to be representative of the 'true' pattern, but currently there is the tendency to regard these areas of occupation as 'exclusive' or 'extraordinary' within any particular period. These observations have as much to do with the negative evidence or 'blank areas' in the distribution of the archaeological record as the positive evidence of settlement. Until further investigations into the 'blank' areas have been carried out, the current distribution patterns will gain momentum. The 'blank' zones need to be tested to identify whether these areas have distorted the interpretation of the archaeological record.

The spatial distribution of the archaeological record is also heavily influenced by the chronological distribution of archaeological research. As already mentioned, the focus of research in Cumbria has promoted certain elements of the archaeological record, primarily Roman remains. Prehistoric remains have not been wholly neglected but there are chronological biases within this research.
3.3 Chronological distribution of the archaeological and palaeoenvironmental record.

The quantity of archaeological and palaeoenvironmental information available for each period within prehistory is extremely variable. This is evident to some degree from the length and detail of the various sections in the previous chapter. The neolithic period, for example, is particularly well catered for in terms of research. This can be explained to some degree by the fact that palynologists have, for a long time, been concerned with the elm decline and its part in understanding the subsistence strategies and land use patterns of neolithic society. The situation is accentuated by the archaeologist's ambition to explain the Langdale axe factories and the influence their products had on the cultural development of the area. A combination of extensive palynological research and the location of the Langdale axe factories provides a rare opportunity for integrated research and provides an ever more focused basis on which future research can build. However, because of the location of the axe factories in the west this has served to emphasise the east-west divide in terms of the spatial distribution of both the archaeological and palynological record.

In contrast the iron age is very poorly represented. At one time the Sites and Monuments Record (SMR) at Kendal held only five records of sites of known iron age date. In terms of numbers this situation has improved, but the overall paucity of material remains and especially pottery, which traditionally forms the basis of chronology, exacerbates the situation. It is only the slow accumulation of radiocarbon dates for individual sites that has improved the representation of this epoch.

With regard to the palaeoenvironmental record the situation is no better. In 1970 Pennington had sixty pollen diagrams from which to construct her vegetational history of the North West of England. Despite this very little evidence was available for the iron age. With the exception of a fall in Alnus and a rise in grass and Coryloid pollen, which was recorded at Burnmoor Tarn and attributed to the climatic deterioration at the opening of the Sub-Atlantic period (Table 2.1), no other diagrams were found worthy of mention (1970, 72). This brief note is sandwiched between the extensive evidence for clearances during the bronze age and Pennington's 'Brigantian' occupation levels dated to the middle of the first millennium AD, the latter being evident in ten upland tarns (op. cit.). The evidence also contrasts with the five pages Pennington is able to devote to the neolithic changes in the North West (1970, 67-71).

In recent years Dumayne et al.'s work on the vegetational history of the iron age landscape between Hadrian's Wall and the Antonine Wall has improved the situation, but on the whole the iron age is still poorly represented (Dumayne, 1992, 1993a, 1993b, 1994; Dumayne and Barber, 1994; Dumayne et al., 1995).

It is difficult at this stage to establish whether the observed biases in the chronological distribution of the archaeological and palaeoenvironmental records are representative of the actual distribution. It is possible that human communities increased or decreased the level of activity in any particular area at any particular time, the intensity and form of that activity being dependent on the social demands at the time.
Again, it is suggested here that the chronological distribution has more to do with the focus of research than the 'true' chronological distribution of human activity. For example, where pollen evidence is available for the iron age (op. cit.) there is a suggestion that large scale clearance took place, but the pollen evidence contrasts with the very limited record of material remains which alone would indicate a very sparsely scattered population. This situation may be improved once the huge number of undated prehistoric sites (Clack and Gosling, 1976, 57) can be categorised, but this is a slow and unsystematic process and serves to emphasise the need for more radiocarbon dates.

This paucity of vegetational history data relating to the iron age may, at least in part, be the result of peat cutting, which became so popular during the medieval period. The removal of layers of peat would have removed the uppermost material, possibly that relating to the Roman and iron age periods. The limited vegetational history for the iron age may be the result of post-depositional processes affecting the preservation of archaeological and palaeoenvironmental records rather than an indication that the landscape was not exploited from the bronze age onwards.

In summary, there are very clear patterns in the chronological distribution of both the archaeological and palaeoenvironmental records but each appears to compliment the other in the sense that a lot of information, both archaeological and palaeoenvironmental, is available for the neolithic but very little of either for the iron age. It is difficult to determine whether this patterning is representative of human occupation during these periods or whether it is the result of variable recovery. It is suggested here that both activities play a part in this distribution, but the only means of testing this is to investigate some of the 'blank' areas for material covering all prehistoric periods.

In conclusion, despite the natural and cultural processes identified, and the biases in the spatial and chronological distribution in the data that they create, there is a suggestion of considerable inter and intra regional variability in the archaeological and palaeoenvironmental record. There is a need to test this variability to assess whether the biases in the records are a reflection of differential preservation, destruction and recovery or a 'true' reflection of the settlement patterns, the economic or ritual use of prehistoric landscapes.

3.4 Practical problems of integration

It is one thing identifying theoretical ways in which palaeoenvironmental and archaeological evidence can be mutually beneficial to the interpretations of the archaeological landscape, but quite another to identify practical ways in which this can be achieved. One very important observation made during the research and writing of the previous chapter was the difficulty in integrating archaeological and palaeoenvironmental data. This stemmed primarily from the differences in the chronologies used by palynologists and those used by archaeologists. Where there are no radiocarbon dates available, the palynologist relies almost exclusively on Godwin's pollen zones (1956) to provide relative dates for pollen profiles. The pollen zones are then often related to the Blytt-Sernander sequence of Holocene climatic episodes which are based on peat bog stratigraphy (Bell and Walker 1992). On the basis of Godwin's pollen zonations, the elm decline occurred in
Britain c.3000 BC, but as more and more radiocarbon dates have become available it has been shown that the elm decline is not often identified as a single episode and (where it is clear) it occurred in different places at different times. Within Cumbria the date given to the elm decline is variable. Obviously, because the elm decline is used as a standard against which most other zones are dated, this has serious implications for the use of relatively dated pollen diagrams for the interpretation of the archaeological landscape.

Where archaeologists are lacking radiocarbon dates, it is necessary to base dating of artefacts on typology, of sites on morphology and events relative to other, dated, events. The problem with all these relative dating methods is that they are generally based on dated contexts found outside the area under investigation. As more and more radiocarbon dates have been determined, the chronological sequence of certain typologies has been thrown into question, as have the chronological sequences of site morphologies. In a similar way that the elm decline occurred at different places at different times, the archaeological evidence also indicates some chronological variability both on an inter- and intra-regional scale and as such may not be conducive to the use of relative chronologies.

One theme to run common throughout the synthesis of the archaeological and palaeoenvironmental record of Cumbria is the evidence for at least some settlement continuity. This is not only apparent at the coastal sites where mixed artefact assemblages indicate a continuity of settlement use from the mesolithic to the bronze age (Barnes, 1956), but also in the vegetational history data which shows pre elm decline clearance for the small scale cultivation of cereals preceding episodes of more intensive clearance of the woodland. It is evident from this that the knowledge and technology required to carry out cereal cultivation were available in both mesolithic and neolithic societies and did not require an influx of people to bring their knowledge or tools with them. Such evidence for settlement continuity serves to exacerbate the problem of relative dating methods. For example a site which, on morphological grounds, is datable to the neolithic, may continue in use until the end of the bronze age but may not have required major rebuilding or alterations. Its outward appearance may have remained unchanged, but the use, value and meaning of the site may have altered through time and this may only be accessible through intensive fieldwork if not large scale excavation.

What settlement continuity highlights is that there are no clear divisions in the archaeological and palaeoenvironmental record on which to base cultural chronological boundaries. Bradley and Edmonds use evidence for the continuity of occupation to illustrate the futility of the period divisions based on subsistence strategies and artefact assemblages (1993). In the coastal areas of Cumbria there is a considerable amount of evidence for continuity in the use of sites from the late mesolithic to the bronze age. In the areas which were settled early in the late mesolithic, continued clearance is often recorded late into the neolithic. This point is highlighted by the fact that radiocarbon dates of the mesolithic sites at Eskmeals are closely comparable to the earliest date of the waterlogged site at Ehenside Tarn, which is assigned to the neolithic on the basis of its artefact assemblage. The structural remains at both sites are similar; if anything, the latter site left more ephemeral traces. Apart from the pottery, almost the only feature to distinguish these two occupations was the presence of group VI axes at Ehenside Tarn (Bradley and Edmonds, 1993).
Another problem evident from the Cumbrian material is the inaccessibility of good quality flint. Difficulties in distinguishing between early and late industries are created by the type of material used in the production of tools. In the absence of locally available, good quality, flint resources, Cumbrian mesolithic communities readily made use of pebble flint, chert and volcanic tuff. The physical and chemical properties of these materials make the production of precise tool shapes more difficult than with good quality flint and although general characteristics of the tools may be identifiable to the mesolithic, the diagnostic attributes may not be sufficient to allow distinction between early and late assemblages. The short supply of raw materials also meant that people were more economical with the available resource and would utilise what would otherwise be considered waste flakes.

In theory the problem of dating should be resolved by the determination of radiocarbon dates wherever suitable deposits allow. This would certainly improve the resolution of archaeological and palaeoenvironmental integration. However, in addition to being impractical from a financial point of view, the problem is not that easily resolved. Where radiocarbon dates can be quoted, the presentation of dates in academic texts is again variable. Although attempts have been made to standardise the presentation of dates, and the situation has improved in the last ten years or so, there is still the problem of integrating material which was dated some time ago before standardisation was encouraged. It is often unclear whether the date is presented in its calibrated form and if so by which curve it was calibrated. Clearly this has implications for the use of published dates in the interpretation of evidence outside that for which the date was originally determined. It also makes the integration of diverse evidence problematic. In recent years the situation has improved and most scholars specify the form of the data presentation and usually provide a specific laboratory and sample code so that the original date can be checked if necessary.

Another problem in the integration of palaeoenvironmental and archaeological data is that of spatial scale. This applies particularly to the use of palynological data for the interpretation of archaeological evidence. Almost twenty years ago it was recognised that the judicious selection of sites for palaeoenvironmental and palaeoclimatic studies would permit palaeoecologists to answer specific research questions that go beyond primary descriptions of past vegetation (Jacobson and Bradshaw, 1981). This work describes the relationship between basin size and pollen source area and predicts the proportions of local, extralocal and regional pollen sampled by basins of different sizes. Despite the widespread acceptance of the research among palaeoenvironmentalists (cf Moore et al., 1991), the technique has received little attention from archaeologists involved in the interpretation and integration of palynological data. It has been recognised that the integration of palaeoecological information and surface artefact scatters would be made considerably easier if such information related directly to the precise study area under consideration (Schofield, 1991). In this sense the potential of such a technique has been recognised by archaeologists but has not, as far as can be ascertained, been widely accepted despite the very clear implications for archaeological landscape studies. Basically, sites which attract considerable quantities of regional pollen rain will be unsuitable for integrating with 'on site' archaeological remains where the investigation is primarily concerned with the local and extra-local vegetation. In contrast, a small pollen sampling site dominated by pollen from a local area will have little to contribute to an archaeological study carried out on a regional scale. If it can be shown that pollen
data relates to the same geographical space as the archaeological evidence, the process of integration will not only be easier but the potential of this integration considerably more productive in terms of the information recovered. It is more likely that the two types of data will complement each other to a greater extent and will identify areas for further research. It may be that the vegetation history data will be able to ask very specific questions of the archaeology and vice versa, enabling a more focussed and detailed research design.

In conclusion, then, it would seem that both natural and cultural processes have influenced the pattern of distribution of both archaeological and palaeoenvironmental evidence in Cumbria. This spatial distribution is influenced further by the chronological distribution of research, with the Roman period having received the lion's share of the attention as far as the archaeology is concerned and the neolithic, from a palaeoenvironmental point of view. Despite having identified some of the biases in the distributions, it is still possible to identify 'real' intra and inter regional variability in both the archaeological and palaeoenvironmental record. Unfortunately the integration of the two bodies of data is problematic partly because of the different chronological scales used in archaeological fieldwork and palynological investigations and partly because it is difficult to identify whether pollen evidence actually relates to the area under archaeological consideration.

In theory the dating problem could be resolved with the use of radiocarbon dates, but the inconsistency in the presentation of dates in academic texts makes it difficult to interpret or integrate information based on radiocarbon dates.

The problem of spatial representation particularly with regard to palynological data can only be remedied by the careful selection of sampling sites within areas of archaeological investigation. It is necessary to ensure that both data sets cover the same geographical space and the same chronological period.

There is clearly a need to address some of these problems so that the full potential of available information can be realised and so that any future research can be integrated with the existing data. In an attempt to enhance our understanding of the prehistoric landscape of Eastern Cumbria, this research proposes a methodological approach to the collection of archaeological and palaeoenvironmental evidence which should ensure that the resulting data is mutually compatible and the potential of the data enhanced.

The area of Eastern Cumbria selected will ensure that some of the 'blank' areas in the spatial distribution of both the archaeological and palaeoenvironmental records are tested. It is also hoped that by collecting material from all prehistoric periods the patterns evident in the chronological distribution of data will also be put to the test.
In the previous two chapters it has been shown that Cumbria harbours extensive prehistoric archaeological remains and possibly the most comprehensive vegetation history in the country. However, the spatial distribution of the archaeological and palaeoenvironmental records highlights a number of patterns, the most obvious being the bias towards the western half of the county (Figs. 2.2 and 2.3 and Pennington, 1970, Fig. 1). Although the distribution patterns in the archaeological record may represent the 'true' distribution of human activity areas, it is suggested that they are more indicative of areas in which research has been carried out. This is almost certainly the case with regards to the palaeoenvironmental record.

For the current research, an area of Eastern Cumbria has been selected in the hope that this will go some way towards 'filling in the gaps' in the spatial distribution of research. It is also hoped that investigation of some of the archaeologically and palaeoenvironmentally 'blank' areas will help to establish whether the chronological distribution is representative of the 'actual' archaeological and palaeoenvironmental landscape.

The study area (Fig. 4.1) encompasses a sample of the diverse east Cumbrian landscape from the Pennine uplands in the north east to the broad, flat valley of the river Eden in the centre and the karst scenery of the limestone ridge in the south. North to south, the area focuses on the river Lyvennet, a tributary of the Eden, which runs from Crosby Ravensworth Fell (NY612107) northwards to meet the Eden just south of Temple Sowerby (NY612271). The Eden cuts through the study area diagonally south-east to north-west en route to the Solway Firth. Eastwards from the Eden the land gradually rises through the piedmont foothills of the Pennines towards the steep western slopes of the Pennine uplands which form the eastern boundary. The total area of the region is approximately 500 square kilometres.

The physical landscape of the area owes many of its characteristics to four main factors: the solid geology; the overlying drift geology; glacial erosion resulting from the last glacial period; and the subsequent modification of the area by human activity.

4.1 Solid geology (Fig. 4.2)
Within the study area, the main elements of the landscape are the Northern Pennines, the limestone uplands to the south and the Eden Valley. The dominant characteristics of the terrain in all these areas can be attributed primarily to the underlying rock. The geological development of these interlocking and interdependent areas was not synchronous but was the result of the many phases of deposition, movement, uplift and erosion which have taken place over the last 500 million years and which continue to modify the landscape today. Eastern Cumbria has been affected either directly or indirectly, by each of these geological formation processes.
Fig. 4.1 Location of study area.
The oldest rocks in the region are the Skiddaw slates which form the basis of the north Pennine ridge. These comprise sediments which were laid down during marine conditions, a phase temporarily disrupted by a period of volcanic activity during the Ordovician period. During this activity eruptions of tuffs and lavas in the area of Cross Fell were accompanied by some uplift and resulted in the formation of areas of dry land.

A "continental" phase followed during which compression from the north west and south east buckled the strata into hills and hollows and induced a fracture in the pre-existing sediments. This compression was accompanied by uplift and the intrusion of vast amounts of igneous material and this, despite subsequent deposition, has been exposed by erosion and is better known now as the Shap Granites, an economically important resource to the communities of Cumbria.

The relatively extensive areas of newly created, elevated, land, heavily influenced sedimentation in the deltaic and marine conditions of the early Carboniferous phase. A high ridge extended from the Isle of Man to the north Pennines forming a barrier between lagoons which existed to the north and south. This land surface was again gradually encroached upon by the sea and deposits of coarse conglomerates, scree, boulder beds and Piedmont fans accumulated around its borders. Eventually the ridge was completely submerged and thick limestone beds were deposited over large parts of the region. Limestone outcrops most obviously along the western slopes of the Pennines, but also forms a ridge running from Kirkby Stephen (NY 775085), across the southern part of the study area to the valley of the river Ellen in the north west. Towards the end of the Carboniferous era the limestone was successively overlain by Millstone grits and Coal Measure deposits.

A period of folding followed which resulted in the definition of the Pennines as a north-south ridge and the initiation of major faults to the west and north. At the close of the Carboniferous period the whole of the area had been uplifted and a second "continental" phase, associated with more igneous activity, was launched. The major igneous activity of this time was the intrusion of the Whin Sill Dolerite and the emplacement of the associated dykes over large areas of Northern England. Within the study area, the Whin Sill outcrops along the Eden fault but is most obvious around the head of High Cup Nick to the south east of the study area. Here erosion has cut a deep combe into the main line of the scarp face. The Whin Sill forms the rim of the coombe and is visible in its characteristic columnal form.

The raised Carboniferous rocks of the Pennines were severely eroded and reddened which led to the deposition of Permian sandstones in the Eden valley, particularly around Appleby (NY 685205) and Kirkby Stephen. In a period of high temperature and low humidity, wide areas of the land were covered by sand dunes and this brought about the formation of Magnesian limestone and ultimately the accumulation of thick anhydrite and gypsum beds on both sides of the Pennines. Within the study area the direct record of solid rock formation ends with the deposition of Triassic sandstones. The red sands and red and green mottled muds lie between the Eden and the
Fig. 4.2 Solid geology of Cumbria.
Pennines. Later formations probably occurred but were denuded after great earth movements which took place during the subsequent Tertiary period.

These movements caused much faulting and are mainly responsible for the arrangement of rocks visible today (Fig. 4.2). The Pennine escarpment of Carboniferous limestone was raised from the younger Permo-Triassic rocks. Although faulting in this area had taken place earlier, the movement was probably completed during Tertiary times and was responsible, together with some erosion, for the Vale of Eden, lying between the raised block of limestone country to the east and the Lake District to the west. These movements were again accompanied by widespread igneous activity which in Northern England manifest themselves as a suite of east south-easterly heading tholeiitic dykes to the east of the Pennines. Little more is known of the events in the region during this time but by the end of the Tertiary period the topography of the Cumbrian Landscape was well developed, with the steep western slopes of the Pennines acting as an eastern boundary.

4.2 Pleistocene

The dramatic landscape of the region, including its associated drainage system, went on to influence the subsequent glacial history. The specific sequence of events during the early Quaternary period (the Pleistocene) is difficult to determine, but the evidence suggests that up to four phases of ice advance and decay took place. Each advance and retreat of the ice sheets distorted the evidence of preceding events by eroding and redepositing earlier diagnostic sediments. In practice this removed, or rendered unrecognisable, earlier interglacial periods or glacial readvances.

By contrast, the last eight thousand years of the Devensian stage (from c.18,300 to 10,300 years ago) can be deciphered from the spreads of deposits left by the last ice sheets and this reveals an extremely complex glacial episode, in which the whole of the region was covered by ice at least once and in some places several times.

During this period ice sheets decayed leaving glaciers to eminate from the Lake District and the Pennines. These carried with them huge amounts of debris which was ultimately deposited in lowland areas. Some areas received material from more than one source as streams came together, diverted, retreated and readvanced. Ice from the north, south and east merged on the Carlisle Plain but the highest points of the Pennines appear to have remained ice free even at the height of periglacial activity.

In general the uplands suffered erosion from active, periglacial, geomorphological processes which resulted in a general reduction in relief. However, it was subsequent deposition of material from these processes which had the greatest impact on the topography. Ice erosion in the Pennines and Lake District removed virtually all pre-existing soil, unconsolidated deposits and rock surfaces, leaving the upland areas with bare and often rounded profiles. Deep corries and cirques were created as the ice retreated and U-shaped valleys, characteristic of the area, provide a legacy of valley glaciation. Innumerable drainage channels were cut by streams running out of, under, or into, the ice particularly during periods of rapid melting.
In contrast, the lowland areas were generally modified by the deposition of detritus carried by the ice and melt waters from the higher ground. Many of the existing valleys were plugged with deposits of clay, sand and gravels and some areas were blanketed in extensive sheets of boulder clay (Fig. 4.3). In the Lake District ice radiating from the central massif mingled and was partly deflected by vast sheets of ice flowing southwards from Scotland. On the west coast of Cumbria, debris which had travelled south from Scotland flowed alongside local ice carrying erratics from Carrock Fell. A similar pattern of deposition is evident in the Eden Valley, where ice flowing south east from Scotland was deflected by ice flowing eastwards from the Lake District. The Scottish ice was forced over Stainmore and, at some point (when the Lake District ice flow was particularly strong), through the Tyne Gap and over the higher ground to the north. The main deposit at this time was glacial till which, having been carried by the ice from the uplands, was deposited in the lowlands when the ice flow was slower. Till takes many forms but only one type is found in most areas of the north west, suggesting that the area was affected by only one major glacial episode in the late Devensian (Taylor et al., 1971, 87). Till deposits have modified large areas of the Cumbrian landscape, and the infilling of the Solway basin by glacial till (except where Drumlins protrude) was responsible for raising the Solway Plain above OD. South of Penrith the wide Eden/Petteril valley is likewise largely covered by thick red clay deposits. Deposits of clay and fluvio-glacial sands and gravels also encircle the Lake District, and dominate the Furness and Lonsdale lowlands to the south (Fig. 4.3).

The gradual deglaciation witnessed the dwindling of the ice caps to piedmont glaciers and then to valley glaciers and it is thought that most of the meltwater channels in the region were cut in this period. The major Lake District valleys and corries suffered the most with significant over deepening which, in places, flooded to produce lakes. In a final phase of glaciation the Solway Basin and the north west Cumbrian coast received a thin, reddish, stony, clay which it is thought was deposited during a minor readvance of Scottish ice.

Following the withdrawal of the ice sheets, the north of England was subject to a late-glacial phase when the climate fluctuated between intense cold spells and relatively mild conditions. During this period widespread solifluction took place modifying many of the earlier glacial deposits and leaving in its wake head deposits and scree on upland slopes. The modification of the earlier deposits took the form of deep ice wedges in some inland areas and corries in the Lake District, and on nearby hills, were also actively enlarged during the cold spells. Ice from some of these corries moved down into adjacent valleys where minor moraines mark maximum ice extents and temporary pauses during subsequent retreat phases. Pollen found in swamps and lakes behind some of these moraines shows that the last such ice movements took place at the end of the Devensian stage about 10,300 years ago (Taylor et al., 1971, 89).

Raised sea levels and isostatic recovery are also features of the late glacial phase. Water which had formerly been locked up in the ice sheets was returned to the sea, relieving the land mass of a huge weight. Initially this uplift of the land served to maintain the coastal territories between Cumbria and the Isle of Man until the inundation of the Irish Sea Basin in the sixth millennium BC.
Fig. 4.3 Drift geology of Cumbria.
4.3 Holocene

The later Quaternary period, or Holocene, has witnessed relatively insignificant geological changes compared to the preceding 50+ thousand years. The main changes are associated with the final return to the current sea level.

This was a period of continued erosion of uplands and silting up of existing valleys. It was also a time when former freshwater swamps were inundated as the sea encroached upon former areas of land. This manifests itself most obviously in the form of peat deposits which occur in numerous coastal localities in Cumbria. Most coastal and inland peats were formed in the Boreal and Atlantic stages from about 7500 to 3000 years BC (Fig. 2.1), when the temperature was considerably higher than today (Shimwell, 1985, 307, Table 16.1). On the coast the peats are often overlain by recent beach deposits and estuarine alluvium and are only occasionally exposed. Inland peats in lowland areas are also commonly interbedded with alluvium.

Excluding alluvium, wind blown sand constitutes the most obvious of the recent deposits around the present coast. Stretches of marine alluvium, left behind following a relatively recent sea level fall of 3-5m, are however present at some places. Spreads of calcareous tufa are also a fairly common recent deposit, in areas where limestone or gravels rich in limestone pebbles are present.

4.4 Drainage

Eastern Cumbria is served by one main river system, that of the river Eden, which flows northwest from the Yorkshire Dales to meet the west coast at the Solway Firth. Although modified since by the deposition of post glacial deposits, the course of the Eden is still determined, to a great extent, by the underlying geology and the tectonic movements of the late Tertiary period.

The river catchment is dominated by runoff from the Pennines and the limestone uplands to the south and during the Pleistocene the Eden also received runoff from the Howgill Fells. Once the river Lune had worked headwaters through the Lune gorge at Tebay, however, the Howgill runoff was diverted from the Eden into the Lune with the division between the watersheds marked by Sunbiggin Tarn (Harvey, 1985, 124).

Within the study area (Fig. 4.4) the Eden occupies a wide, relatively flat, flood plain which is overlain throughout with varying depths of alluvial deposits. The broad meandering curves of the river reflect the relatively slow speed with which the Eden flows along this section of its course. The velocity of flow is determined to a large degree by the slope and the Eden receives high flood flows from steep tributaries on the east side. On the west side, one of the largest tributaries is the river Lyvennet which flows north from the limestone uplands around Crosby Ravensworth Fell to meet the Eden at the limestone/red sandstone transition just south of Temple Sowerby. The Lyvennet is a fast flowing river which has cut a deep V shaped valley through the limestone ridge at the head of the river. The valley broadens slightly from Crosby Ravensworth, but is still tightly constrained by the elevated ground on either side of this section. At its northern end, just before the river meets the Eden, it widens and meanders more.
Other main tributaries such as the Crowndundle, Milburn and Trout Becks drain the highest points of the Pennines from where they flow westwards within deeply incised channels. Although undoubtedly modified by geomorphological processes, these tributaries follow the lines of late glacial stream channels cut by meltwaters as the ice retreated. The streams are fast flowing and erosive but reduce in speed and broaden out as they reach the foothills of the Pennines and the Eden flood plain.

4.5 Climate

The variation in altitude in the study area, which ranges from 880m OD in the Pennine uplands to just under 100m OD in the Eden valley, is reflected in the climatic conditions of the area. In general the climate of the uplands is cool, wet and windy and is severe by British standards, appearing more oceanic or sub arctic than temperate. The lowlands suffer a similar, if slightly less extreme, version of this climatic range.

The upland areas ‘suffer’ both high annual precipitation rates and low evaporation/transpiration levels. Regionally, the average annual rainfall for areas over 300m is calculated at 1000mm (Harvey, 1985, 132), but locally on the Moorhouse Nature Reserve, the rainfall figure is considerably higher at c.1900mm (Johnson and Dunham, 1963, 117). The rainfall is generally consistent throughout the year, with precipitation occurring on an average of 250 days of the year and autumn being the wettest period (Heal and Perkins, 1978, 12). Daily variability can be high and floods can occur at any time of the year caused by long durations of heavy rain, highly localised heavy thunderstorms and the occasional heavy snow melt. Heavy localised thunderstorms caused serious flooding in the Howgills in 1982 (Harvey, 1985, 133). The Eden valley sits within a rain shadow and receives considerably less rain than the uplands, although it does suffer from severe north westerly winds.

The mean annual temperature at the Moorhouse Nature Reserve, which sits at an altitude of 558m OD, is 5.1°C and only reaches above 10°C during July and August. The area experiences some snow fall, with an average annual snow cover of no less than 66 days (Heal and Perkins, 1978, 13). This is in contrast to the lower areas which, at sea level, experience 5 days and at 300m OD 30 days of snow lie (Harvey, 1985, 132). Even at high altitudes snow generally lies for a series of short periods rather than one long one, which reduces the risk of a major snow melt flood.

4.6 Soils and their development

The soils of eastern Cumbria closely reflect the geological and drainage conditions of the area. The region is dominated by fine and medium textured soil derived from a wide range of Pleistocene drift deposits. The climate of the early postglacial period enabled soil development on increasingly stable slopes covered in colonising vegetation. The traditional view is that by the end of the Boreal (Fig. 2.1), soils were supporting deciduous forests which covered most of the area, with the exception of the highest and/or steepest slopes, up to 762m OD (Pennington, 1970).

For the purpose of this research soil development and distribution as important not least for the part they play in determining the visibility of archaeological material. As discussed in Chapter Three, certain soils
such as peat and alluvium can physically mask the archaeological record by covering the evidence. On the other hand, soils most favourable to arable agriculture, can highlight archaeological sites in the form of crop marks and soil marks on aerial photographs.

The various geomorphological processes at work throughout the Holocene have altered various elements of the region's topography, not all of which are detectable in the current landscape. In a similar way that late glacial processes removed evidence of earlier glacial periods, later periods of change have often removed, or rendered inaccessible, earlier evidence of soil development and modification. For this reason current soil maps cannot be used directly in the reconstruction of the prehistoric landscape. The properties of some soil types can, however, help in the interpretation of earlier landscapes. The preservation of sediments in conjunction with organic material allows the analysis of pollen and lithology as well as the determination of dates by radiocarbon dating.

The following description of the soils is based on the 1:250,000 map produced by the Soil Survey of England and Wales (Sheet 1, Northern England, 1983). Because of the wide and varied distribution of drift deposits throughout the area and their importance as soil forming materials, soil associations (Fig. 4.4) will be described in relation to the properties of the parent material (Fig. 4.2. and Fig 4.3 ).

4.6.1 Northern Drift
The Northern drift (deposited by Irish sea ice) is an extensive till deposit covering lowland areas of Cumbria from the west coast inland up to 200m OD in places on the Pennines.

These soils (Fig. 4.4, 711n and Appendix 1) are mainly found bordering the river Eden. On the eastern side they are found spreading in places up the foothills of the Pennines. Extensive spreads are also found either side of the Lyvennet valley where they form the main soil type from Crosby Ravensworth northwards to Temple Sowerby. Although large areas around Temple Sowerby are used for arable agriculture, the majority remains as permanent pasture. The risk of waterlogging is generally remedied by installation of artificial drainage, but despite this, regular improvement by ploughing and reseeding is required. Where these soils are under arable agriculture their potential for crop mark identification is reasonably good.

4.6.2 Pennine drift
Pennine drift is a medium to fine textured till with lead minerals derived from the local millstone grit series and coal measures. It is dominated by grits, sandstones and shales and is found mainly on gentle slopes of less than 10° in the Pennine foothills.

The Pennine drift plays host to two soil associations differentiated not only in composition and texture but also by altitude. The Brickfield association (Fig. 4.4, 713e and 713g and Appendix 1) is characteristic of Pennine drift.
Fig. 4.4 Soils and drainage system within the study area. For explanation see text.
lying up to 230m OD and the Winter Hill association (Fig 4.4, 101B and Appendix 1) above 230m OD. The cooler temperatures and higher rainfall above 230m OD have led to peat accumulation particularly on flattish and gently sloping surfaces. Depending on site conditions, aspect and rainfall, the change takes place between 300 and 500m OD (Kear, 1985, 85).

These soils, particularly those of the Winter Hill association, are found crowning the Pennine ridge in extensive swathes. The Brickfield association tends to abut the peat deposits on the steep western slopes of the ridge. The wetland habitat provides very poor grazing which will only support one sheep to the acre (Johnson and Dunham, 1963, 4). Research on Moorhouse Nature Reserve has highlighted the effects the peat formation has had on the archaeological record. Stone tools and horn sheaths of ancient cattle have been recovered from the peat at depths of between 1.2m and 1.4m on Hard Hill (op cit 1963, 150). Today erosion of the peat is severe (Tallis, 1985).

4.6.3 Lake District Drift
Lake District drift is a medium to coarse textured, very stony, till and head derived particularly from the slaty Silurian mudstone of the Borrowdale volcanic series. It occurs widely in local valleys on strongly undulating relief with enclosed hollows filled with alluvium or peat. These soils (Fig. 4.4, 541o, 541g, 541p and Appendix 1) are not a dominant type in the area and only occur in small isolated patches to the south.

4.6.4 Fluvio-glacial sands and gravels
The fluvio-glacial sand and gravels are less extensive than the tills and are coarse textured and highly siliceous. They manifest as undulating hummocky relief but also occur on sides of valleys, particularly in the Eden valley.

The Newport soil association (Fig. 4.4 and Appendix 1) occurs in the north west of the study area mainly to the west of the Eden although small isolated patches do also occur on the east. This is possibly one of the most productive soils in the area with regards to arable agriculture.

4.6.5 Alluvium
The study area is only affected by flood plain and valley floor alluvium (Fig. 4.4, 811a and Appendix 1) which occurs along the river Eden and its tributaries. Some areas of alluvium have been incorporated into arable fields around Temple Sowerby. These deposits have also been shown to affect the recovery of archaeological material and this will be discussed in more detail in Chapter seven.

4.7 Soils from solid rocks
In upland areas post glacial deposits, consisting mainly of coarse textured materials, are, and have been in the past, subjected to sustained and heavy rainfall for much of the year. As a result these parent materials have produced intensely leached soils of low base status. The main area to be affected is the Pennines.
4.7.1 Skiddaw slates

On the steepest hills, above 460m, soils of the Winter Hill association are recognised (Fig. 4.4, 1011b, and Appendix 1). The steep and moderately steep slopes below 300m are covered with deeper free draining soils of the Manod association (Fig. 4.4, 611c and Appendix 1). These are found in interrupted patches along the steep slopes of the Pennine ridge. Inaccessibility and erosion make this soil association of low potential in terms of the recovery of archaeological material.

4.7.2 Silurian slates

The soils of the southern Lake District uplands are developed either on softer shales, mudstones, siltstones flags of the Silurian system or on glacial drift derived from it. Within the study area it is the latter which is of relevance. These soils are not a dominant type in the area, they only occur in small isolated patches to the south and on the Pennine slopes.

4.7.3 Carboniferous Limestone

Carboniferous limestone outcrops along the west side of the Pennine ridge and to the south of the study area in an east to west running ridge (Fig. 4.2). Soils derived from the limestone are generally very shallow. These soils are not a dominant type in the area and only occur in small isolated patches to the south.

4.7.4 Millstone grit and coal measures

The millstone grit series include mudstones, shales and more resistant sandstones and grits. The grits produce steep craggy outcrops as well as upstanding tors which sit on some plateau tops. Large areas particularly over 460m are covered by variable depths of oligofibrous peat. This restricts where soils develop directly on solid rock particularly above 330m along the west margin of the Pennines. These soils (Fig. 4.4, 631a, 631f and Appendix 1) are not a dominant type in the area, they only occur in small isolated patches on the steep slopes of the Pennines. Inaccessibility and erosion make this soil association of low potential with regards to recovery of archaeological material.

4.7.5 Upland peats

Peat provides an almost continuous cover on flat to undulating upland areas above 300m, particularly on the Pennines. This is ombrotrophic peat which provides the parent material for organic soil development and the Winter Hill association (Fig. 4.4, 1101b and Appendix 1). The very acid conditions have reduced biological activity so that partially decomposed organic material has accumulated on the surface. Although the formation of upland peat varies from place to place, it is known to have began c.5500 BC in the Pennines (Johnson and Dunham, 1963), with a renewed intensity c.600 BC. Continuation of the process has produced the blanket bogs on the upland plateau (Kear, 1985, 92). Averaging between 3-4m they thin towards the plateau edge. Today erosion of the peat is severe (Tallis, 985).

The east Cumbrian landscape is clearly diverse in terms of its geology, drift geology, climate, drainage, relief and soils. Such a landscape not only provides an interesting backdrop for the reconstruction of prehistoric landscapes but it poses many questions about the ways in which human communities interacted with it.
CHAPTER 5

METHODOLOGY

The discussion so far has identified a number of patterns in the archaeological and palaeoenvironmental records of prehistoric Cumbria. These indicate intra- and inter-regional variability in both the chronological and spatial distributions of the data. These distributions could represent the 'real' distribution of human activity during the prehistoric periods but equally they could be indicative of the spatial and temporal spread of research carried out in the area. To test the relevance of these patterns, it has been suggested that 'blank' areas within the spatial and temporal distributions of data should be investigated. This would help to identify whether archaeological and palaeoenvironmental evidence from these areas supports or contradicts the current understanding of the prehistoric landscapes. It has also been suggested that the level of understanding could be improved if the archaeological and palaeoenvironmental records were more compatible. It is proposed that the integration of the data would be greatly improved and would provide a potentially more meaningful contribution if both sets of data were known to relate to the same geographical space.

The area of eastern Cumbria selected for the case study was chosen on the basis that it would help to 'fill the gaps' in the spatial distribution of archaeological and palaeoenvironmental research. It was also felt that the diversity of the landscape would provide the foundations for testing the intra- and inter-regional variability in the data which is so clearly evident in the Lake District, on the western side of the county. The various microenvironments within the study area make for dramatically different landscapes and would therefore have offered very different settlement opportunities for prehistoric communities. The selection of the case study area was also dependent on the availability of suitable deposits for palynological investigations. A preliminary survey of place name evidence followed by site visits has indicated that appropriate sediments are available.

This chapter introduces the methodological approach adopted for the reconstruction of the prehistoric landscape in eastern Cumbria. The methodology is based on a site selection process which was originally devised for palaeoenvironmental and palaeoclimatic studies (Jacobson and Bradshaw, 1981). The approach hopes to increase the compatibility of archaeological and palaeoenvironmental data so that the full potential of data integration can be realised.

5.1 Site selection

The case study area covers approximately 500 square kilometers, an area too large for a complete archaeological and palynological investigation particularly within the time limitations of this project. It was essential therefore to sub-sample the area so that a representative sample of the region could be intensively investigated.
The method of sub sampling was based primarily on the need to answer the questions posed by the research so far. The questions are: are the patterns in the distribution of the archaeological and palaeoenvironmental records a 'true' reflection of human activity areas or the result of differential preservation, destruction and recovery? Is the intra-regional variation in the vegetation history and archaeological landscapes which is evident in the west of the county also apparent in the east? and how can palaeoenvironmental data be fully integrated with the archaeological record? These questions and the suggested methodological approaches to solving them are outlined in Fig 5.1. The suggested solutions provide the basic reasoning behind the sub sampling and site selection methods employed.

5.1.1 Palynological site selection
Pollen grains are preserved in a variety of materials including peat, lake sediments, soils, tufa, alluvium and loess and as a consequence can be found in a variety of contexts including archaeological features, cave deposits, ice, faecal material and honey. However, the arrival, movement and preservation of pollen grains vary from one source to another (Moore et al., 1991) and it is the research objectives which determine which source should be selected. Each type of site and material has its advantages and disadvantages. Because suitable sites for palaeoenvironmental sampling are limited in the landscape, it was felt that these sites needed to be selected before the areas which were to be subjected to intensive archaeological survey although some consideration of the archaeological record was inevitable.

The East Cumbrian landscape is particularly well suited to palynological investigation because of the number and variety of sites where pollen is preserved. Areas of blanket peat, lowland mosses, valley mires and lake sediments are all available. In order that the pollen sample sites can be easily compared to each other, it was felt that each sample site should comprise similar deposits. This would reduce the problem of comparing pollen assemblages which had been subjected to very different depositional processes. A pollen assemblage from a lake deposit will have undergone very different formation processes to one originating from blanket peat.

The site selection process consisted of four basic stages. Initially, the Ordnance Survey 1:10,000 and 1:50,000 Landranger map series were studied for place names which implied waterlogged deposits. Names such as Temple Sowerby Moss, Peat gate, Morland Moss and Cliburn Moss were considered potential sites because of the reference to wetland areas. Sites marked by the map conventions for marsh land or natural waterbodies were also taken into account. This initial survey resulted in a total of forty potential sites being identified.

The second stage of selection involved the assessment of these sites in the field to confirm the suitability of each. It has been suggested above that the potential of palynological and archaeological data will be enhanced if both data sets relate to the same geographical space. Each pollen sampling site needed to comprise primarily of local and extra-local pollen so that greater confidence could be placed on the origin of the pollen and its relevance to the surrounding archaeology. Jacobson and Bradshaw have shown that the size of the site will determine the level of regional, local and extra local pollen rain entering the site (1981). For the purpose
Fig. 5.1 Questions posed by the existing archaeological and palynological records and suggested methodological approaches to their solution.
of this research sites between 100m and 250m in diameter were required. This would ensure that the majority of the pollen entering the site would be extra local in origin and representative of the areas proposed for intensive archaeological investigation. The sampling model proposed by Jacobson and Bradshaw (op. cit.) assumes that the site is situated within a forested environment and will therefore have been subjected to the various pollen dispersal and filtration processes occurring within such an environment (Tauber, 1965). It was important therefore that this was a consideration in the site selection process for the current research.

Each of the forty potential sites was visited in the field to determine their size, and samples were taken to establish the depth of peat. Peat of very shallow depth was unlikely to cover the vegetation history for the whole of the prehistoric period.

The third stage in the site selection process was the consideration of the main geographical zones. To gain a representative cross section of the landscape, the uplands, lowlands and piedmont areas all needed to be sampled. This process of elimination reduced the forty potential sites to ten.

The final stage comprised of pollen being extracted from each pollen core for analysis in the laboratory. The cores were sub sampled every 24cm, and samples of 1cm³ were analysed to evaluate the quantity and quality of pollen preservation. Sites which showed pollen preservation to be good, and offered evidence to suggest all prehistoric levels were represented, were chosen. Four sites were selected (Table 5.1 and Fig 5.2).

Despite the application of a fairly strict set of criteria in the site selection process, a concession had to be made with regards to the upland zone. The Pennine uplands are covered in blanket peat which stretches continuously for several kilometres. Deposits which cover such a large spatial area are normally dominated by regional pollen rain (Jacobson and Bradshaw, 1981) and, as discussed in Chapter Three, are difficult to integrate in projects which are concerned primarily with local or extra-local pollen profiles. However, for the purpose of this research it was essential that the upland area was represented in the data collection. Great Rundale was selected on the basis of Turner and Hodgson's work in the Northern Pennines (1983). Basically, Turner and Hodgson have shown that between c. 5000 and 3000BC

"...little of the variation (in pollen assemblages) can be attributed to local site morphology and no evidence was found that each site was not receiving a large proportion of its pollen from within a short distance" (1983, 95. Italics are my addition).

Although this situation may have changed as time progressed, there is little reason to suggest that Great Rundale, which is situated just west of the North Pennine group of sites investigated by Turner and Hodgson, was not dominated by local and extra local pollen. It is hoped that vegetation histories already constructed for the Upper Teesdale area (Chambers, 1978; Turner and Hodgson, 1983) and the Moorhouse Nature Reserve (Johnson and Dunham, 1962) would offer comparative studies and the possibility of establishing the level of regional pollen rain entering the peat stratigraphy.
Another compromise had to be made in the selection of sites on the limestone uplands in the south of the study area and in the piedmont foothills of the Pennines. There were no wooded sites available for sampling in these areas. At Howgill in the piedmont foothills, the initial sampling of the pollen profile indicated that the area had been wooded until relatively recently. A severe reduction in trees and an increase in grasses were only apparent in the top 25cm of the core. With a total depth of over 1.5m it was assumed that the top few centimeters related to post prehistoric periods. Clearly this implied that the site had been wooded during the prehistoric periods and as such would have been subjected to pollen filtering processes identified by Tauber (1965). This would have ensured that until the time of deforestation the site would have been in receipt of pollen originating from extra local sources. So, although the site was not wooded at the time of sampling, it would have been during the period covered by this research.

On the limestone uplands in the south of the study area, the initial analysis of the pollen core indicated that the area had never been densely wooded and as such would have left the site exposed to an influx of regional pollen rain. However, the sample site is sheltered within a small basin shaped dip, is small in spatial extent and has a very limited water catchment area. All these features serve to reduce the input of regional pollen although it will be more influential than in samples taken from wooded sites. Although the pollen sampling site was not ideal, it was important from an archaeological point of view that this area was sampled.

<table>
<thead>
<tr>
<th>SITE</th>
<th>NGR</th>
<th>HEIGHT OD</th>
<th>SIZE</th>
<th>SITE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temple Sowerby</td>
<td>NY 61602705</td>
<td>110m</td>
<td>200 m²</td>
<td>Basin mire</td>
</tr>
<tr>
<td>Howgill Castle</td>
<td>NY 67712990</td>
<td>290m</td>
<td>100 m²</td>
<td>Small valley mire</td>
</tr>
<tr>
<td>Bank Moor</td>
<td>NY 63981265</td>
<td>290m</td>
<td>100 m²</td>
<td>Swallow hole</td>
</tr>
<tr>
<td>Great Rundale</td>
<td>NY 72102815</td>
<td>699m</td>
<td>100 m²</td>
<td>Blanket bog</td>
</tr>
</tbody>
</table>

Table 5.1 Pollen core site characteristics.

5.1.2 Archaeological site selection

In Fig. 5.1 it is suggested that archaeological investigation should be directed towards 'new' or 'blank' areas in the spatial distribution of the archaeological record; that all the physical zones in the landscape should be sampled to test the intra-regional variation in settlement opportunities; and that at least one well surveyed area should be investigated to test the strength of the existing record. The first two of these suggested methodological approaches have been incorporated, indirectly, in the selection of pollen sampling sites. The third suggested approach to archaeological site selection was relatively easy to incorporate, because only one part of the case study area had been subjected to intensive archaeological investigation. It was important, therefore, that a pollen sampling site was located in this area and was the reason behind the selection of the pollen sampling site at Bank Moor on the limestone uplands.

Fig. 5.1 also suggests that, for the purpose of integration, archaeological and palaeoenvironmental data should represent the same geographical space. In order that the archaeological evidence would be collected from the same geographical space as that represented in the pollen data, a five square kilometre 'micro-region' around each pollen site was defined for intensive archaeological investigation (Fig. 5.2). This provides a 10% sample of the case study area. The size of the micro-regions was considered to be comparable to the pollen
Fig. 5.2 Study area showing pollen sampling locations and areas proposed for intensive archaeological investigation. In the event, field work was only carried out in the Temple Sowerby, Great Rundale and Howgill Castle areas.
catchment areas and manageable within the time limits of the project. The distribution of the pollen sampling sites ensured that the main topographic areas of the landscape were sampled and the 'micro-regions' simply ensured that the archaeological record of the uplands, lowlands and piedmont foothills was also investigated.

5.2 Site descriptions

5.2.1 Temple Sowerby Moss

Temple Sowerby Moss (Fig.5.3) is a designated Site of Special Scientific Interest (SSSI) (English Nature File Ref. NY62/2). It is a small basin mire (approximately 200m square) which has developed in a slight depression in glacial drift over Penrith Sandstone. It is notable for its development of fen communities which, over almost all of the site, occur beneath a cover a alder/willow carr or in wet places under the birch-dominated woodland that occupies the core of the site.

The 'micro-region' around Temple Sowerby Moss is fairly low lying and is situated on the terraces above the flood plain of the River Eden. The Eden flows roughly north to south along the western edge of the 'micro-region'. The area is also served by Birk Sike, a small stream the course of which appears to have been diverted, in places, by the quarrying activity which has taken place in the north east of the area. Birk Sike flows through areas of very wet marshy grassland and heath which lies to the east and south east of the Moss.

There is some lower woodland around the edge of the SSSI and in the wetter areas outside. Adjacent to the SSSI on the northern side are pasture areas. These are, for the most part, improved but in parts of the field to the north west are patches of Juncus, although the extent of this has been greatly reduced in relatively recent years. To the south east and south west of the SSSI, alder and willow carr extend beyond the boundaries. To the south west the moss is bordered by damp, neutral grassland which has not been substantially improved. In one part of the field to the south west of the carr Phragmites is common.

The pollen sampling site was selected primarily because of its size and the suitability of it for determining the local and extra local vegetation history. It was also chosen because of its close proximity to a site which had previously been analysed for pollen (Pierce, 1986). Although unpublished, the earlier core would provide a comparative study for the purpose of investigating very local pollen deposition.

With the exception of the area covered by Newbiggin Mine, that occupied by the existing Temple Sowerby village (Fig.5.3), and the areas of pasture already mentioned, much of the 'micro-region' is used for the cultivation of winter- barley, sugar beet and turnips for animal fodder. This land use pattern had some influence on the definition of the 'micro-region' for the purpose of archaeological investigations. The rotational ploughing for winter- and summer crops would enable systematic field walking to be carried out.

Temple Sowerby Moss is set within a surviving medieval landscape. The village plan around a central green is of medieval origin and many houses within the village retain features of their earlier counterparts. The
Fig. 5.3 Temple Sowerby Moss and surrounding micro-region.
medieval open field system of agriculture is preserved in the form of ridge and furrow which is evident as both earthworks and cropmarks around the village. The current ownership of Temple Sowerby Moss is itself a remnant of the communal agricultural system of the medieval system, with long narrow strips belonging to different members of the village community.

There is a number of archaeological sites documented within the micro-region (Fig. 7.1). These fall into two categories, those that appear as crop marks and those recorded as single finds. The age of the crop marks are unknown but it was hoped that field walking would give an indication of the date of the underlying archaeology. Of the single finds, two perforated stone axes (Appendix 2, CS site nos. 246 and 439) represent late neolithic/early bronze age activity, whilst a series of five axes (Appendix 2, CS site nos. 440, 441, 442, 443 and 444) indicates human activity from the early to late bronze age. Although the distribution of the finds suggests they were found within a very limited area, this is merely the consequence of early data recording. The finds were found individually at different times, but most of the bronze age axes were purchased as a group 'from Temple Sowerby'. The Tullie House Museum Prehistoric Collection records the group as originating from Temple Sowerby but unfortunately the exact provenance is not recorded. When entered in the National Archaeological Record, a grid reference, close to the centre of the village of Temple Sowerby, was allocated to the record presumably to offer a vague location. When plotted, the distribution pattern suggests a rare bronze age hoard, but clearly this is the result of the recording method and not a 'true' distribution.

5.2.2 Howgill Castle

The pollen sampling site at Howgill Castle is situated in a small valley mire at the foot, and to the west, of Burney Hill (Fig. 5.4). The site sits in one of the several U-shaped glacial valleys which dissect the whole of this area. The dominant vegetation is acid grassland and the main land-use type is rough grazing for sheep and to a lesser extent, cattle on the lower, less steep, improved pastures. Around Red Carle, in the north west of the 'micro-region', the vegetation type is wet, heath acid grassland mosaic. Attempts have been made to drain the area although these have met with little success. In the centre of the 'micro-region' is a coniferous plantation known as Hill Plantation, to the east of which marshy grassland dominates and is itself dominated by Juncus. To the south west of Hill Plantation are smaller coniferous plantations with a few, older, deciduous trees left standing.

A fairly well established, man-made tarn lies to the east of Hill Plantation and is fed by Mudgill Sike, which surfaces just north of Burney Hill and flows eastwards into the tarn before turning northwards along the valley bottom. Knock Ore Gill originates in the Pennine Uplands and flows along a small but steep V shaped valley to the south of Burney Hill, where it divides in two. One tributary continues as Milburn Beck down to the River Eden just north of Temple Sowerby and the second tributary continues as Stank Beck which flows north of Howgill Castle and meets with Milburn Beck at Newbiggin Moor. Stank Beck was, during the late medieval period, diverted to flow through Howgill Castle to provide a fresh water source during times of siege and to serve the sanitation system of the castle.
Fig. 5.4 Howgill Castle and surrounding micro-region.
The sampling site at Howgill Castle is again situated in a predominantly medieval landscape, which is dominated by the castle itself. Ridge and furrow in the form of earthworks and cropmarks surround the castle complex and extend as high as 320m OD up the valley side. A network of linear land boundaries also influences the landscape in this area. It was hoped that pollen analysis would not only provide a vegetation history but also shed light on the local land-use practices which necessitated the construction of such land divisions.

The Sites and Monument Record documents a single earthwork site within the micro-region (Fig. 7.21, site no. 297). The earthwork enclosure lies on the southern edge of the study area and was identified from aerial photographs following the removal of an overlying plantation. Measuring approximately 120m east to west by 140m north to south, the enclosure is 'D' shaped and defined by a bank which survives to a height of 0.3m. The enclosure is sub divided north to south by a second bank. The date of the enclosure is unknown, but it was hoped that field work in the area would provide some indication of the chronological phasing of the earthwork.

5.2.3 Bank Moor

Bank Moor (Fig. 5.5) is situated on the Carboniferous limestone, mudstone and sandstone geological series in the south of the study area. The vegetation on the lower slopes of the upland area is dominated by acid grassland which rises to Calluna-dominated dry heath and dry heath acid grassland mosaic with patches of calcareous grassland. The northern part of the 'micro-region' is dominated by a large coniferous plantation, with smaller ones just to the north and to the south west. Small areas of deciduous woodland are present in the north east corner of the 'micro-region'. The lower lying areas on the western side of the area are largely farmed and consist of improved and reseeded pasture.

The pollen sampling site is itself a small swallow hole in the limestone which has formed a small surface basin at the boundary between two river catchments. To the east the land slopes down towards Scale Beck and to the west down towards the River Lyvennet.

The archaeology around Bank Moor is well documented, with a total of twenty four 'sites' known from within the micro-region and recorded on the database (Fig. 7.27 and Appendix 2). These appear as either earthwork monuments or artefact scatters and include eight cairns and a cairn field of bronze age date and eleven artefact scatters of neolithic to bronze age date. In addition there is an iron age/Romano-British settlement and two undated earthwork sites which were recorded in the mid 20th century but have since been lost/destroyed. The area is rich in monuments indicative of a prehistoric 'ritual landscape', but bronze age funerary monuments survive along side artefact scatters which have been interpreted as neolithic and bronze age settlement sites (Cherry and Cherry, 1987). Clearly the area was important for a variety of activities from at least the neolithic through to the Romano-British period.
Fig. 5.5 Bank Moor and surrounding micro-region.
5.2.4 Great Rundale

Great Rundale (Fig. 5.6) sits within a SSSI known as Appleby Fells (English Nature file ref. NY72/3). The underlying geology within the SSSI is largely of carboniferous sandstones and limestones, although Great Rundale Tarn, from which the sample site gets its name, is on gritstone. The geology variously affects the biological interest. The great importance of the area lies in its rich variety of habitats and associated plant and animal species. The most important vegetation communities are those of limestone grassland, limestone flush, blanket bog, heath and montane ledge, but other habitats of subsidiary interest are areas of acidic grassland, acidic flush, open water, limestone pavement and woodland. Blanket mire has developed over most of the ground and represents the most extensive habitat within the SSSI. Open water occurs in the Appleby Fells in the form of several upland streams and as peat pools and some larger tarns on peat (eg. Little Rundale) or gritstone (eg. Great Rundale).

This area of the Pennine uplands falls within the catchment area of two rivers. The four tarns which lie within the micro-region are drained to the east by tributaries of Maize Beck, itself a tributary of the River Tees. The steep western slopes drain down towards Great Rundale Beck and Swindale Beck, both tributaries of the River Eden.

The visible archaeology around the pollen sampling site at Great Rundale is dominated by the post-medieval industrial phase. Lead mining was an important industry in the area and the slopes to the west of Great Rundale Tarn are scattered with the derelict remains of mine shafts, slag heaps and associated buildings. Water leats link the buildings with the fell tops and Great Rundale Tarn itself was dammed probably as part of the water management system associated with the mining activity.

The Sites and Monument Record documents two cairns of prehistoric date. One lies approximately 600m north west of Seamore Tarn (Fig. 7.16, site no. 158), the other in the north west corner of the micro-region (Fig. 7.16, site no. 157). The latter is the most north easterly example in a widely spaced group of cairns making up a rough line running north east to south west from High Scald Fell to Rossgill Edge.

5.3 Palynological investigation

5.3.1 Pollen sampling strategy

Each site was cored using a Russian sampler during the winters of 1992 and 1993. Sub-samples of 1cm\(^3\) were taken at 8cm intervals for pollen extraction. This policy was adopted for all four cores as a means of retaining systematic data retrieval and assisting in comparative studies between the 'micro regions'. Although acknowledged that an interval scale of 8cm would not pick up fine variations in the pollen assemblage, it was considered that general trends would be adequately recorded to determine local vegetation variation across the case study area. It was also believed that such an interval scale would provide a suitable resolution for integration with archaeological evidence particularly where radiocarbon dates were unavailable and dating was dependent on typological or morphological techniques.
Fig. 5.6 Great Rundale and surrounding micro-region.
5.3.2 Laboratory methods
Pollen was extracted using a standard process described by Moore et al. (1991, 41-46). The process included potassium hydroxide digestion, hydrochloric and hydrofluoric acid treatments, and acetolysis. The pollen was stained using aqueous safranine and mounted in silicone oil.

5.3.3 Pollen identification and pollen sum
Identification and counting of pollen grains were carried out using a Nikon binocular microscope at a magnification of x 400 (x40 objective and x10 eyepiece). This provided sufficient magnification for the identification of most pollen grains and an adequate field of view for comfortable counting. A x100 oil immersion objective was employed where greater detail of surface sculpturing was required for the identification of problematic grains.

Each slide was sampled by means of linear traverses passing from one edge of the slide to the other in 1mm intervals. There is some evidence to suggest that the movement of pollen grains under the weight of the cover slip is inversely related to the size of the grain and that larger grains may be more frequent in the centre and smaller grains at the edges (Brookes and Thomas, 1967). Linear traverses would therefore eliminate the effects of this possible bias.

In order that a representative and acceptable estimate of the pollen proportions was recorded, a total of 500 grains was counted for each level in the diagram (Birks and Birks, 1980, 168). Pollen identification was made with reference to Moore et al. (1991), Faegri et al. (1989) and a reference collection held by Leicester University Geography Department. Cereals were identified using the criteria outlined by Andersen (1978) which include assessment of the annulus diameter, overall grain size, and surface sculpturing. Pollen concentration values were calculated for all sites. A single Eucalyptus tablet of known concentration was added to each sediment sample and pollen concentration calculated using the formula outlined by Birks and Birks (1980, 208).

5.3.4 Charcoal abundance
The quantification of charcoal fragments in pollen samples has been the subject of numerous studies (cf Clark, 1988; Patterson et al., 1987; Rhodes, 1998). Despite this attention, the development of a standard preparation and quantification technique has not been forthcoming. This is partly due to the infinite number of variables affecting the dispersal and taphonomy of charcoal (Patterson et al., 1987; Tauber, 1965). There is, however, a single observation recurring in the literature which suggests the larger the charcoal particle size, the closer the sampling site is to the source of the fire (Simmons and Innes, 1996; Clark, 1988; Patterson et al., 1987). Although no specific size divisions are recommended in the literature, for the purpose of this research it was decided that charcoal particles should be expressed as those less than 50 μm in length and those 50μm and larger. Clark suggests that particle sizes over 50μm are unlikely to have been transported great distances from their point of origin before deposition (1988). Samples studied during the course of this research indicate that the small fragments were very much smaller than 50μ and were clearly distinguishable from those in the larger size category.
5.3.5 Diagram construction and organisation

The pollen diagrams have been calculated and drawn using the computer programmes TILIA and TILIA-GRAPH. The diagram was constructed on the basis of the percentage of total pollen excluding aquatics and spores. It was decided that the exclusion of pollen and spores of aquatics plants in the sum would ensure that the overall pollen sum was not distorted by very localised pollen input. Aquatics and spores were counted but expressed in the diagram as percentages of the basic sum plus their own sum ($\Sigma$Pollen + $\Sigma$Aquatics), therefore avoiding greater than 100% of any taxon.

Plant nomenclature follows that of Clapham et al., (1981). The pollen diagrams are constructed along conventional lines with the vertical axis representing depth and time and the horizontal axis the proportional abundance of pollen taxon. For reasons of clarity, the diagrams for each site (Figs. 6.0a - 6.3b) have been divided into two. Each one of the two diagrams is arranged from the left starting with the calibrated radiocarbon dates. This is followed by the diagrammatic representation of the stratigraphic sequence of sediment types. The conventions used in the stratigraphic sequence are explained in a legend at the base of each diagram. Detailed descriptions of the lithosratigraphic units of each pollen core are given in Appendix 3.

On the first diagram for each site (Figs.6.0a, 6.1a, 6.2a, 6.3a) the stratigraphic sequence is followed to the right by a series of graphs which represent the proportion of arboreal types followed by shrubs and dwarf shrubs or Ericales. Following this is a summary of the main dryland herbs, the details of which are given on the second diagram. Next in the sequence to the right is the abundance of charcoal fragments within each sample.

The summary diagram which displays graphically the way in which the total pollen sum is divided into tree, shrub, herbaceous and ericaceous components at each level follows the charcoal readings. The summary diagram allows one to see at a glance any major shifts in for example arboreal and non arboreal pollen ratios, that may be of importance in the zonation and interpretation of a pollen diagram. Summary diagrams for aquatics and spores are represented at the right hand side of the diagram and are followed by local pollen zone divisions. Details of the aquatic and spore types represented are given on the second diagram.

The second diagram for each site (Figs. 6.0b, 6.1b, 6.2b and 6.3b) follows a similar sequence starting with the calibrated radiocarbon dates followed by the stratigraphic sequence of sediment types. To the right of this is the detailed proportional representation of the various herbaceous pollen types recorded at each level of sampling. This is followed by similar details of the spores and pollen of aquatic species. The abundance of charcoal is shown again so that it can be easily related to the herbaceous pollen component. To the right of the charcoal representation is a graph showing the total pollen and spore concentration of each sample and to the right of that the pollen sum for each sample. The overall summary diagram, displaying the way in which the total pollen sum is divided into tree, shrub, herbaceous and ericaceous components, is shown again along with the local pollen assemblage zone divisions for easy comparison with the herbaceous component of the pollen profile.
5.3.6 Local pollen assemblage zones

The pollen diagrams have been divided vertically into a series of zones on the basis of their pollen content. These are marked by horizontal lines drawn across the diagrams. The zones represent biostratigraphic units defined purely on pollen content. The main aim of zoning the diagrams is to divide the pollen diagram into a series of convenient units, each of which is as internally homogeneous as possible, and displays recognisable pollen characteristics upon which it may be differentiated from adjacent zones. It follows that the zone boundary lines will be placed at those points where change in the pollen spectra is most marked. The zones represent local pollen assemblage zones and provide convenient divisions for the purpose of describing and interpreting the pollen diagram.

5.3.7 Radiocarbon dating

Radiocarbon dates were determined for each of the pollen cores with the exception of Temple Sowerby. Unfortunately financial support was not available for all the pollen cores and because a dated diagram (Pierce 1986) was already available from Temple Sowerby, the available funds were distributed between the other pollen profiles.

Three levels from each core were dated to provide a chronological framework for the vegetation history. The highly organic deposits from Howgill Castle and Great Rundale were conducive to conventional dating which was carried out by Queens University Belfast. The deposits from Bank Moor contained significantly lower organic levels, so dates were determined using the technique of accelerator mass spectrometry (AMS). This was carried out at the Oxford University Radiocarbon Accelerator Unit.

5.4 Archaeological investigation

5.4.1 Archaeological database

Initially, the Sites and Monuments Record (SMR) and National Monuments Record (MNR) were consulted for the whole of the study area and all sites dating from the mesolithic to the iron age periods were entered into a database devised on an Apple Macintosh computer using the FILEMAKER PRO programme (Appendix 2). Sites recorded as 'unclassified crop marks' or similarly vague, undated, entries referring to cropmarks and earthworks were also included as a source of reference. Other major sources such as Cherry and Cherry (1987), the North West Ethylene Pipeline Gazetteer of Archaeological Sites (Lancaster University Archaeological Unit 1993), report on the archaeological assessment evaluation for the Temple Sowerby Bypass (unpublished report, Lancaster University Archaeology Unit) and Tullie House Museum Prehistoric Collection were also consulted and any 'sites' which did not equate with those on the SMR or NMR were added to the database. A 'site' is defined here as any single entry within these texts whether it is, for example, a single find spot, an artefact scatter, a cropmark, soilmark or earthwork.
5.4.2 Aerial photography

The aerial view is of considerable value to the identification, depiction and interpretation of the archaeological landscape. It provides an elevated view of the ground surface and its features which aids the perception of significant pattern and the appreciation of relationships between one feature and another. It is the pattern made by earthworks, cropmarks and soil marks which distinguishes these features from the variety of geological, agricultural and other phenomena which can also produce patterns in the landscape.

For the purpose of this research both oblique and vertical aerial photographs were consulted. The main objective of this investigation was to identify previously unknown sites either as upstanding earthworks in areas not previously investigated or as cropmarks or soil marks in areas where centuries of ploughing have removed all architectural traces. The accumulation of new discoveries would not only help in identifying the 'true' distribution of the archaeological record, but would also aid in the selection of suitable areas on which to focus fieldwalking, field survey or excavation.

Most of the photographs are held by the NMR in Swindon, although some obliques of known, individual sites were available from the SMR office in Kendal. Once identified, sites were transcribed onto an Ordnance Survey 1:10,000 map and the photograph details recorded in the data base of sites (Appendix 2). Information was transcribed using the Mobius network technique to correct for the tilt and height distortion inherent in all aerial photographs (Wilson, 1982).

5.4.3 Fieldwalking

Fieldwalking is perhaps the most commonly used technique for building up a picture of past human activity in an area. It is particularly useful in identifying pre-medieval sites in areas where later landuse patterns have destroyed earthworks or other structural evidence relating to the earlier periods. The technique involves the removal of artefacts from their context for analysis, and for this reason the finds need to be recorded in as much detail as is possible in the field. The artefacts can then be plotted and any find scatters identified. Scatters can represent a number of different archaeological features, some of which may have survived to some degree below the plough soil and others which have been completely destroyed. The density and composition of the scatters can give an indication of the type of site that is represented. The relationship between the scatters can then be assessed to ascertain the extent to which a specific area was inhabited.

A great deal of debate has centred around the definition of 'sites', and it has been clearly shown that what constitutes a 'scatter' in one area may not in other parts of the country. For example "...Southern England - and particularly the river valleys - are one continuous flint scatter" (Clarke and Schofield, 1991, 105), but in the North-West of England, where the only natural source of flint comes from beach pebbles on the west coast, any manufactured flint tools found in the plough zone should be considered significant.

For the purpose of this research the traverse and stint method of fieldwalking devised by Liddle for the Leicester Museums Service has been adopted (1985). This is a systematic method which enables a relatively quick reconnaissance of an area which can then be followed up in key areas by more detailed grid-walking.
The method entails the division of the field into equally spaced traverses which are then divided at intervals into stints. The traverses are numbered with each stint defined by a letter. A number and letter can then be used to define a particular area of the field. The divisions are recorded in relation to the field boundaries on a 1:10000 or 1:2500 OS map. If this is recorded before walking starts, the material can easily be related back to its findspot and no identifications or distribution diagrams are required in the field.

A field boundary, usually the straightest, was used as the base line and the traverse and stint markers laid out at right angles to this. Walkers were aligned at the start of each traverse and walked in a straight line looking 2m either side of the line. Any artefacts found were placed in a bag marked with the field name/number, date, initials of the walker and the traverse and stint identification. A new bag was used for each division in the field.

This method ensures that a representative sample of the evidence can be collected and that no one area of the field is over represented. It also allows scatters to be easily identified and facilitates follow up fieldwork if necessary.

The distance between the traverses and the length of the stints depends on the research objectives and has to be decided upon before the fieldwalking begins. Liddle suggests that traverse spacing of over thirty meters means that too few artefacts will be recovered to give useful information, while below 10 meters the pattern of any scatter of artefacts encountered would be seriously damaged (Liddle 1985, 9). For the purpose of this research traverses were spaced at 10m intervals and stints were 30m long.

Fieldwalking was carried out around Temple Sowerby, where the cultivation of fodder crops facilitated archaeological investigation of this kind. A total of twelve fields, scattered around the existing village, was walked (Fig.5.3). There was a number of practical limitations on the number of fields which could be walked. Firstly, the rotative nature of modern agricultural practices meant that only certain areas were available in the two years allocated to fieldwork. Arable agriculture is carried out on a relatively small scale in the area and is generally only for the production of fodder crops. All fields which were ploughed during the period of fieldwork were walked.

Gypsum quarrying in the north east of the micro-region had once been far more extensive than it is now and areas which had formerly been quarried have now been restored through landscaping (Fig.5.3). Obviously it would be impossible to analyse material found in this area because it will have been mixed into a single homogeneous mass. It is possible that soil was imported from other areas to 'fill' the quarry holes, in which case the provenance or context of any archaeological material would be impossible to determine. For this reason the area defined was not walked. A small area in the south west corner of the study area could not be walked due to the refusal of access by the landowner. Field number TS7 lies just outside the micro-region and TS 8 only partially within it (Fig.5.3), but both became available for fieldwalking during the course of the research. Because access to ploughed fields on the east side of the River Eden was restricted, it was decided that TS7 and TS8 would be walked in order to sample the river terraces.
5.6 Summary

In summary, the methodology was devised on the basis of the work carried out by Jacobson and Bradshaw (1981), which suggests that the pollen catchment of a sampling site is more easily defined when the site covers a small spatial area. This research also suggested that the smaller the site the more likely it is to reflect the local and extra-local vegetation history.

Because of the problems experienced in the integration of palaeoenvironmental and archaeological data, the current research suggests that where palaeoenvironmental data, specifically pollen data, is to be used in archaeological landscape studies, it is important to identify to which part of the landscape the vegetational history relates. It is also suggested that the potential of the two data sets in terms of the level of analysis and interpretation possible would be greatly increased if the archaeological record related to the same geographical space as the vegetation history. The methodology was therefore designed to ensure that both data sets would be collected under the control of a single research design and from the same geographical space. It was hoped, too, that the methodology, the distribution of the pollen sampling sites and the archaeological 'micro-regions', would go some way towards answering the specific questions about the distribution of the archaeological record and the regional variability recorded in the vegetation and archaeological records from the west of the county described in earlier chapters.

<table>
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Table 5.2 Chronological scale (after Bradley 1984, 5, Fig1.1).
This chapter documents the physical results of the palynological investigations. Initially the pollen diagrams are described on the basis of their defined local pollen assemblage zones. Each zone represents a biostratigraphic unit (Birks and Birks, 1980, 16) which is deliberately independent of interpretative comment. The following descriptions are not therefore restricted to taxa which are influenced by anthropogenic activities: all major contributors are considered. Charcoal is also mentioned where significant levels were found to be present.

Because of the difficulty in distinguishing between pollen grains of Corylus and Myrica, no attempt has been made to separate these grains; instead, the umbrella term 'Coryloid' is used. An exception to this rule is Bank Moor where the basic soils would not be conducive to the growth of Myrica, but are favourable to the growth of Corylus (Godwin, 1956, 199). Here the grains are recorded as Corylus.

The pollen grain identification of Cannabis/Humulus type is based on that devised by French and Moore (1986) who distinguish Cannabis from Humulus on the basis of the level of pore protrusion. Others have also acknowledged the suitability of this distinction (Whittington and Gordon, 1987). On this basis, all examples of this type of pollen grain, identified during the course of this research, fall into the category of Cannabis. However, it has been recognised that the natural variation in both species makes accurate differentiation problematic (Moore et al., 1991, 103). From hereon in, this type of pollen will be described as that of Cannabis but the identification should be treated with caution.

6.1 Bank Moor

The Bank Moor diagram (Fig. 6.0a and b) has been divided into five local pollen assemblage zones. On the basis of regular fluctuations in the percentage of trees and herbs, BM-b has been divided into five sub-zones.

BM-a 218-190cm

The herbaceous component dominates this zone with significant contributions from Artemisia, Helianthemum, Plantago lanceolata, Rumex acetosella, Thalictrum and Rubiaceae. Herbs peak at a depth of 201cm with 73%, as Gramineae and Cyperaceae increase and Betula and Salix decrease. Shrubs are poorly represented but remain fairly constant throughout. Betula is the only significant contributor to the arboreal component although Pinus, Ulmus, Quercus, and Alnus are also present. High levels of charcoal fragments in the small size class and a moderately high number in the large size class are recorded at 193cm. The pollen spectra of this zone indicate that the local vegetation is one of open grassland with some extra-local, small, woodland stands.
BM-b 190-120cm
BM-b1 190-180cm. This phase represents a short lived reduction in herbs particularly of *Artemisia, Heliantemum, Rumex acetosella* and *Thalictrum*. This is compensated to some degree by a peak in *Filipendula*, but an increase in *Betula* to 34% accounts for the overall reduction in herbs. Other trees and the shrub component show little change.

BM-b2 180-167cm. In this part of the zone there is an increase in the herbaceous component, reaching former levels of 60-71%. This is accounted for by peaks in Gramineae, *Plantago lanceolata, Helianthemum* and *Filipendula* and a reduction in *Betula*. High charcoal readings were recorded in the smaller size class at both 169cm and 177cm.

BM-b3 167-156cm. *Betula* once again experiences a short lived expansion with a peak of 39% (TLP) at 161cm but declines again at the top of this sub-zone. This corresponds to a reduction and subsequent increase of Cyperaceae, but *Thalictrum* and *Filipendula* also increase significantly to increase the overall herbaceous component. High readings of charcoal fragments of the smaller size class were recorded at 161cm.

BM-b4 156-135cm. This phase of the zone witnesses the most dramatic of changes, with arboreal pollen declining to just 10% despite an expansion of *Pinus* from 3% to 6%. *Betula* contributes just 3% and *Quercus Ulmus* and *Alnus* make up the difference. Shrubs increase from 3% to 15% as both *Corylus* and *Salix* begin to contribute 7% and 8% respectively towards the top of the sub zone. The greatest influence comes from Cyperaceae, which increases from 25% to 51% mid way through the phase. There is a reduction in the diversity of species which make up the herbaceous component, but certain taxa make greater contributions including Lactuceae and *Thalictrum*. Another characteristic of this sub-zone is the increase in aquatic species. Although the diversity of taxa is little changed, the contribution made by certain species such as *Myriophyllum spicatum, Potamogeton*, and *Sphagnum* has increased significantly. *Selaginella* also increases considerably during this phase. A high number of charcoal fragments of the smaller size class was recorded at 145cm and a very high number of both size classes at 137cm.

BM-b5 135-120cm. The last phase of this zone sees a final expansion of *Betula*, reaching 31% at the top of the zone. Cyperaceae declines gradually throughout and cereal type pollen is recorded for the first time. Within the herbaceous component *Filipendula, Saxifraga oppositifolia* and *Artemisia* all increase their contribution. The increase in certain aquatic species continues with *Myriophyllum alterniflorum* and *Typha latifolia* now making significant contributions. *Pteridium* also increases to 8% mid way through the zone. Very high readings of charcoal fragments, from both size classes, are recorded at 121cm and 129cm.

Throughout BM-b the pollen spectra indicate an open landscape displaying a diverse herbaceous flora with small stands of *Betula* within the locality. The increase in the contribution of aquatic species and Cyperaceae towards the top of the zone suggests an increasingly wet environment.
BM-c 120-70cm

This zone is characterised by the dramatic expansion of shrubs. Corylus increases from 4% at the end of BM-b to 67% at a depth of 105cm. At this point both the arboreal and herbaceous components show a marked decline. After this peak Corylus declines quite rapidly as Ulmus, Quercus and Alnus all start to make significant contributions to the arboreal component. Pinus increases with a peak of 18% at 113cm. Despite the diversification in tree pollen, the overall percentage is little affected as the increase in other tree species is compensated by a decline in Betula to between 1% and 8% during this zone. Gramineae and Cyperaceae both decline early in the zone but recover from 105cm onwards. At the top of the zone, herbs constitute 42% of the total land pollen, of which Gramineae and Cyperaceae make almost equal contributions (16-20%). The frequency of cereal type pollen also increases but the overall diversity of herbs is greatly reduced. Filicales increase rapidly in the early phases of this zone but after 105cm retains a level of between 13% and 19%. The diversity of aquatic species is also reduced with only Sphagnum making a significant contribution by the top of the zone. Pteridium, although dropping to less than 3% through the middle of the zone, makes a significant contribution both at the bottom and top. This is in contrast to Polypodium, which peaks in the middle of the zone.

This zone marks the most dramatic change in the vegetation cover with a huge expanse of shrubby woodland dominated by Corylus. The increasingly closed canopy causes a decline in light demanding herbaceous species. The scattered woodland stands become more diverse as Alnus, Ulmus and Quercus become established, although the spatial extent of the tree cover is little changed. Both the expansion of shrub land and the diversification of the woodland stands are relatively short lived and by the end of the zone an open landscape is redeveloping. Pteridium is able to spread in areas of the newly opened landscape by the end of the zone.

BM-d 70-45cm

A steady increase in herbs and a gradual decrease in shrubs and trees characterises this zone. With regard to the arboreal component Alnus is the only major contributor retaining levels of between 25% and 31%. The decline in shrubs is mainly due to the continued decline in Corylus, which by the end of the zone represents only 10% of the total land pollen. Salix is present but at less than 3% throughout the zone. Gramineae continues to increase in the early part of the zone, reaching a peak of 39% at a depth of 65cm, but a decline is in progress by the end of the zone. Although the diversity of herbaceous species continues to decline, an overall increase in herbs has resulted from a steady increase in Cyperaceae throughout the zone. The diversity of aquatic species is also reduced. Following a decline in Sphagnum at 65cm, Pteridium increases again and retains a fairly constant level throughout the remainder of the zone. Filicales also increase slightly from 65cm. A high number of charcoal fragments of the smaller size class was recorded at all levels throughout this zone. Once again the landscape is one of increasingly open vegetation with a gradual reduction in wooded areas and shrub species.
Fig. 6.0a Bank Moor pollen diagram (Trees, Shrubs and Ericales).
Fig. 6.0b Bank Moor pollen diagram (Herbs, Spores and Aquatics).
This zone is characterised by the overwhelming dominance of herbs. The rapid expansion of Cyperaceae, from 29% at the top of BM-d to 81% mid-way through BM-e, accounts for the predominance of herbs throughout the zone. An increase in both Lactucae and Plantago species also contributes a significant percentage to the herbaceous component. *Calluna* and *Empetrum* both increase their frequency, appearing at all depths throughout the zone but only representing less than 3% each at all levels. With the exception of *Alnus* early in the zone, no tree species contributes more than 3% to the total. Likewise, *Corylus* declines to 2% and *Salix* to even lower levels. All aquatic species are reduced to less than 3% each. Following an initial drop Filicales retains a level of 3% until a depth of 17cm when it declines to 1%.

The landscape is one of almost completely open grassland scattered with herbaceous flora, particularly *Plantago* type and Lactucae.

### 6.2 Great Rundale

The diagram from Great Rundale (Fig. 6.1a and b) has been divided into four local pollen assemblage zones:

**GR-a 200-171cm**

This zone is characterised at the beginning by a slight but steady increase in *Betula*, *Quercus*, *Alnus* and Coryloid. *Prunus* and *Tilia* are present but at less than 3% each. The only arboreal pollen to decline from the beginning of the zone is *Ulmus* which, although only representing 3% of the total land pollen, fluctuates at between 1% and 2% throughout the remainder. The herbaceous component declines, largely due to the demise of Gramineae and *Calluna*, but regains its former levels by the end of the zone to the detriment of trees and shrubs, particularly *Alnus*, *Quercus* and Coryloid. The diversity of herbaceous taxa is overall very low with only *Calluna* and *Empetrum* contributing more than 30%. *Plantago lanceolata* is also present but at less than 3%. Aquatics are poorly represented in terms of the diversity of taxa but *Sphagnum* is present in significant quantities at both the beginning and end of the zone. This zone represents an open woodland environment with developing heathland.

**GR-b 171-116cm**

Trees continue to decline and herbs increase at the very beginning of the zone, but by 154cm tree pollen increases to former levels of 44%. From this point there is a gradual decline of arboreal pollen. This is evident initially in the *Quercus* curve but *Betula* also declines from a depth of 138cm. Peaks in *Calluna* at 170cm and 146cm are matched by corresponding declines in the Coryloid curve. Individually, taxa show little change although *Ulmus* has a short lived recovery at 146cm and *Empetrum*, Ericales and *Plantago lanceolata* make a more significant contribution to the herbaceous component than had previously been the case. Other herbaceous species such as *Filipendula*, *Ranunculaceae*, *Rumex acetosella*, *Saxifragaceae granulata* and *Gentiana* make their first appearance. *Pteridium* becomes established contributing up to 5% at 138cm but *Sphagnum* is reduced to 2% by the end of the zone.

This zone represents an open, mixed deciduous woodland dominated by *Alnus*, *Quercus*, *Betula* and Coryloid. Open areas are indicated by the presence of *Pteridium* in particular but also by the diversification of the open habitat herbaceous species.
Fig. 6.1a Great Rundale pollen diagram (Trees, Shrubs and Ericales).
Fig. 6.1b Great Rundale pollen diagram (Herbs, Spores and Aquatics).
This phase is characterised by a number of fluctuations in the herbaceous and shrub component. *Calluna* declines very quickly from 25% to 0% at the beginning of the zone but soon recovers to 33% at 98cm. For the remainder of the zone *Calluna* fluctuates but never contributes less than 10% or more than 33%. The most severe drop in *Calluna* at 106cm is mirrored by a dramatic increase in Cyperaceae and may represent a very localised phenomenon. However, the decreases in *Calluna* at 90cm and 74cm, and its subsequent recovery, have a negative correlation with peaks and subsequent decreases in Coryloid. The herbaceous pollen input increases from 32% at 74cm to 49% at the end of the zone with a peak of 63% at 58cm. This rise is a response to an increase in *Calluna*, Gramineae (which rises from 2% at 82cm to 13% at 26cm), and *Plantago lanceolata*. With the exception of the peaks noted above, shrubs decline in the second half of the zone as Coryloid is reduced from 32% at 74cm to 17% at the top of the zone. Although fluctuating, tree pollen also declines overall from 38% mid zone, to just 15% at the top. This is the result of a decline in *Betula, Quercus and Alnus*. *Pinus* is only present at a depth of 66cm but represents less than 3%. *Ulmus* is present at less than 3% until 58cm when it fades out entirely. *Alnus* and *Betula* increase slightly at 34cm as levels of Gramineae, *Calluna* and *Plantago lanceolata* decline. This corresponds to a drop in *Pteridium* to less than 3%. At 26cm Cyperaceae, *Calluna* and *Plantago lanceolata* recover, exceeding former levels, and cereals are present contributing 2% of the total land pollen. The diversity of herbs also increases but from 34cm all trees fall into steady decline. *Sphagnum* fluctuates considerably throughout the zone but peaks at 26cm. A relatively high number of charcoal fragments of both size classes was recorded at 58cm, 90cm and 114cm. The open Ericaceous heathland is expanding to the demise of the local woodland. The overall increase in the herbaceous component is the result of an increase in Gramineae and *Calluna*. The levels of *Pteridium* indicate the open nature of at least part of the landscape and suggest trees are either confined to small stands or are scattered in their distribution.

**GR-d 25-0cm**

This phase is characterised by the sudden decline in tree and shrub pollen. The decline in tree pollen which began at the end of GR-c continues into GR-d, with trees only contributing 9% at the beginning of this zone. This decline is evident in the *Betula, Quercus and Alnus* curves, but a regeneration of *Ulmus* and *Quercus* at the very top of the zone provides a 7% rise in tree pollen. Shrubs decline from 5% to just 1% through the zone. Ericaceous heathland, along with Gramineae and Cyperaceae, spread into some of the open areas created by the demise of the woodland.

**6.3 Howgill Castle**

The Howgill Castle diagram (Fig. 6.2a and b) has been divided into four local pollen assemblage zones:

**HC-a 167-146cm**

The zone is characterised by a steady increase in the percentage of both tree and shrub pollen. Trees increase from 27% to 36% and shrubs from 28% to 47%. The increase in shrubs is mainly the result of the rapid rise in Coryloid from 14% to 40% from the middle of the zone onwards. This is mirrored in the tree pollen by a
Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

Herbs

Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay

Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

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Shrubs

Trees

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Fig. 6.2a Howgill Castle pollen diagram (Trees, Shrubs and Ericales).

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Shrubs

Trees

Herbaceous Bryophyte peat

Silty organic Wood

Rich clay
Fig. 6.2b Howgill Castle pollen diagram (Herbs, Spores and Aquatics).
decline in Betula. At the same level (159cm) Pinus begins a steady increase and is joined by Ulmus and Alnus at the top of the zone. The herbaceous component responds with a sharp decline in Cyperaceae throughout the zone and a steady more gradual decline in Gramineae from 159cm onwards. The diversity of herbaceous taxa also declines towards the top of the zone. The diversity of aquatic species diminishes through the zone but Sphagnum and Filicales fluctuate relative to each other throughout.

The pollen spectra reflects an increasingly closed landscape. The open landscape, evident early in the zone, is rapidly colonised by Coryloid and Betula woodland. The light demanding herbaceous species can no longer compete with the increased canopy cover and rapidly decline throughout the zone.

**HC-b 146-90cm**

In the early stages, this zone witnesses a continued increase in Coryloid which reaches a peak of 63% at a depth of 143cm. After this point Coryloid, although fluctuating, declines rapidly to 23% by the middle of the zone (119cm). This particularly sharp decline corresponds to a peak in Cyperaceae and a slight increase in the diversity of herbaceous taxa. Pinus and Alnus also decline at this level despite relatively stable curves throughout the rest of the zone. The Betula curve remains fairly stable, until 103cm where it drops to just 11%. Tilia makes its first appearance at the bottom of the zone and reappears at the top, after a drop at 119cm, but never reaching more than 1%. Coryloid increases again throughout the zone, reaching a peak of 55%. Quercus increases from 103cm but Pinus declines to less than 3% at the top of the zone. Filicales declines until 119cm then rises again until 103cm before disappearing completely at the top. Aquatics decline steadily in both diversity and frequency of taxa.

This zone represents a mixed deciduous woodland which is dominated by Coryloid. A short lived expansion of herbaceous species may simply reflect a very localised expansion of Cyperaceae but the overall increase in the diversity of the herbaceous component and a reduction in Filicales indicate a temporary opening of the woodland canopy with Pinus, Alnus and Coryloid most noticeably affected.

**HC-c 90-27cm**

A number of quite radical changes characterises the pollen profile during this zone. The herbaceous component declines from 10% at the beginning of the zone to 4% at the end and at depths of 79cm and 63cm drops to just 2%. This steady decline is due mainly to the reduction in Cyperaceae from 8% at the beginning of the zone to less than 2% at the end. Arboreal pollen fluctuates throughout this phase but in general continues to increase. From a depth of 63cm Alnus increases rapidly from 7% to 49% at 47cm but declines slightly at 39cm before increasing again towards the end of the zone. Betula peaks early at 79cm with 41% and retains this dominance only to be exceeded by Alnus at a depth of 63cm. Quercus increases its contribution from the beginning of the zone and makes a steady contribution of between 5% and 9% throughout the remainder. Ulmus reaches a peak of 8% at a depth of 63cm but declines thereupon, with the exception of a small peak at 47cm, to less than 2% at the top of the zone. Cereals make their only appearance at a depth of 39cm but contribute less than 1%. Pinus remains at less than 2% throughout this zone.
Filicales fluctuates throughout but attains a peak of 16% at 39cm before declining for the remainder of the zone.

The pollen spectra reflects an almost completely closed woodland environment. Mixed deciduous woodland including Betula, Alnus, Quercus, Ulmus and Coryloid has created an almost completely closed woodland canopy, although the presence of some light demanding herbaceous taxa does indicate that some small openings survived.

**HC-d 27-0cm**

Once again this zone is characterised by considerable changes in the pollen profile. The arboreal contribution declines significantly from 82% to 28% with the curves of Alnus, Quercus and Betula showing rapid declines. The massive rise in herbaceous pollen is reflected in the curves of Gramineae and Cyperaceae which rise from 1% to 27% and 18% respectively. Plantago lanceolata also rises significantly to 3% and the diversity of herbaceous taxa increases once again. Sphagnum rises sharply at the top of the zone.

This zone represents an opening of the woodland canopy and the establishment of light demanding herbaceous species. The local landscape is one of open grassland with some small, open, deciduous woodland stands.

**6.3 Temple Sowerby**

The diagram from Temple Sowerby (Fig. 6.3a and b) has been divided into seven zones, one of which (TS-c) has been divided into three sub-zones. A hiatus was recorded at a depth of 132cm. Here the pollen concentration was too low to warrant analysis. A second hiatus is evident at a depth of 68cm. Here several very radical changes noted in the pollen profile indicate a break in the pollen profile.

**TS-a 248-219cm**

This zone is characterised by a slight decline in Gramineae early in the zone. This is followed by a gradual but eventually rapid increase at the top of the division. Cyperaceae, although fluctuating in the first half of the zone, declines gradually throughout. A drop in Cyperaceae at 240cm corresponds with a peak in Betula but this is short lived and Betula declines from this point for the remainder of the zone. Although the diversity of herbaceous species remains fairly constant, certain species are present in larger quantities. These include Rumex acetosa, Rumex acetosella, Thalictrum and Rubiaceae. Aquatic plants are not present in large quantities. Filicales witnesses a short lived peak at 240cm. High levels of charcoal of both size classes are recorded at 248cm and at 224cm. The pollen spectra reflect an open grassland environment with small stands of Betula and Salix woodland.

**TS-b 219-180cm**

The most notable feature of this zone is the corresponding fluctuations of Cyperaceae and Gramineae. Despite the fluctuations these types continue to contribute between them an average of 83% of the total dry land pollen. The diversity of the herbaceous component increases during this zone, resulting in a slow but notable increase in total herbs from 88% at the beginning of the zone to 93% at the top. Certain herbs such as
Cannabis, Filipendula, Rumex acetosa and Saxifragaceae increase in frequency, whilst others such as Ranunculaceae, Lactuaceae, Plantago lanceolata and Anthemis appear for the first time. Cereal-type pollen also appear for the first time. On the whole Betula declines until after 184cm, when it shows a fairly rapid increase. In general trees are fairly insignificant, contributing an average total of less than 10% throughout this phase. However, a small peak in tree pollen is recorded at 208cm when their contribution is increased to 17%. Filicales increases, throughout the first half of the zone contributing up to 5% (208cm). A few aquatic species are present but none contribute more than 3%. High levels of charcoal of both size classes are recorded from 208cm and 192cm. A large number of charcoal fragments of the smaller size class is recorded between the above samples at 200cm. This zone again represents an open grassland environment.

TS-c 180-122cm

TS-c1 180-162cm. This sub-zone witnesses a marked increase in arboreal pollen from 16% to 28%. This is accounted for by an increase in Betula and the establishment of Pinus which contributes 5-6%. The shrub component remains between 5% and 6% but the herbaceous component is reduced by 13% to 66% by the end of the zone. This reduction is reflected mainly in the Gramineae and Cyperaceae curves. A reduction in Betula from 168cm corresponds with a large increase in Gramineae causing an overall increase in herbs.

TS-c2 162-142cm. This zone is characterised by a decline in tree pollen from 19% to 11%. The decline is more gradual than the earlier increase and it is once again the Betula curve which is most affected. The diversity of tree pollen during this zone is also reduced as Quercus disappears from the profile. Only Betula and Pinus make contributions over 3% to the arboreal component. Salix is also reduced. The increase in herbs is largely reflected in the increase in Cyperaceae, but Gramineae and Cyperaceae are still showing corresponding fluctuations in their curves. The overall diversity of herb species also declines through this sub-zone with, excluding Gramineae and Cyperaceae, only Filipendula and Rosaceae present. A slight increase in Betula and Pinus at the end of the sub zone, and a corresponding drop in Cyperaceae, provides an overall increase in arboreal pollen.

TS-c3 142-122cm. This zone is interrupted by a hiatus at 132cm where too little pollen was preserved for analysis. An additional sample was taken at 136cm to compensate but it should be remembered that level 132cm contained very little pollen.

The rise in arboreal pollen continues until 136cm when it then declines slightly until the top of the zone. The shrub component remains fairly constant. Gramineae and Cyperaceae continue to fluctuate relative to each other but the herbaceous component overall diversifies with Cannabis, Chenopodiaceae, Saxifragaceae, Umbelliferae and Reseda lutea reappearing. After the peak in arboreal pollen at 136cm herbaceous pollen increases again until the end of the zone.

This zone again shows the dominance of open grassland species throughout, but generally there is an expansion of woodland cover dominated by Betula and Pinus. An increase in Cyperaceae at a depth of 148cm
Fig. 6.3a Temple Sowerby pollen diagram (Trees, Shrubs and Ericales).
Fig. 6.3b Temple Sowerby pollen diagram (Herbs spores and Aquatics).
(TS-c2), accounts for the most striking reduction in arboreal pollen at this level, but may represent a very localised expansion of the species.

**TS-d 122-102cm**

Ts-d marks the start of very drastic changes in the pollen record. Throughout the zone Coryloid pollen increases, beginning the zone at less than 1% and increasing to 14% by the top. *Pinus* continues to decline until 116cm but retains a level of 4% for the remainder of the zone. *Betula* reaches a maximum at a depth of 108cm where it contributes 31% of the total dry land pollen, but this is followed by a decline at the top of the zone. The diversity of taxa has increased within the tree component with *Tilia* making its earliest appearance and an increased frequency of *Alnus*. The increase in *Betula* and Coryloid are primarily responsible for the gradual decline in the herbaceous component which is so clearly evident from the summary diagram (Fig. 6.3). This decline is reflected in the curves of both Gramineae and Cyperaceae. Once again the diversity of herbaceous species is reduced. Within this zone the pollen reflects a landscape which is becoming increasingly closed with the gradual expansion of mixed woodland dominated by *Betula* and Coryloid.

**TS-e 102-73cm**

TS-e is notable for its dramatic increase in shrub pollen. The greatest change is recorded in the Coryloid curve which rises from 12% at the end of TS-d to 38% by the end of TS-e. *Alnus* also increases from less than 2% at the end of TS-d (108cm) to 14% by the end of this zone. *Ulmus* continues to make a contribution with a small peak at a depth of 84cm. *Pinus* maintains a fairly steady plateau of between 2% and 5% throughout the zone. *Betula* takes a steady decline throughout the division. The overall increase in both tree and shrub pollen is mirrored by a sudden drop in Gramineae from 35% at the end of TS-d to 6% at the beginning of TS-e. A more gradual decline continues throughout the zone with Gramineae contributing only 3% by the end. Cyperaceae continues to rise until a depth of 92cm when this is reversed. *Calluna* compensates to some degree, contributing between 2% and 5% throughout the zone. The diversity of the herbaceous component is increased with various species including Chenopodiaceae, *Cannabis*, Lactuceae, *Plantago lanceolata*, *Plantago maritima*, *Rumex acetosella* and *Rumex acetosa* reappearing after being absent from the profile. Filicales has become established with a continuous curve evident throughout the profile. A relatively high number of charcoal fragments of the larger size class is recorded at a depth of 84cm and 92cm.

The pollen spectra within this zone indicates a considerable expansion of Coryloid at the expense of open grassland. Tree cover is also increasing as *Alnus* and *Ulmus* become established. The fact that the woodland remains open is indicated from the increase in the diversity of light demanding herbaceous species.

**TS-f 73-24cm**

This phase is characterised by the regeneration of the herbaceous component which by 52cm is contributing 58% of the total dry land pollen. On the whole both trees and shrubs suffer as a consequence. Coryloid, despite a peak of 46% at 72cm, declines steadily throughout the zone although fluctuations in the curve do occur. *Pinus* is reduced to less than 3% after 68cm but recovers slightly from 36cm onwards. At the beginning of the zone (72cm) *Alnus* is reduced to just 3%. At a depth of 60cm it recovers to some degree
but continues a steady decline from then on. The frequency of Quercus is increased and Fraxinus makes its first appearance at the top of the zone (28cm). Betula continues a slow decline early in the zone but increases again from 60cm. At a depth of 44cm Betula reaches 18% and remains fairly stable from then on. From 52cm Ulmus contributes 3% which continues until 36cm when it declines again to 1%. On the whole arboreal pollen maintains a fairly stable contribution. The increase in the herbaceous component is largely due to the contribution made by Cannabis which, although being present in other parts of the pollen profile, displays a continuous curve throughout this zone. The increase from 7% at 68cm to a peak of 25% at 60cm, declines to 5% at a depth of 44cm. A further increase to 16% occurs before Cannabis disappears completely after 28cm. At this point (28cm) the herbaceous component retains its dominance with an increase in Gramineae and Calluna. Cereals appear for the first time, albeit in small quantities between 60cm and 36cm. The overall diversity of herbaceous taxa is increased as Chenopodiaceae, Lactuceae, Rubiaceae, Umbellifereae, Ribes Ruben, Plantago lanceolata and Rumex acetoella and Rumex acetosa reappear with increased frequency. The diversity of aquatic species increases slightly at the top of the zone, although the overall contribution is minimal. Filicales retains a fairly stable level throughout the zone but falls into decline at the very top. Sphagnum increases in both quantity and frequency towards the top of the zone. A high level of charcoal fragments of the larger size class is recorded at 68cm. A moderately high number, again of the larger size class, is recorded at 52cm and 36cm.

Dramatic changes in the pollen profile and the reduction in the pollen concentration levels at 68cm are interpreted as a hiatus in the development of the peat. The effects of this will be discussed in more detail later but for the time being, the pollen profile of this zone represents a gradual expansion of open areas dominated by Cyperaceae, Calluna and Cannabis type. The continued, if gradual, increase in trees indicates that it is shrubs and particularly Coryloid type which suffer as a result of the openings.

TS-g 24-0cm

This zone is distinguished by its sudden increase in tree pollen. Early in the zone, the later characteristics of TS-f are still apparent with both trees and shrubs declining. This is the result of a sharp rise in Gramineae, which reaches 43% at a depth of 20cm, and a continued rise in Calluna. The expansion of the herbaceous component is short lived and the dominance of the trees soon becomes apparent. The regeneration of trees from 20cm onwards is to the detriment of both shrubs and herbaceous species, the main cause of this being the very steep rise in the Pinus curve from 4% at the beginning of the zone to 70% at a depth of 8cm. Beyond this point there are signs of a decline but this is compensated by a rise in Betula and Salix, retaining the overall dominance of arboreal pollen. Sphagnum shows a dramatic peak at a depth of 20cm but on the whole aquatic species decline in both frequency and diversity. Filicales contributes less than 3% throughout the zone. High levels of charcoal in the larger size class are recorded in all samples within this zone. This zone marks the final transition from an essentially open woodland environment to one of a closed woodland dominated by Pinus and Betula.
6.4 Charcoal

The quantification of charcoal fragments in pollen samples has been the subject of numerous studies (Clarke, 1988; Patterson et al., 1987; ). Despite this attention the development of a standardised technique has not been forthcoming. This is partly due to the infinite number of variables affecting the dispersal and taphonomy of charcoal (Patterson et al., 1987; Tauber, 1965; ). There is, however, a single observation recurring in the literature, which is that the larger the charcoal particle size, the closer the sampling site is to the source of the fire (Clarke, 1988; Patterson et al., 1987; Simmons and Innes, 1996). This is difficult to apply to the data at Bank Moor where it was observed during counting that some fragments had been broken after being mounted on the slide. On several occasions it was possible to match the breaks of two or more fragments. Tests carried out by Patterson et al. on the effects of the pollen sample preparation on charcoal fragments have shown that, although mounting in Silicon oil had little effect on the size distribution, the use of hydrofluoric acid during sample preparation may affect particle size distribution in pollen samples (1987, 10). This is particularly significant for the interpretation of charcoal at Bank Moor because the sample preparation included prolonged washing in hydrofluoric acid to remove sediment particles from the samples. It is possible that this process weakened the structure of the charcoal and caused it to break under pressure beneath the cover slide. Mehringer et al. have shown that when charcoal of smallest class size is abundant, charcoal of all size classes is more common and that both size classes are positively correlated at a high level of significance (1977, 346). This they suggest, would result from breakage and they prefer to interpret the larger fraction as representative of original charcoal in the samples. A correlation between large and small charcoal size classes is apparent in some samples at Bank Moor (121 cm-137 cm) but not in the others. It is suggested that this is due to increased breakage and for this reason high readings within either size class are considered to be relevant to this research.

The problem of breakage does not appear to have affected samples from Temple Sowerby, Howgill Castle and Great Rundale, so only large fragments, indicative of local or extra local fires, are included in the discussion.

6.5 Setting the cultural context - chronology

The importance of a chronological framework for the integration of archaeological and environmental data has already been discussed and the adoption of the chronology for this research and the limitations of its application explained (Chapter 5, Table 5.2). It is necessary now to apply this chronology to the pollen data. Ideally every local pollen assemblage zone would be radiocarbon dated but due to financial constraints this was not possible. Two dates were obtained for Temple Sowerby, and three for Great Rundale, Bank Moor and Howgill Castle (Table 6.0).

In the case of Temple Sowerby it was initially assumed that radiocarbon dates from the pollen core analysed by Pierce (1986, grid reference NY 616270) could be extrapolated and used to date the pollen diagram constructed for this research (NY 616271). The two sites are only ten metres apart and produced an almost identical depth of peat deposits with similar lithostratigraphic characteristics. It was possible to match peaks and troughs in the pollen profiles from the two diagrams, the most prominent being a rise in Alnus corresponding with a rise in Coryloid and Calluna. However, the hiatus between 69 cm and 89 cm which was
<table>
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<th>Site</th>
<th>Sample No.</th>
<th>Depth (cm)</th>
<th>Radiocarbon Age</th>
<th>One sigma</th>
<th>Two sigma</th>
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<td>Cal</td>
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<td>3098 BC</td>
<td>3037 BC</td>
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<td>6736 ± 110 BP</td>
<td>5720 BC</td>
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<td>Howgill Castle</td>
<td>UB3841</td>
<td>23-24</td>
<td>4767 ± 50 BP</td>
<td>3637 BC</td>
<td>3577 BC</td>
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<td></td>
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<td>Bank Moor</td>
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<td>870 ± 50 BP</td>
<td>1047 AD</td>
<td>1169 AD</td>
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<td>OxA-5867</td>
<td>187</td>
<td>6675 ± 60 BP</td>
<td>5635 BC</td>
<td>5563 BC</td>
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Table 6.0 Details of calibrated radiocarbon dates. The date ranges are shown on the pollen diagrams. Dates in bold text are those used to calculate peat accumulation rates. Dates given for Temple Sowerby are those determined for the pollen diagram constructed by Pierce (1986) and the depths given relate to that diagram.
recorded on Pierces' diagram (op cit), is not evident in the same form in the diagram constructed for this research. Pierces' hiatus manifests as a 20cm band of the core which is devoid of pollen or a least with a pollen concentration so low it was not worthy of analysis. A much narrower hiatus is evident in the diagram used for this research at a depth of 68cm where several very radical changes are noted in the pollen profile. The most obvious of these is a temporary drop in *Alnus* from 24% at 76cm to less than 1% at 68cm. This corresponds with a steep rise in Coryloid, Gramineae and *Sphagnum* and a simultaneous drop in pollen concentration. The hiatus is followed by an equally distinct rise in *Cannabis/Humulus* type pollen.

High levels of *Cannabis* pollen, in association with cereal pollen and other anthropogenic indicators, have been recorded elsewhere in Cumbria. At Skelsmergh Tarn, high levels of Cannabis pollen were associated with a clearance phase (Walker, 1955, 242). Although no radiocarbon dates are available for this site a date of c. 500 BC was proposed on the basis of Godwin's pollen zonations (Godwin, 1956, 62). At Sunbiggin Tarn, to the south of the study area, *Cannabis* pollen appears during a peak in cereal pollen, and in the presence of other species indicative of cultivation such as *Artemisia, Plantago major/media* and *Chenopodiaceae* (Chinn, 1990). Here, the levels were much lower than those recorded at Temple Sowerby and unfortunately no dates are proposed for this site. At Ehenside Tarn a peak in *Cannabis/Humulus* type pollen is associated with widespread clearance dated to about 800 AD (Walker, 1966, 201). It is interesting that Walker cites an extract from an essay dated 1709 on the natural history of Cumberland and Westmorland which states that *Cannabis sativa* was growing 'plentifully on the skirts of Cross Fell and other places within both these counties' (Robinson, 1709 cited in Walker, 1966).

One problem in using comparative sites is the overall lack of dating evidence. In Britain, where radiocarbon dates are cited, *Cannabis* cultivation is associated with the medieval period or later, when documentary sources often substantiate the evidence with reference to hemp fields or hemp retting pools (French and Moore, 1986; Bradshaw et al. 1981; Whittington and Edwards, 1989). Interpretation is made more difficult because so little is known of the past patterns of production, and the legal restrictions placed on growing *Cannabis* have hindered experiments into the physiology of the plant and its cultivation (Whittington and Edwards, 1989, 93).

However, Whittington and Edwards infer that a sudden increase in Cannabaceae pollen to high levels is a response to *Cannabis* cultivation or retting (1989, 80). It is difficult without high resolution pollen analysis to establish precisely which is being carried out at Temple Sowerby but the pollen spectra identified here during the peak in *Cannabis* is similar to that associated with hemp retting at other sites (Bradshaw et al., 1981), but *Cannabis* cultivation cannot be ruled out. Either way the steep rise and sustained levels of *Cannabis/Humulus* type pollen are considered to be medieval in origin.

With what appears to be medieval or later levels immediately above the hiatus, the break in the pollen profile is interpreted as being the result of peat cutting. This must have occurred prior to the hemp retting activities or cannabis cultivation which resulted in the high levels of *Cannabis* pollen entering the pollen profile. On
Pierce's diagram the hiatus is thought to have been the result of oxidation and loss of pollen caused by a drop in the water level or fire (Innes pers. comm 1993).

Although the hiatus in Pierce's diagram occurs at a similar depth to that in the diagram used for this research, they do not appear to be contemporary. The rises in *Alnus* Coryloid and *Calluna* appears on Pierce's diagram immediately above the hiatus (above 69cm). The corresponding pollen profile in the diagram used for this research occurs immediately below the hiatus (below 68cm). It is suggested from this that the depth of the two hiatuses is purely coincidental.

This has obviously created problems in the dating of the most recent diagram. It is not possible to simply lift the dates from one diagram and place them at a similar depth on the other. However, the samples used for dating Pierce's diagram (Table 6.0) were taken above the hiatus, one between 64-68cm and the other between 28-34cm, in effect bracketing the rise and subsequent fall in *Alnus*. This provided a date of 5632 Cal BC for the beginning of the *Alnus* rise and a date of 3037 Cal BC for the beginning of its decline.

Because the rise in *Alnus* and the corresponding changes in the pollen profiles are comparable between the two diagrams, it was considered appropriate to transpose the date for the beginning of the *Alnus* rise on to the most recent diagram. The peat accumulation rate (Aaby, 1986, 155) was calculated for the section of the diagram which falls between the two radiocarbon dates (0.15mm per year). The rise and subsequent fall of *Alnus* on Pierce's diagram occur over a depth of approximately 40cm, that on the most recent diagram occur over a depth of approximately 36cm. It was felt that the two were so closely comparable that, although the date of 3037 Cal BC could not automatically be used to date the same horizon on the most recent diagram, the peat accumulation rate determined for Pierce's diagram could be applied to the diagram produced as part of this research. From this it was possible to estimate the date at the base of the hiatus to be 3699 BC.

A second minor hiatus is also recorded at 132cm. Here the pollen concentration is too low to warrant counting. This is not considered to be a problem because it is not associated with any major changes in the pollen profile. It appears to represent a short term change in the local conditions which was not conducive to the preservation of pollen.

Clearly, the extrapolation of dates from another pollen diagram can be problematic particularly for high resolution studies of past vegetation, but in a wider landscape study such as this it does provide a broad chronological framework upon which the vegetation history can be reconstructed. The dates have therefore been used for this purpose but where quoted, the origin of the dates should be remembered.

One possible problem with the radiocarbon dates from Bank Moor is that of hard water contamination. Radiocarbon dating within a Carboniferous landscape can be problematic because of the risk of 'old' carbon, from the limestone, being incorporated into the sample (Aitken, 1990, 86). Aitken explains that aquatic plants growing in a limestone region may absorb, via ground water and photosynthesis, carbonate derived from the limestone. Although deposited carbonate can be removed from a sample by washing in acid, there is
no pre-treatment that can deal with old carbon incorporated by photosynthesis (Aitken, 1990, 65). Formation of peat incorporating these plants may therefore provide anomalous, ‘older’ dates.

Investigations into the effects of contamination have, in general, focused on varved clays (Wolfarth et al., 1993) and other lake sediments (Regnél, 1992), where the ‘reservoir effect’ has the opposite result of incorporating ‘younger’ carbon, from the water surface, into older deposits on the base of the lake.

Although the deposition and taphonomic processes affecting lake sediments are quite different to those affecting peat deposits, these findings have potential implications for the dates determined from Bank Moor. In an area where no similar deposits have been radiocarbon dated it is impossible to carry out comparative studies based on known ‘accurate’ measurements. There is however a number of factors which indicate that the dates from Bank Moor are ‘accurate’. The first is the general lack of aquatic species in the sections of the core from which the upper (28cm) and lower (187cm) dating samples were taken (Fig. 6.0a and b and Table 6.0). Although this does not apply to the sample taken at 128cm, there is little to suggest, based on the other two dates, (1169 Cal AD and 5663 Cal BC) that this date (1887 Cal BC) is ‘older’ than anticipated. Besides, although aquatics are recorded in the pollen profile, there are reasonably large wood fragments, and charcoal in the peat and these would have dominated the sample being dated. Wood and charcoal are less likely to introduce ‘old’ carbon: if anything these will contain ‘new’ carbon in the form of humic acid, but this is extracted and discarded during sample preparation, reducing the risk of contamination (Aitken, 1990, 87).

Another indication that the dates from Bank Moor are ‘accurate’ is provided by the upper date which corresponds with the surface of the peat. Assuming the surface of the peat to be 1994, and there is no suggestion of disturbance, the upper section of the core provides an accumulation rate of 0.34mm per year (Table 6.1), very similar to the accumulation rate determined from OxA - 5883 (1887 Cal BC) and OxA - 5882 (1169 Cal BC) which calculates to 0.30mm per year (Table 6.1). The lower sections of the core do suggest a much slower accumulation rate, but this may be explained by the sediment type and autocompaction which is discussed below.

6.6 Accumulation rates

The calculation of peat accumulation rates is generally reliant on a series of calibrated radiocarbon dates and the use of age/depth curves (Aaby, 1986, 155). The non linear nature of peat accumulation has been shown to relate to the degree of humification and humidity, with a general tendency to higher accumulation rates for younger peat layers, due to autocompaction of the deeper deposits (Aaby and Tauber, 1975, 11). Others are of the opinion that strongly humified peat was formed in periods with a low peat accumulation rate, while slightly decomposed peat originated in periods with rapid peat growth (Granlund, 1932 cited in Aaby, 1986, 158). At Draved Moss 55 radiocarbon dates were determined from a peat section of 2.5m (Aaby and Tauber, 1975). This level of resolution is very rarely available to palynologists and makes it difficult to apply the methodology elsewhere when only two or possibly three dates are available.

For this research the peat accumulation rates have been calculated for each of the cores using available radiocarbon dates and a simple time/depth calculation. The most obvious problem with this method is that it
assumes a consistent peat accumulation between the dated horizons. This also applies to the method used at Draved Moss (Aaby and Tauber, 1975), but is less of a concern where such a large number of dates is available. The more simple method adopted for this research also requires the extrapolation of determined accumulation rates to the levels below the deepest, and above the highest, radiocarbon-dated levels. The level of accuracy is comparable to the coarse chronological resolution available for the archaeological evidence in Eastern Cumbria. The broad and overlapping cultural periods applied in the context of this research are as accurate as the archaeological evidence will allow. In an area where very little excavation has taken place, it is impossible to attribute particular sites or finds to anything more than broad chronological/cultural periods.

At Bank Moor, Great Rundale and Howgill Castle, the dates are fairly evenly spaced through the core, which reduces the problem of extrapolation required to determine the accumulation rates outside the date bracketed sections of the core. The method used to determine the peat accumulation rate at Temple Sowerby has already been discussed.

6.6.1 Bank Moor

The accumulation rates are fairly consistent from 128cm and above but are considerably lower from 128cm to the base of the core. However, the diverse and significantly high aquatic component within the pollen assemblage between 121cm and 161cm may help to explain the lower accumulation rate. This conforms to Aaby and Tauber’s findings that peat formed in wet conditions is more compressible than peat formed in dry conditions and is therefore more susceptible to autocompaction as it becomes buried (1975, 12).

Between 28cm and 128cm the accumulation rates are higher. Although this variance between the top and bottom of the core is expected (Aaby and Tauber, 1975, 11), the difference between this unit and that lower down the core is quite considerable. This can again be related to the lithostratigraphic units. Wood fragments are recorded in the core between 63cm and 147cm but are most frequent between 78cm and 105cm. The latter unit, a bryophytic peat, contains wood fragments up to 3cm in diameter. Kaye and Barghoorn (1964) have demonstrated that both bryophytes and wood are rather more resistant to compaction (1964) and this may explain the considerable difference between accumulation rates above and below 128cm.

<table>
<thead>
<tr>
<th>Depths cm.</th>
<th>Accumulation rate mm per year</th>
<th>Pollen core characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-28</td>
<td>0.34</td>
<td>Fibrous moss and herb peat with silt and clay components to a depth of 20cm. Silty clay with fine organic matter 20-28cm.</td>
</tr>
<tr>
<td>28-128</td>
<td>0.30</td>
<td>Silty clay organic peat with increasingly large wood fragments to a depth of 105cm.</td>
</tr>
<tr>
<td>128-218</td>
<td>0.16</td>
<td>Diverse range of aquatics in significantly high proportions to a depth of 161cm. Increasingly clay rich with depth, with high degree of humification.</td>
</tr>
</tbody>
</table>

Table 6.1. Bank Moor peat accumulation rates.

6.6.2 Great Rundale

At Great Rundale the accumulation rates are varied (Table 6.2). Here an unusual pattern of accumulation is recorded with the highest accumulation rate recorded in the lowest metre of the core. Once again the
lithostratigraphic units can provide an explanation for this. Within the lowest unit (100-200cm), the peat is only slightly humified and contains *Calluna* stems. The woody elements of the *Calluna* will be resistant to compaction and this combined with the slight humification will have retained a high accumulation rate. The same processes seem to be in action in the top section of the core although the lack of wood in this unit might explain the lower accumulation.

The middle section of this core has the lowest recorded accumulation rate. It would appear that the increased humification recorded in this unit has reduced the speed of accumulation (Aaby, 1986, 160).

<table>
<thead>
<tr>
<th>Depth (cm)</th>
<th>Accumulation rate (mm per year)</th>
<th>Unit characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-19</td>
<td>0.34</td>
<td>Slightly humified herbaceous peat containing grass, <em>phragmites</em> and <em>Calluna</em>.</td>
</tr>
<tr>
<td>19-100</td>
<td>0.29</td>
<td>As above until 60cm then moderately decomposed moss peat with charcoal flecks and small wood fragments.</td>
</tr>
<tr>
<td>100-200</td>
<td>0.45</td>
<td>Slightly humified herbaceous peat with charcoal flecks and <em>Calluna</em></td>
</tr>
</tbody>
</table>

Table 6.2. Great Rundale peat accumulation rates.

6.6.3 Howgill Castle

At Howgill Castle it is clear from the radiocarbon dates that the upper levels of peat have either suffered from erosion, artificial drainage or have been cut in the past (Fig. 6.2a and b). Peat has been used for fuel from at least as early as the medieval period, and peat cutting was certainly widespread during this period and later. Remnants of the medieval open field system are evident, in the form of ridge and furrow, on the slopes surrounding the hanging valley. It is possible that the peat was being exploited at the same time, possibly as a fuel supply for the inhabitants of Howgill castle, the seat of the manor for the Forest of Milburn. The castle itself is known to date from the early 13th century (Martindale, 1908, 198).

It is also possible that modern drainage systems have affected the accumulation of peat. 'Modern' drainage ditches have been dug along the foot of the valley slope to the north of the mire and post war drainage systems have been installed in the fields to the south of the mire. The coniferous plantation on the southern slope of the valley will also have had the effect of reducing the amount of water supplied to the mire in the form of surface runoff. All of these factors may have had an effect on the development of the peat.

For whatever reason, or reasons, the peat in the upper levels of the core has been disturbed, which rendered the surface date of 1994 unsuitable for the determination of peat accumulation rates. For this reason, and because of the rapid and dramatic changes in the pollen profile at the top of the core, levels above 23cm have not been used for this research.

At Howgill castle the peat accumulation rate (Table 6.3) is relatively consistent throughout the core. The very slight decrease below 86cm can be attributed to autocompaction, but the effects of this process have perhaps been restricted by the wood fragments in the lower levels.
<table>
<thead>
<tr>
<th>Depth cm</th>
<th>Accumulation rate mm per year</th>
<th>Unit characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 - 86</td>
<td>0.37</td>
<td>Slightly humified herbaceous peat with intermittent bands of silty peat containing more organic matter and charcoal flecks. A unit of banded, bryophytic peat containing charcoal fragments from 38cm-74cm.</td>
</tr>
<tr>
<td>86 - 167</td>
<td>0.39</td>
<td>Slightly humified, silty, herbaceous peat to a depth of 132cm. Silty clay with herbaceous organics and large wood fragments from 132cm. Band of sand between 152-164cm.</td>
</tr>
</tbody>
</table>

Table 6.3. Howgill Castle peat accumulation rates.

### 6.6.4 Temple Sowerby

The method used in the determination of peat accumulation rates at Temple Sowerby has already been discussed. Because this process involved the extrapolation of dates from another diagram (Pierce 1986 unpublished), there was a number of limitations to its use. The accumulation rates could only be estimated for local pollen zone TS-e, which is characterised by the rise in *Alnus*, Coryloid and *Calluna*. This was comparable to the pollen profile for which the date was originally determined. The hiatuses and variable pollen concentration levels in the diagram constructed for this research suggest that to use the same accumulation rates further down the diagram would introduce inaccuracies. Changes in pollen concentration have been linked to changes in peat accumulation rates (Middeldorp, 1982, 225), and there are clear differences in the pollen concentration in the bottom half of the Temple Sowerby core (Fig. 6.3 and 6.3a). From 108cm to the base of the core pollen concentration is considerably lower than it is at the top and is particularly apparent at a depth of 132cm where pollen concentration was too low for accurate analysis. Low pollen concentration equates with rapid peat accumulation (Middledorp, 1982, 225) and clearly on this evidence it was impossible to extrapolate an accumulation rate over this section of the core.

<table>
<thead>
<tr>
<th>Depth cm</th>
<th>Accumulation rate mm per year</th>
<th>Unit characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>75-102</td>
<td>0.15</td>
<td>Slightly humified and stratified, Bryophytic peat with a herbaceous component increasingly woody to base.</td>
</tr>
</tbody>
</table>

Table 6.4 Temple Sowerby peat accumulation rates.

### 6.6.5 Application of chronology

In order to establish the time span covered by each of the pollen diagrams the accumulation rates have been used to estimate the age of each of the local pollen assemblage zones (Tables 6.5 to 6.8). Details of the chronological span of the individual cores and their interrelationship are presented in Fig. 6.4. It is immediately apparent that only the early neolithic period is represented in all the pollen diagrams. At Temple Sowerby the 'dated' section of the core spans from the late mesolithic to the early neolithic. Howgill Castle represents the period from the early mesolithic to the early neolithic. Bank Moor covers the early mesolithic through to the present day and Great Rundale from the early neolithic to the present day. For the purpose of this research only areas of the pollen diagrams representing the period from the early mesolithic to the end of the iron age will be discussed.
### Table 6.5 Divisions and sub-division of Bank Moor pollen diagram.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Depth in cm</th>
<th>$^{14}$C date</th>
<th>Archaeological Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM-a</td>
<td>218-190</td>
<td>7494 - 5749 BC</td>
<td>early mesolithic</td>
</tr>
<tr>
<td>BM-b1</td>
<td>190 - 180</td>
<td>5749 - 5126 BC</td>
<td>late mesolithic</td>
</tr>
<tr>
<td>BM-b2</td>
<td>180 - 167</td>
<td>5126 - 4316 BC</td>
<td>late mesolithic</td>
</tr>
<tr>
<td>BM-b3</td>
<td>167 - 156</td>
<td>4316 - 3630 BC</td>
<td>early neolithic</td>
</tr>
<tr>
<td>BM-b4</td>
<td>156 - 135</td>
<td>3630 - 2322 BC</td>
<td>early - late neolithic</td>
</tr>
<tr>
<td>BM-b5</td>
<td>135 - 120</td>
<td>2322 - 1641 BC</td>
<td>late neolithic - early bronze age</td>
</tr>
<tr>
<td>BM-c</td>
<td>120 - 70</td>
<td>1641 - 113 BC</td>
<td>early bronze age - iron age</td>
</tr>
<tr>
<td>BM-d</td>
<td>70 - 45</td>
<td>113 BC - 651 AD</td>
<td>iron age - post Roman</td>
</tr>
<tr>
<td>BM-e</td>
<td>45 - 0</td>
<td>651 - 1994 AD</td>
<td>post Roman - Modern</td>
</tr>
</tbody>
</table>

### Table 6.6 Divisions and sub-division of Great Rundale pollen diagram.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Depth in cm</th>
<th>$^{14}$C date</th>
<th>Archaeological Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR-a</td>
<td>200 - 171</td>
<td>3495 - 2870 BC</td>
<td>neolithic</td>
</tr>
<tr>
<td>GR-b</td>
<td>171 - 116</td>
<td>2870 - 1684 BC</td>
<td>late neolithic - bronze age</td>
</tr>
<tr>
<td>GR-c</td>
<td>116 - 25</td>
<td>1684 BC - 1213 AD</td>
<td>bronze age - early medieval</td>
</tr>
<tr>
<td>GR-d</td>
<td>25 - 0</td>
<td>1213 AD - 1994 AD</td>
<td>early medieval - Modern</td>
</tr>
</tbody>
</table>

### Table 6.7 Divisions of Howgill Castle pollen diagram.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Depth in cm</th>
<th>$^{14}$C date</th>
<th>Archaeological Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC-a</td>
<td>167 - 146</td>
<td>7316 - 6784 BC</td>
<td>early mesolithic</td>
</tr>
<tr>
<td>HC-b</td>
<td>146 - 90</td>
<td>6784 - 5365 BC</td>
<td>late mesolithic</td>
</tr>
<tr>
<td>HC-c</td>
<td>90 - 27</td>
<td>5365 - 3683 BC</td>
<td>late mesolithic - early neolithic</td>
</tr>
<tr>
<td>HC-d</td>
<td>27 - 23</td>
<td>3683 - 3577 BC</td>
<td>early neolithic - late neolithic</td>
</tr>
</tbody>
</table>

### Table 6.8 Divisions and sub-division of Temple Sowerby pollen diagram.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Depth in cm</th>
<th>$^{14}$C date</th>
<th>Archaeological Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS-a</td>
<td>248 - 102</td>
<td>? - 5632</td>
<td>? - late mesolithic</td>
</tr>
<tr>
<td>TS-e</td>
<td>102 - 73</td>
<td>5632 - 3699 BC</td>
<td>late mesolithic - early neolithic</td>
</tr>
<tr>
<td>TS-f</td>
<td>73 - ?</td>
<td>?</td>
<td>medieval - post medieval</td>
</tr>
<tr>
<td>TS-g</td>
<td>?</td>
<td>?</td>
<td>post medieval</td>
</tr>
</tbody>
</table>

### 6.7 Vegetation History

#### 6.7.1 Early Mesolithic c. 8500-6500 BC

The vegetation of Eastern Cumbria at this time is considerably varied. At Bank Moor only two samples, at the base of the core, can be taken to be early mesolithic. From these it appears that the landscape around Bank Moor was one of rich, open grassland with small stands of *Betula*-dominated woodland. *Pinus* makes less of a contribution than at Temple Sowerby, but in the North West this has been shown to be edaphically rather than climatically controlled, as it is further south (Pennington 1970, 58). The acidic soils and peat deposits around Temple Sowerby would be ideal for the establishment and growth of *Pinus* but shallow soils around Bank Moor would have limited its spatial spread.

At Red Tarn Pennington has interpreted the persistence of late glacial indicator species as evidence that solifluction remained sufficiently active at this altitude (518m) to keep the forest open longer (1964). The exposed nature of Bank Moor, although at a lower altitude than Red Tarn, may have suffered in the same way, but the thin soils of the limestone plateau would anyway have provided a 'natural' refuge for late glacial herbaceous taxa.
At Howgill the early mesolithic is represented from c.7316 cal BC. Here the vegetation is different, with open *Betula* and Coryloid woodland dominating the landscape. Pine makes less of a contribution than at Temple Sowerby but Coryloid is well established. Once again some of the late glacial species survive into the period indicating the open nature of the woodland. It is interesting to note that a single cereal pollen grain was recorded in a mid to late 8th millennium BC context. This is particularly early and raises questions as to whether the cereal grains are in fact unusually large grass pollen grains. Although Andersen (1978) devised a method of distinguishing between wild grasses and cereal pollen, it is acknowledged in his work that it is often difficult to make the distinction. The overall dominance of herbs at this time is largely due to the high percentage of Cyperaceae but this is possibly a very local phenomenon which, combined with *Sphagnum*, represents the vegetation growing on the mire surface. From the early to mid 7th millennium BC the woodland is becoming more mixed as *Pinus, Ulmus, and Alnus* become established, but the expansion of Coryloid percentages causes a reduction in the areas covered by both the woodland and grassland.

At Temple Sowerby it is difficult to give a detailed description of the vegetation at this time due to the problems of dating sections of the diagram below 102cm. However, a tentative use of the accumulation rate (Fig 6.4) does enable one to estimate that the vegetation history of the early mesolithic is represented below approximately 122cm. Immediately below this depth the pollen profile indicates a vegetation of open grassland with areas of increasingly mixed woodland stands dominated by *Betula, Pinus* and *Salix*. Although the gradual rise in Gramineae indicates an opening of the woodland areas, the diversity of the herbaceous component is limited.

<table>
<thead>
<tr>
<th>Site</th>
<th>Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temple Sowerby</td>
<td>Open grassland with small stands of mixed woodland dominated by <em>Betula, Pinus</em> and <em>Salix</em>.</td>
</tr>
<tr>
<td>Howgill Castle</td>
<td>Open Coryloid and <em>Betula</em> woodland becoming increasingly mixed with <em>Pinus, Ulmus</em> and <em>Alnus</em>.</td>
</tr>
<tr>
<td>Bank Moor</td>
<td>Open grassland with small stands of <em>Betula</em> and <em>Salix</em> woodland</td>
</tr>
</tbody>
</table>

Table 6.9 Summary of early mesolithic vegetation.

6.7.2 Late Mesolithic c. 7000-4000 BC

At Howgill Castle the late mesolithic vegetation consists of mixed deciduous woodland dominated by Coryloid. Over this period the woodland expands rapidly, significantly reducing the open grassland areas. The expansion of *Pinus* and *Ulmus* at this time is closing the woodland canopy and the decline of *Betula* between c.6784 cal BC and c. 5365 cal BC, is probably a direct result of the competition with Coryloid for openings in the increasingly closed canopy. At c.6400 cal BC there is a rapid decline in Coryloid and an equally rapid expansion of Cyperaceae resulting in the opening of the woodland canopy. The fact that Coryloid values recover immediately after this level suggests the opening is simply the effect of relative changes in the percentage of Cyperaceae and represents a very localised phenomenon. This may simply indicate the expansion of Cyperaceae growing on the mire surface, although the increase in Rosaceae type pollen may
Fig. 6.4 The chronological span of pollen cores and their inter-site relationship.
suggest a certain amount of opening significant enough to encourage certain members of this family to appear for the first time.

From c.5265 cal BC the woodland cover becomes more dense with a further and rapid expansion of *Betula* and *Quercus*. *Pinus* declines but *Ulmus* and *Alnus* retain a fairly steady level until c.4600 cal BC when *Alnus* increases dramatically, closing the forest canopy. The more light-demanding *Betula* and Coryloid fall into decline.

Around Bank Moor the late mesolithic vegetation remains one of open grassland, rich in a diverse range of herbaceous taxa. *Betula*, *Corylus* and *Salix* create a more mixed woodland but remain as only small stands. The high levels of charcoal recorded from c.5900 BC, and throughout the remainder of this period, do not appear to correlate with fluctuations in any one species or vegetation group. All the high readings of charcoal are within the smaller size class and this may be the result of wind dispersal from fires some distance away (Patterson et al., 1987, 6). Many of the late glacial herbaceous species continue to thrive in the open grassland on Bank Moor with the landscape as a whole experiencing little change.

At Temple Sowerby *Betula* and Coryloid are able to survive side by side as they encroach on the open grassland, but by c. 5632 cal BC mixed deciduous woodland develops as *Alnus* and *Ulmus* become established and *Quercus* increases in frequency. At this time the composition of the woodland has become more diverse and the spatial area occupied by the woodland has increased. At the same time the diversity of the herbaceous component has also increased and yet the spatial area covered by these has decreased.

A simultaneous expansion of *Calluna* was probably within the woodland understorey, but the subsequent levels of *Calluna* fluctuate slightly. It is interesting that troughs in the *Calluna* curve correspond quite clearly with peaks in charcoal levels. The use of fire in the management of heathland has, and continues to be, widely practised (Behre, 1988, 656) and this appears to be the case at Temple Sowerby in the late mesolithic period. This type of heathland management is generally associated with encouraging new growth for grazing regimes and to prevent reafforestation (op cit).

<table>
<thead>
<tr>
<th>Site</th>
<th>Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temple Sowerby</td>
<td>Increasingly closed and expanding mixed deciduous woodland dominated initially by <em>Betula</em> and Coryloid. Evidence of heathland management throughout.</td>
</tr>
<tr>
<td>Howgill Castle</td>
<td>Increasingly closed, mixed deciduous woodland dominated by hazel in first half and later by <em>Betula</em> and <em>Alnus</em>.</td>
</tr>
<tr>
<td>Bank Moor</td>
<td>Open grassland with small stands of <em>Betula</em> dominated woodland.</td>
</tr>
</tbody>
</table>

Table 6.10 Summary of late mesolithic vegetation

6.7.3 Early Neolithic c. 4300-3200
At Temple Sowerby the early neolithic is only present in the pollen profile between approximately 82cm and 73cm and all but the last 2cm fall within the chronological overlap between the late mesolithic and early neolithic. Until c. 3899 cal BC the increasingly closed, mixed, deciduous woodland continued to expand as
to support mixed woodland is supported by pollen diagrams from Cross Fell (Turner, 1984, 354) and other sites in the Northern Pennines (Turner et al., 1973, 402), although these sites tend to display higher levels and greater diversity in herbaceous taxa. However, the level of variation in forest composition on the Pennine uplands as a whole, and over distances of just a few hundred metres, has already been recognised (Turner and Hodgson, 1979, 645).

<table>
<thead>
<tr>
<th>Site</th>
<th>Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temple Sowerby</td>
<td>Increasingly open <em>Alnus</em>, woodland with <em>Coryloid</em> and <em>calluna</em> shrubland spreading into areas of grassland.</td>
</tr>
<tr>
<td>Howgill Castle</td>
<td>Dense <em>Alnus</em>, <em>Betula</em>, <em>Coryloid</em> and <em>Quercus</em> woodland.</td>
</tr>
<tr>
<td>Bank Moor</td>
<td>Open grassland with small stands of <em>Betula</em> dominated woodland.</td>
</tr>
<tr>
<td>Great Rundale</td>
<td>Open Coryloid <em>Alnus</em>, <em>Betula</em>, and <em>Quercus</em> woodland.</td>
</tr>
</tbody>
</table>

Table 6.11. Summary of early neolithic vegetation

6.7.4 Late Neolithic c. 3300 - 2000 BC

At Bank Moor the vegetation of the early late neolithic is marked by a general reduction in the diversity of herbaceous taxa, although certain species contribute greater amounts of pollen (Lactuaceae and Cyperaceae) and others appear more frequently (Chenopodiaceae and Caryophyllaceae). *Selaginella* increases considerably and *Pteridium* is more frequent indicating the continued open environment. At c. 2941 cal BC, *Betula* decreases considerably and Gramineae slightly whilst Cyperaceae increase dramatically. High levels of charcoal in samples above 145cm are associated with increased levels of *Betula* and reduced levels of Cyperaceae. The extremely high levels of charcoal, recorded in both the large and small size classes above 145cm, do suggest that the charcoal is the result of local fires. From this evidence it might be suggested that surface vegetation was being cleared, with the use of fire, regardless of its composition.

The removal of the surface vegetation may have influenced the hydrology of the mire. The amount of water taken up by the vegetation is reduced and surface run off into the mire increased (Moore et al., 1986). The stratigraphic unit for this section of the core at Bank Moor supports this theory, showing a finely stratified, blue/grey organic clay. This stratigraphic unit extends from 115 - 147cm, and corresponds precisely with an increase in the diversity and quantity of aquatic plants and high levels of charcoal. The presence of charcoal indicates a humanly induced clearing of the vegetation, but the correlation between the increase in the quantity and diversity of aquatic species and the stratified clay levels in the core may also be interpreted as a change in climatic conditions. It is possible that an increasingly wet climate raised surface water levels and subsequently enabled the establishment of aquatic plants. An increase in rainfall would also increase the surface run off into the basin and the organic clay may well represent the erosion of the basin edge at this time. If climatic changes were responsible for the change in the vegetation, it appears to have been a fairly localised phenomenon because there is no evidence of similar vegetation or stratigraphic changes at Great Rundale. It is possible that in an area such as Bank Moor even relatively small changes in rainfall could have a significant effect on the vegetation. The thin soils and open nature of the vegetation would be particularly susceptible to erosion during periods of high rainfall and it may be this alone which initiated the changes in the surface vegetation. In areas where soils were thicker and perhaps more stable, the effects of slight changes may not be so apparent. However, the particularly high levels of charcoal recorded at Bank Moor during the late neolithic
period suggest that the surface vegetation in the area of the sampling site was being altered, through the use of fire.

At Great Rundale the *Alnus, Betula, Quercus* and Coryloid woodland remains fairly stable, although this is opening slightly at c.2886 cal BC. This is evident from the introduction of the light-demanding types such as *Pteridium, Gentiana, Saxifragaceae* and *Plantago lanceolata* and the spread of *Calluna* and Gramineae. The only tree to obviously suffer is *Alnus*, which is reduced and never regains its former levels from this point on. A second phase of opening of the woodland is evident at around c. 2316 BC, where a drop in Coryloid is matched by a peak in *Calluna* and *Empetrum*.

At c.2137 cal BC *Betula* levels decline by approximately 50% whilst *Pinus* and *Tilia*, although only previously present at less than 3%, are no longer present in the pollen profile. *Ulmus* also decreases. Coryloid peaks at around this time but follows soon after with a gradual decline. *Calluna* and *Empetrum* also decline as Gramineae and Cyperaceae increase slightly. The expansion of Gramineae and Cyperaceae corresponds with an increase in *Pteridium*, and together indicate an opening of the woodland canopy. Without supporting evidence from anthropogenic indicator species it is difficult to attribute this to anything other than ‘natural’ fluctuations in woodland openings, perhaps attributable to wind throw.

<table>
<thead>
<tr>
<th>Site</th>
<th>Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Moor</td>
<td>Open grassland with increase in <em>Betula Pinus</em> and <em>Corylus</em> woodland.</td>
</tr>
<tr>
<td></td>
<td>Indication of some surface clearance with the use of fire.</td>
</tr>
<tr>
<td>Great Rundale</td>
<td>Open <em>Alnus, Betula, Coryloid</em> and <em>Quercus</em> woodland with expanding heathland.</td>
</tr>
</tbody>
</table>

Table 6.12. Summary of late neolithic vegetation.

### 6.7.5 Early Bronze Age - 2100 - 1600 BC

At Bank Moor around c.1950 cal BC, high levels of charcoal coincide with the first appearance of cereal-type pollen. The only taxa to appear affected by the burning is Cyperaceae which continues to decline throughout the early bronze age. The herbaceous component becomes increasingly diverse but, despite an increase in Gramineae, declines overall. Aquatics continue to rise, reaching maximum levels by c.1654 BC and coincide with a greatly reduced pollen concentration.

At Great Rundale, by c.1827 cal BC there is a marked drop in Coryloid and an increase in Gramineae, *Calluna* and, perhaps most importantly *Plantago lanceolata* and *Pteridium*. Although *Plantago lanceolata* had been present lower down the core it was always at less than 3%. It would appear that deliberate changes are now being made to the vegetation cover. charcoal is present at this level but in very low amounts, which would suggest other processes are involved. Small scale or periodic clearances by human interference have been identified at a number of upland sites: at Valley Bog, Upper Teesdale, Chambers has identified a period of woodland clearance on the basis of high levels of Gramineae and *Plantago lanceolata* (1978, 279). At other sites in Upper Teesdale Turner *et al.* have used similar data to suggest periodic clearances for the purpose of grazing animals (1973, 405). Simmons and Innes offer an alternative explanation, by suggesting that alterations to the woodland canopy at North Gill, North Yorkshire are due to the use of leaves and branches
for foddering (1996, 339). Fine resolution pollen analysis would be necessary to establish the full character of the woodland openings at Great Rundale, but it would appear that some human interference is taking place during the early bronze age.

<table>
<thead>
<tr>
<th>Site</th>
<th>Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Moor</td>
<td>Continuation of surface burning possibly followed by small scale arable agriculture; later expansion of hazel woodland.</td>
</tr>
<tr>
<td>Great Rundale</td>
<td>Open <em>Alnus, Quercus, Betula</em> and hazel woodland. Indication of some human interference.</td>
</tr>
</tbody>
</table>

Table 6.13. Summary of early bronze age vegetation.

6.7.6 Late Bronze Age c. 1300 - 500 BC

At Bank Moor by c.1442 cal BC significant changes are evident in the pollen profile, most notably a massive increase in *Corylus*. Prior to this period *Corylus* had been fluctuating with levels no higher than 7%, but on the whole contributing less than 3%. At c.1442 cal BC *Corylus* increases to 41%. The rise coincides with an equally dramatic drop in *Betula*. The overall level of arboreal pollen drops only slightly as a peak in *Pinus* compensates to some degree for the decline in *Betula*. Every aspect of the pollen profile alters at this time: the levels of charcoal are comparatively low and do not suggest anything more than extra local fires; Gramineae, Cyperaceae and the diversity and quantities of other herbaceous taxa decline; and aquatic species decline in quantity. A small peak in *Pteridium* and the survival of some light-demanding herbaceous species indicate that the woodland was still open, but the marked peak in Filicales shows that on the whole the canopy created the shady environment preferred by the ferns.

The decline in aquatic species suggests that the increasingly closed vegetation cover reduced the surface water supplied to the mire and subsequently caused a reduction in the aquatic species growing on its surface. Certainly the organic, rich herbaceous peat with wood recorded for this section of the peat core substantiates this argument. The increased frequency of *Polypodium* also indicates dryer conditions.

It would appear that, after a period in which fire was used to clear the surface vegetation, *Corylus* was able to regenerate, far exceeding levels previously achieved. The extent of woodland stands remained much the same but the open grassland decreased rapidly as *Corylus* spread.

The increase in *Corylus* continued until it reached a peak at c.1174 cal BC, from which point it falls into decline. The beginning of this decline is marked by an expansion of *Alnus* which replaces *Betula* as the dominant woodland species. Small increases in *Ulmus* and *Betula* show an increase in the diversity of the woodland cover. The overall diversity of herbaceous species is in decline, but a gradual increase in Gramineae and Cyperaceae marks the beginning of the re-establishment of an open grassland community. Cereals are present through most of the period suggesting the newly opened landscape was being utilised for small scale arable agriculture, but the lack of other anthropogenic indicators including charcoal makes interpretation difficult. Aquatic species continue to decline illustrating that the re-establishment of surface vegetation reduced the levels of water supplied to the surface of the site. An increase in *Polypodium* also indicates an increasingly dry environment. Filicales is able to spread beneath the woodland canopy.
At Great Rundale the activities of the early bronze age continue until c. 1649 cal BC, when a reduction in Plantago lanceolata and Pteridium seems to mark a change in vegetation composition. At this time Quercus and Alnus increase from former levels along with Gramineae and Calluna. Reductions are recorded in Betula and Coryloid. This phase is associated with relatively high levels of charcoal in both size classes and suggests that some local clearing of woodland was being carried out with Gramineae and Calluna colonising the open clearings. By c.1473 cal BC more changes are evident, the overall diversity of the herbaceous species declines even further, but cereal type pollen peaks. Calluna disappears from the pollen profile temporarily. Gramineae and Alnus also decline. Cyperaceae and Sphagnum both increase considerably and may represent a change in the vegetation growing on the mire surface. If this is the case it would appear that the surface of the peat is becoming increasingly wet. By c.1270 cal BC Calluna recovers to levels exceeding those previously attained and Sphagnum makes a significantly higher contribution to the pollen profile. Quercus and Betula show marked declines and although slightly fluctuating, never recover to their former levels. Coryloid increases at the beginning of the late bronze age but after peaking at c. 989 cal BC begins to decline again. The peak in Coryloid corresponds to a decline in Calluna but this is short lived and Calluna soon expands to former levels.

It appears that although some human interference in the form of woodland clearance is indicated in the early stages of the late bronze age at Great Rundale, the overall pattern is of expanding heathland to the demise of woodland. The spread of Calluna independent of Gramineae presumably indicates the spread of blanket peat near to the site. The fact that it, in general, remains high once it has risen means that, once established, this blanket peat continued to grow and trees were unable to regenerate on that ground. This pattern has been recognised by Turner et al. in Upper Teesdale following periodic phases of human interference (1973, 403). At Great Rundale it appears that the surface of the blanket peat was becoming increasingly wet, making it more difficult for woodland communities to survive but conducive to the spread of blanket peat.

<table>
<thead>
<tr>
<th>Site</th>
<th>Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Moor</td>
<td>Open hazel, Alnus, Ulmus, Betula and Pinus woodland with later expansion of former grassland communities</td>
</tr>
<tr>
<td>Great Rundale</td>
<td>Open hazel, Alnus, Betula and Quercus woodland. Expanding blanket peat.</td>
</tr>
</tbody>
</table>


6.7.7 Iron Age 700 BC - 100 AD

Bank Moor experiences a continued opening of the vegetation during the iron age, slowly returning to the open grassland environment characteristic of the mesolithic and neolithic periods although with greater quantities of shrubland species. As well as an overall increase in Gramineae and Cyperaceae the diversity of the herbaceous taxa also increases, with certain species reappearing. Pteridium increases at both the beginning and end of the iron age, indicating the continued opening of the woodland cover. Filicales remains at a fairly constant level, presumably surviving beneath the open woodland canopy.

During this period Alnus reaches its highest levels, establishing itself as the dominant woodland species. Quercus shows a small peak but Ulmus, Pinus and Betula all decline with each contributing less than 3% to
the total land pollen sum by the end of the iron age. The overall changes at Bank Moor indicate a continued reduction of woodland, of which *Alnus* is now the dominant species, and expansion of open grassland communities.

By c. 443 cal BC Great Rundale experiences an increase in Gramineae and Cyperaceae, with cereal-type pollen appearing more frequently. The evidence for the expansion of blanket peat makes it unlikely that cereal cultivation was being practised at this site. Chambers experienced similar levels of cereal pollen grains at Valley Bog, but suggests these had blown in from more lowland areas (1978, 279). The gradual reduction of the woodland canopy would make the surface of the blanket peat more susceptible to regional pollen rain (Tauber, 1965) and this may explain the increased frequency of cereal pollen at Great Rundale, although cereal pollen is not generally considered to be a component of pollen rain because of its poor dispersal characteristics. *Sphagnum*, although fluctuating, generally increases, but with the exception of *Calluna*, Gramineae and Cyperaceae, very few herbaceous species are recorded.

An increase in the opening of the vegetation cover characterises the iron age period at Great Rundale. By c.183 cal BC there are significant reductions in all tree species and Coryloid, which is matched by increases in Gramineae, *Calluna* and *Plantago lanceolata*. Corresponding fluctuations in *Calluna* and Cyperaceae suggest there was competition for growing space on the surface of the mire. The expansion of Plantains and the reappearance of other herbaceous taxa may suggest further human intervention but again the evidence is scant. At c.100 cal AD there are slight increases in the levels of charcoal recorded in both size classes and these correspond to further reductions in *Betula*, *Alnus*, *Quercus*, Coryloid and ferns. In response Gramineae, Cyperaceae, *Calluna* and *Pteridium* expand, which may suggest there is a renewed period of human activity in the area. The frequency and quantity of cereal pollen have also increased but, although cereal cultivation is a common characteristic of the iron age, the expansion of heathland and the exposed nature of the site would have made cultivation difficult. However, on the south west fells of the Lake District, Pennington has identified a period of clearance for arable agriculture at c.200 AD which, she believes, was responsible for the permanent deforestation of this part of the Lake District (1970, 72). At Valley Bog, Upper Teesdale, Chambers has recorded a major phase of deforestation during the late iron age. This was similar to that carried out during the bronze age, in as much as the clearings were used for grazing, but those in the iron age were more pronounced and lasted for a longer period of time (1978, 280).

<table>
<thead>
<tr>
<th>Site</th>
<th>Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Moor</td>
<td>Open grassland with small stands of <em>Alnus</em> and hazel woodland.</td>
</tr>
<tr>
<td>Great Rundale</td>
<td>Expanding blanket peat with a marked demise of open woodland communities. Human interference in the form of woodland clearance.</td>
</tr>
</tbody>
</table>

Table 6.15. Summary of iron age vegetation.
CHAPTER 7

ARCHAEOLOGICAL INVESTIGATIONS

This chapter will document the archaeological record within the study area as a whole but more specifically the results of the archaeological investigations carried out within the four micro-regions. The primary object of this work is to test whether the patterns of both spatial and chronological distribution evident in the existing archaeological record are a true reflection of human activity areas or the result of differential preservation, destruction and recovery of material. The results of this work will then be integrated with the palynological data in Chapter eight, as a basis for the reconstruction of the prehistoric landscapes.

The archaeological database (Appendix 7.3) records sites within the study area as a whole and is based on the SMR, NMR and other available sources (see Chapter five; Archaeological database). The database also includes the new discoveries identified through the course of this research. Reference to site numbers relate to entries on the archaeological database where details of the sites and their sources can be located.

7.0 Field walking

The prehistoric period in Cumbria is represented by monuments, individual stray finds and lithic scatters. Lithic scatters are the most common form of settlement evidence for the whole of the prehistoric period and since other prehistoric artefacts seldom survive in the ploughsoil, analysis of the lithic material is essential for our understanding of the nature of this settlement. Analysis and interpretation of surface assemblages in Cumbria and the north west in general is problematic because so little excavated lithic material from securely dated contexts is available for comparison. The identification of diagnostic flints for dating purposes, or the local character of lithic assemblages in general, is therefore very difficult. This problem is compounded by the fact that there are no local sources of good quality flint so poor quality pebble flint and chert were utilised. Higham highlights this problem and suggests

"...in general terms, the stone industries of the northern counties are poor ... The poverty of the northern industries was due at least in part to the poor sources of workable stone - largely from small beach pebbles and from drift deposits ... The northern assemblages in general are poor in variety, and lack implements of any size" (Higham, 1986, 21).

It has also been noted that, where artefacts are present, they may display only a few of the technological or typological traits encountered on contemporary material elsewhere because knapping strategies had to be adapted to the local raw materials (Middleton et al., 1995, 18).

Where research into the identification and interpretation of lithic scatters has been carried out this has tended to focus on areas in the south of England (Schofield, 1991; Shennan, 1985) where flint is locally available in abundance. Identification of 'sites' within these areas is generally based on the isolation of high density scatters within an area of low density 'background noise' (Schofield, 1991, 4). Interpretation of these 'sites' is
then dependent on number and/or percentage determinations of diagnostic flints tools and production

These interpretative methodologies are difficult to apply to assemblages in the north west of England where
the lithic scatters are generally much smaller in number and spatially more dispersed. The work of the
certainly improved our knowledge of both the distribution and structure of lithic assemblages in both eastern
and western Cumbria. However, much of this material, particularly in the east, derives from mole hills and is
therefore difficult to analyses in terms of intra- or inter- site variation (Hazelgrove, 1985, 25).

Until further field survey is carried out and more lithic material is collected and analysed, the meaning of
local assemblages, in terms of human behaviour, must be partly speculative, but the available data do,
amongst other things, highlight certain commonalities and form a basis on which to build such theories.

Having studied the material found during the North West Wetland Survey (NWWS) in conjunction with
other lithic finds from North Lancashire, Middleton et al. suggest that some of the broad national changes in
flint working can form a basis for interpreting lithic scatters in the north west of England (Middleton et al.,
1995, 18). Middleton et al. identify two broad cultural divisions in flint working technologies; late mesolithic -
early neolithic (c.6700-3200 cal. BC), which is broadly denoted by a blade type technology: and late
neolithic - bronze age (c. 3200 - 800 cal. BC), which witnessed a general reduction in the standard of
production of flakes but also includes elaborate artefacts made from good quality material.

7.1 Temple Sowerby

A total of eleven fields in Temple Sowerby was systematically walked using the methodology devised by
Liddle (1985) which has been described in Chapter five. This provided a 12.15% sample of the study area
(Fig. 7.1). Although all observed material was collected, only lithics were found to represent prehistoric
activity. A total of 78 pieces was recovered and a breakdown of this material is given in Tables 7.1 - 7.3.
During the fieldwork a number of clusters of material was identified and these are described here as groups
containing individually numbered items. The composition of the groups is shown in Table 7.4. Isolated finds
are numbered and described as single finds (Table 7.5). Detailed descriptions of all the material are provided
in the Finds Inventory (Appendix 4).

Although some individual artefacts are made from good quality translucent flint, the majority of the material
collected was of poor quality and presumably derives from pebble flint and chert which has been collected
from river gravels and drift deposits nearby. There is no documented evidence that quarrying was being
carried out, although it is possible that chert was collected from seams in the local outcrops of Carboniferous
Limestone (Johnson and Dunham, 1963, 157).
Figure 7.2 illustrates the diversity of the raw material represented in the assemblage. The descriptions of the material are simple and do not portray the full array of colour, texture and quality which is actually represented but it does show that flint as a whole dominates the assemblage with 63%.

7.1.1 Composition of the assemblage
The assemblage is dominated by waste material comprising of discarded flakes and cores but also includes a number of finished forms. Table 7.1 illustrates the overall composition of the material and this is related to the range of raw material in Table 7.2.

<table>
<thead>
<tr>
<th>Product</th>
<th>No. of pieces</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Waste</strong></td>
<td></td>
</tr>
<tr>
<td>Unclassified lumps</td>
<td>1</td>
</tr>
<tr>
<td>Primary flakes</td>
<td>1</td>
</tr>
<tr>
<td>Secondary flakes</td>
<td>11</td>
</tr>
<tr>
<td>Tertiary flakes</td>
<td>22</td>
</tr>
<tr>
<td>Cores and core fragments</td>
<td>13</td>
</tr>
<tr>
<td>Rejuvenation flakes</td>
<td>1</td>
</tr>
<tr>
<td><strong>Finished forms and utilised flakes</strong></td>
<td></td>
</tr>
<tr>
<td>Scrapers</td>
<td>10</td>
</tr>
<tr>
<td>Knives</td>
<td>3</td>
</tr>
<tr>
<td>Blades</td>
<td>10</td>
</tr>
<tr>
<td>Other retouched flakes</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>78</td>
</tr>
</tbody>
</table>

Table 7.1 Temple Sowerby: characteristics of the lithic assemblage.

7.1.2 Setting the cultural context
No diagnostic mesolithic forms of either early, broad, obliquely blunted, points or later, narrow, geometric forms (Jacobi 1976) are present in the assemblage. There is, however, the suggestion of a blade type technology which manifests itself as a number of narrow flakes (cf. Fig. 7.4 nos. 7, 9-12), cores from which small narrow flakes have been removed (cf. Fig. 7.3 no. 6) and waste flakes showing signs of blade flake scars on the dorsal surface (cf. Fig. 7.3 no. 7). Some of these can only be described as waste flakes but others show signs of retouch (cf. Fig. 7.4 no. 7) and a small number appear as finished forms (cf. Fig. 7.4 no.12). There are also blade flakes which could be utilised without the need for additional working (cf. Fig. 7.4 no. 4). The technological trait of blade production is known to have continued at least into the early neolithic (Edmonds, 1995, 35) so although it is impossible to break the assemblage into specific chronological periods it would appear that a technology, known at a national scale to be of late mesolithic - early neolithic in date, is present in the assemblage.

The majority of the diagnostic tools present in the material collected from Temple Sowerby is however, more indicative of later neolithic/bronze age activity. Included in this category are the various forms of scrapers including thumbnail examples (cf. Fig. 7.4 nos. 5 and 8), and knives (cf. Fig. 7.3 no. 2) including one plano-convex knife (cf. Fig. 7.5 no. 8).

There is therefore an apparent, if very broad, division to the material which indicates that at least two periods of activity can be identified, a late mesolithic-early neolithic phase and late neolithic- bronze age phase. It is interesting that these are precisely the divisions made by Middleton et al. using material collected during the
This cultural division, based on technological traits, forms the basis of the following analysis.

### 7.1.3 Late Mesolithic - Early Neolithic (7000-3200 BC)

Although touched on above, a very simplistic description of technological trends in stone working during this period is probably the best starting point for this type of analysis. From a national perspective the most diagnostic feature of lithic assemblages from the mesolithic period is the microlith which, despite changing in form over time (Jacobi, 1976), was produced from narrow or blade type flakes. That this technological trait continued into the early neolithic period is indicated by the number of serrated blades and end scrapers which appear in assemblages of this period (Edmonds, 1995, 37).

### Table 7.2 Temple Sowerby: range of raw material and flake/tool type.

<table>
<thead>
<tr>
<th></th>
<th>Cream/brown chert</th>
<th>Grey/black chert</th>
<th>Grey/black flint</th>
<th>Dark grey flint</th>
<th>Dark brown flint</th>
<th>Fawn flint</th>
<th>White/burnt flint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclass. lumps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste flakes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cores and core frags.</td>
<td>3</td>
<td>4</td>
<td>20</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Rejuvenation flakes</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scrapers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blades</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other retouched flakes</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The emphasis is therefore on the production of blades or narrow flakes and, although regional variations in production are apparent, the regularity in core technology is widespread. Edmonds states that these regularities

"... cut across the regions defined by different traditions of mortuary practice and are maintained even where the nature of the raw materials would have made blade and narrow flake production rather more difficult to achieve. They are even apparent in areas where flint was so widely available that people would never have had to walk very far in order to obtain all they required" (1995, 37).
Fig. 7.1 The micro-region of Temple Sowerby showing the distribution of archaeological sites.
<table>
<thead>
<tr>
<th></th>
<th>Bashed lumps</th>
<th>Waste flakes</th>
<th>Cores and core frags.</th>
<th>Rejuv. flakes</th>
<th>Scrapers</th>
<th>Knives</th>
<th>Blades</th>
<th>Other Retouched flakes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TS1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grp A</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Grp B</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Grp C</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>TS4</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Grp A</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TS5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grp A</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TS8</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grp A</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td><strong>TS11</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Grp A</td>
<td>1</td>
<td>1</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>TS12</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grp A</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grp B</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grp C</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grp D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7.4 Temple Sowerby: composition of finds groups.

<table>
<thead>
<tr>
<th></th>
<th>Bashed lumps</th>
<th>Waste flakes</th>
<th>Cores and core frags.</th>
<th>Rejuv. flakes</th>
<th>Scrapers</th>
<th>Knives</th>
<th>Blades</th>
<th>Other Retouched flakes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TS1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS3</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS5</td>
<td>4</td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS8</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS11</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TS12</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>TS14</td>
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<td></td>
<td></td>
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</tbody>
</table>

Table 7.5 Temple Sowerby: range of single or stray finds by field.

Fig 7.2 Temple Sowerby: percentage of raw material.
7.1.4 Identification of blade type technology
On the basis of Ford’s lithic chronology (1987, 69), a minimum length/breadth ratio of 2:1 was used to distinguish blade flakes from other material. This method was used to identify not only blade flakes but also the suggestion of blade production from blade scars on the dorsal surface of flakes and core fragments. Although this criterion identified a number of narrow flakes, it was found to eliminate many broken pieces which clearly originated from blade flakes, and failed to pick up a complete, retouched bladelet (length:breadth ratio 1.88:1) and a denticulated blade (length:breadth ratio 1.64:1). The length/breadth ratio was therefore supplemented by a visual examination to ensure damaged blade flakes, and others of a long and thin as opposed to a short and squat nature, were included. The initial results of this analysis show that 36% of the total lithic assemblage can be attributed to a blade type technology (Fig 7.6). The composition of this assemblage is presented in Table 7.6

<table>
<thead>
<tr>
<th>Product</th>
<th>No. of pieces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste flakes</td>
<td>5</td>
</tr>
<tr>
<td>Rejuvenation flake</td>
<td>1</td>
</tr>
<tr>
<td>Usable flakes</td>
<td>2</td>
</tr>
<tr>
<td>Retouched blade flakes</td>
<td>5</td>
</tr>
<tr>
<td>Denticulated blades</td>
<td>2</td>
</tr>
<tr>
<td>Other retouched flakes</td>
<td>4</td>
</tr>
<tr>
<td>Cores and core fragments</td>
<td>8</td>
</tr>
<tr>
<td>End scraper</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>28</strong></td>
</tr>
</tbody>
</table>

Table 7.6 Temple Sowerby: composition of the blade type material.

The variety and proportion of raw materials used during this period (Fig. 7.7) are comparable to those in the total assemblage (Fig. 7.2) with grey and black flints dominant but chert is more common contributing 43% of the total blade material.

7.1.5 Typological descriptions
The following descriptions are limited to the broad typological categories of late mesolithic-early neolithic material identified from the assemblage. Detailed descriptions of waste flakes or miscellaneous retouched flakes are not given here but are available in the Finds Inventory (Appendix 4). It was felt that mention should be given of two flakes which, based on their diagnostic features, would be categorised as waste flakes, but in form would have been 'usable' in their own right.

Denticulated blades
Two examples were recorded. One complete denticulated blade produced from cream/brown chert was recovered from field TS12, Group C, no. 1 (Fig.7.5b. no.1). A slightly damaged example produced from fawn coloured flint was recovered as an isolated find in field TS2, no. 10 (Fig.7.3. no. 10).

End scrapers
A single example was recovered as an isolated find in field TS3 (Fig. 7.4. no. 3). This was on a heavy duty, primary, blade flake which had been broken transversely at the bulbar end. It is made from dark grey/black flint and is covered in cream cortex on the dorsal face.
Cores and core fragments

A total of seven cores and a single core fragment was found. Only two of the cores (TS1 Group C no.2 Fig. 7.3 no 6; TS12 Group B no.1 Fig. 7.5 no. 6) and the fragment (TS3 single find no.8) suggest they were used exclusively for blade production; the remainder show signs of both blade type and irregular flake manufacture.

Of the seven cores two can only be described as modified pebbles. Both of these are produced on cream/brown chert pebbles and show evidence for the removal of both long, narrow and irregular flakes. Both were recovered as isolated finds, one in field TS2 (single find no. 6; Fig. 7.3 no. 9 ) and the other in field TS8 (single find no. 2; Fig. 7.4. no. 13). A creamy/white, burnt flint core was recovered from field TS1 (Group C no. 2; Fig. 7.3 no. 6). This example has a plain butt and has been worked around its circumference. A pale grey chert core with a single, plain, platform was found as an isolated find in field TS3 (single find no. 5; Fig. 7.4 no. 2 ). This has been worked part way round its circumference and retains cortex in some areas. Both blades and irregular flakes have been removed. A pale brown/grey flint core with a prepared, plain platform was recovered as an isolated find from field TS8 (single find no. 1). This is re-corticated on one surface and again shows evidence of both blade and irregular flaking. A light grey flint core was found as an isolated find in field TS11 (single find no. 1). This has a single, plain platform and shows signs of both blade and irregular flake production (Fig. 7.5 no. 2 ). A dark grey/black chert core was recovered from field TS12 (Group B no. 1). This retains a single, plain striking platform, with long, narrow blade-like flakes having been removed from around the complete circumference (Fig. 7.5 no. 6). A fragment of a pale grey flint core was recorded as an isolated find in field TS3 (single find no.8). It shows evidence of a plain butt with blade type flakes having been removed but it is badly damaged.

Retouched blades

Five examples of retouched blades were recorded. A complete retouched cream/brown chert flake, struck from a faceted platform, was recovered from field TS1 (Group A no.1; Fig.7.3 no. 1 ). A retouched blade of dark grey chert was found in field TS8 (Group A no.1); this is notched along its right side but the tip of the distal end is broken (Fig. 7.4 no. 7). A second retouched flake from this group (no.7; Fig. 7.4 no. 12) is of pale grey/cream flint. This example is retouched along the lower left edge, around the distal end and along the upper right edge and is notched on the upper left edge with retouch apparent within the notch. A black flint bladelet with brown inclusions along its left and right sides was found in field TS12 (Group D no.1). This is notched on its right side but has a hinge fracture at its distal end (Fig. 7.5b no. 2). The distal end of another blade was recovered from the same field (single find no. 2). This is produced from a dark grey speckled flint and is retouched all around the end of the flake (Fig. 7.5b no. 5).

Usable flakes

Two examples were recorded. A chocolate brown flint flake originating from a bi-polar core was recovered from field TS4 Group A no.2 (Fig. 7.4 no. 4). This triangular shaped flake, although snapped transversely at its distal end and damaged on its dorsal face, could have been used as either an 'edge' tool or a pointed tool. Some smoothing of the edge is evident on the lower left side and around the point. The second flake, found
Fig. 7.3: 1 TS1 Group A; 2-4 TS1 Group B; 5-6 TS1 Group C; 7-10 TS 2 Single Finds.
Fig. 7.4: 1-3 TS3 Single Finds; 4-5 TS4 Group A; 6 TS5 Single Find; 7-12 TS8 Group A; 13 TS8 Single Find.
Fig. 7.5: 1 TS11 Group A; 2-3 TS11 Single Finds; 4-5 and 8 TS12 Group A; 6-7 TS12 Group B.
in field TS8 Group A no. 4, is again triangular in shape and is produced from black chert with cortical inclusions along the left side (Fig. 7.4 no. 9). This piece has a distinctive point which shows evidence of wear. This is particularly clear on the left side of the point where the rough surface has been worn smooth.

7.1.6 Distribution of blade material

The distribution of this material over the fields walked (Fig 7.8) shows that blade type material is present in seven of the eleven fields. No evidence was retrieved from fields TS5, TS9, TS10 and TS14 (Fig 7.1). Clearly the largest concentration of this material was recovered from field TS8 with smaller concentrations evident in TS1, TS2, TS3 and TS12 and single finds recorded in fields TS4 and TS11. The data was broken down further into the finds groups to establish whether any of the groups could be related to clusters of blade type material (Figs. 7.8 and 7.9). TS8 Group A is the only one to display discrete clustering. Other peaks in the graph represent the total of single finds within the respective fields and suggest that no other observed groups are associated with clustering of blade type material. However, TS8 Group A does not exclusively contain blade type material: 40% of the group is made up of late neolithic/bronze age type material including a thumbnail scraper (Fig. 7.4 no. 8 and Fig. 7.10). The group as a whole consists of ten pieces of which four are retouched or usable blade flakes and one is a thumbnail scraper. These reasonably diagnostic pieces span the two broad chronological periods. The subject of mixed lithic scatters is obviously an important one and will be discussed in more detail later.
Fig 7.6 Temple Sowerby: percentage of blade material.

Fig 7.7 Temple Sowerby: percentage of blade flakes to raw material types.
In summary, this primary analysis has indicated the presence of a blade type technology around Temple Sowerby. The range of raw materials shows that grey/black flint dominates the assemblage but that flakes and cores of chert form an important element. Although there is a suggestion of clustering in the material in field TS8 Group A, the mixture of lithics within the group needs further consideration (see below).

7.1.7 Late Neolithic - Bronze Age (3300-500 BC)

On a national scale this period witnesses a change in the character of core working. Dated lithic assemblages indicate that on the one hand there is an overall lack of control in stone working, whilst on the other hand there is a measure of specialisation and formality in the steps taken to produce some flakes (Edmonds 1995, 95). On the whole there is a wider range of retouched artefacts (Ford et al., 1984, 166), which display a high degree of variability in both production and use. In contrast to the late mesolithic - early neolithic period, there is little evidence to suggest that consistent flaking routines were being practised and there seems to have been little concern for the avoidance of errors and mis-hits during production. The latter point is reflected in an increase in the frequency of waste flakes in late neolithic and bronze age assemblages.

Scrapers are one of the most common forms found on later neolithic and bronze age sites. These reflect broad national technological trends, with retouch extending along one or both sides, as well as at the end of flakes. One of the most widespread forms is the thumbnail scraper which, despite displaying regional variation in style, does reflect a concern with the creation and maintenance of a new and clearly defined category (Edmonds, 1995, 140). The late neolithic period also sees the appearance of elaborate stone artefacts such as plano-convex, discoidal and polished knives. Barbed and tanged arrow heads are a common element in Beaker and early bronze age contexts and come to dominate many assemblages. Regional variation in production is evident but a degree of precision, control and attention to form is apparent throughout.

<table>
<thead>
<tr>
<th>Product</th>
<th>No. of pieces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste flakes</td>
<td>29</td>
</tr>
<tr>
<td>Cores and core fragments</td>
<td>5</td>
</tr>
<tr>
<td>Scrapers</td>
<td>9</td>
</tr>
<tr>
<td>Knives</td>
<td>3</td>
</tr>
<tr>
<td>Other retouched flakes</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>

Table 7.7 Temple Sowerby: composition of late neolithic-bronze age material.

The material described as 'other' in Fig 7.6 is comprised of lithics identified as being of late neolithic-bronze age in date and Table 7.7 shows the overall composition of this material.

Because of the irregularity in core technology it is difficult to distinguish waste flakes that have been produced during this period and irregular flakes produced as a result of mis-hits during blade production. Although all the late mesolithic - early neolithic waste flakes attributable to blade type production are identified with reasonable confidence, it is possible that some of the waste flakes ascribed to the Later
Fig. 7.9 Temple Sowerby: number of blades and blade flakes by Group.

Fig. 7.8 Temple Sowerby: distribution of blade material by field.
neolithic - bronze age belong in the earlier assemblage. As a result little weight is given to waste flakes in the following analysis.

The variety and proportion of raw materials being used during this period are displayed in Fig. 7.11. This shows that grey and black flints continue to dominate the assemblage and that chert is less common than during the earlier phase, contributing 30% of the total. A dark grey/olive, translucent, flint, which is absent in the earlier assemblage, was being used during this period.

7.1.8 Typological classification
The following descriptions are limited to the broad typological categories of late neolithic-early bronze age material identified from the assemblage. Detailed descriptions of waste flakes or miscellaneous retouched flakes are not given here but are available in the Finds Inventory (Appendix 4).

Cores and core fragments.
A total of five examples was found but only one is complete. A dark grey chert core was recovered from field TS12 (Group A no.3). This has a cortical striking platform and cortex around one side. A number of irregular flakes has been removed from the other side. The remaining four core fragments are all badly damaged but will be described briefly below. A dark grey flint core fragment was found in field TS 1 (Group A no.7). This has a plain striking platform with cortex around one side. A brown chert core fragment was found in TS1 (Group B no 6); a number of small irregular flakes has been removed but platform details are obscured as a result of damage. A pale grey flint core fragment with a cortical butt and irregular flake scars was also recovered from TS1 (Group C no.3). A black chert core fragment with a cortical striking platform was recovered from field TS12 (Group D no.2). A number of irregular flakes has been removed but none of the scars show clear concentric lines or inverse bulbs of percussion. Attention should also be drawn to the four cores described under ‘blade’ type cores which retain evidence of both blade and irregular flaking.

Scrapers
Nine examples were recovered, of which six are thumbnail scrapers. A thumbnail scraper was found in field TS1 (Group B no.1; Fig. 7.3 no. 3 ). This is produced from a grey/olive translucent flint and retains evidence of a cortical butt. It is retouched on the left and right sides and is slightly damaged at its distal end. A second example produced in pale grey flint was recovered from the same field (Group C no.1; Fig. 7.3 no. 5). This is slightly more elongated than the other examples giving it a tear drop shape, which is retouched around the distal end. A dark grey flint thumbnail scraper was found in field TS2 (single find no.9; Fig. 7.3 no. 8). This is circular, with a central ridge running the length of the dorsal face and retouch around the right side and distal end. The fourth thumbnail scraper was found in field TS4 (Group A no.1; Fig. 7.4 no. 5). This was produced from an olive/brown translucent flint with black and gold inclusions. The inclusions appear to have been an integral part of the design forming a ‘tiger's eye’ motif in the centre of the dorsal face. It is retouched around the full circumference. A fifth example was recovered from field TS 8 (Group A no 2; Fig. 7.4 no. 8). This is produced from a good quality dark grey/brown flint and is retouched around three sides but damaged on the fourth. The sixth thumbnail scraper was found in field TS12 (Group A no. 2; Fig. 7.5 no. 5). This has
Fig 7.10 Temple Sowerby: composition of TS8 Group A.

Fig 7.11 Temple Sowerby: percentage of late neolithic/bronze age artefacts by raw material.
a plain striking platform, is retouched around its complete circumference and is faceted across the whole of the left side of the dorsal face.

A scraper produced from a pale grey secondary flint flake was found in field (TS1 Group B no. 3; Fig. 7.3 no. 4). This is retouched along its right edge and around its distal end: cortex covers most of dorsal face. A crude scraper produced from a cream/brown chert pebble was recovered from field TS11 (Group A no. 1; Fig. 7.5 no. 1). Cortex covers approximately two thirds of the dorsal surface. Another crude scraper produced from a grey/brown chert pebble was found in field TS12 (Group B no. 3; Fig. 7.5 no. 7). This is retouched around one side.

**Knives**

A total of three very different examples was found. A triangular shaped knife of dark grey/olive translucent flint was recovered from field TS1 (Group B, no. 2; Fig. 7.3 no. 2). Part of the dorsal face is faceted and cortex survives on the right hand side point. The left point is broken but is retouched along the broken edge on the bulbar face. It is also retouched along distal end of bulbar face.

A long, narrow, light grey flint knife was found in field TS11 (single find no. 2; Fig. 7.5 no. 3). It is produced from a tertiary flake with a faceted striking platform and is retouched around the complete circumference. The flint, which is opaque with a distinctive matt finish to its surface, is unique to the assemblage. A plano-convex knife made from a translucent dark grey/black flint was found in field TS12 (Group A, no. 4; Fig. 7.5 no. 8). The faceting covering both sides is irregular and has been damaged on one surface at the widest end.

![Fig 7.12 Temple Sowerby: distribution of late neolithic/bronze age material by field.](image-url)
7.1.9 Distribution of late neolithic - bronze age material

The distribution of this material over the fields walked (Fig. 7.12) shows that material identified as late neolithic is present in nine of the eleven fields. No evidence was retrieved from fields TS9, and TS10 (Fig. 7.1). Clearly the largest concentration of this material was recovered from field TS1, but smaller concentrations are evident in TS12, TS2, TS3, TS5, TS8 and TS11. Single finds are recorded from fields TS4 and TS14. The data was broken down further into the finds groups (Appendix 4) to establish whether any of the groups could be related to clusters of late neolithic - bronze age material (Fig. 7.13). TS1 Group A and Group B both contain clusters of material with smaller peaks shown for TS8 Group A, TS12 Group A and TS5 Group A. Other peaks in the graph represent the total of single finds within the respective fields and are not therefore ‘real’ clusters. It is interesting that, with the exception of TS1 Group B and TS5 Group A, all the groups showing peaks are typologically mixed assemblages which contain lithics from each of the two chronological divisions. The subject of mixed assemblages will be discussed in more detail below.

In summary, lithics identified as being of late neolithic - bronze age in date are evident around Temple Sowerby. Raw materials similar to those used during the late mesolithic - early neolithic period continue to be used although chert is less important and new types of good quality flint were introduced. The distribution of the lithics suggests some clustering, but the mixed nature of all but two of the clusters needs further discussion.
7.1.10 Formation of the archaeological record

Although conditions and processes affecting the formation of the archaeological record have already been discussed (Chapter 3), it is necessary, as a cautionary reminder, to outline some of the very localised processes affecting the material from Temple Sowerby. With regard to N-transforms or non-cultural transforms (Schiffer, 1976, 15), there are two main influences on the material recovered from Temple Sowerby. A clear biasing factor is the deposition of alluvium in the flood plain of the River Eden (Fig 7.1). The effect of this was most evident in the recovery of finds from field TS8, where on its east side it drops down into the flood plain (Plate 7.1). All the fields walked in the study area produced a fairly even spread of post-medieval pottery and although this is generally accepted as being indicative of post medieval manuring patterns (Hayes, 1991, 82; Hazelgrove, 1985, 14-20) it also provides a standard against which to monitor pick up rates of other material. In field TS8 post medieval pottery and tile were fairly evenly spread throughout the field except in the area below the contour marking 105m above OD. Below this contour only ten pieces of post medieval pottery were found and no other material was recovered. It is suggested that this reduced pick up is the result of alluvium deposition which has buried and continues to bury the archaeological record. It would appear that only the most recently deposited material (post medieval pottery) is showing on the surface of the field and even this is becoming increasingly buried resulting in a reduction of surface density. Plate 7.1 clearly shows not only the slope of the field but also the change in the soil colour and texture in the area where alluvium has been deposited. To what scale this process of deposition has affected the archaeological record can only be investigated through test pitting and this was, unfortunately, impossible during the period of this research. The development of peat in Temple Sowerby moss and its surrounding areas will have had the same effect on the archaeological record. The accumulation of peat from before the early mesolithic will have buried any archaeological remains.

Cultural, or C-transforms (Schiffer, 1976, 14), may have had a much greater effect on the recovery of archaeological evidence. Newbiggin Quarry and Mine in the north east of the study area have probably had the greatest impact (Fig.7.1). Not only has a large area of the landscape been quarried away, removing any archaeological evidence, but the re-landscaping of the area using spoil from the quarry will have redistributed any surviving material. This will obviously have distorted any patterning in the archaeological record and would only serve to confuse the interpretation had it been fieldwalked. The built up area of Temple Sowerby village was not only inaccessible for field survey but the process of construction itself will also have disturbed any pre-0-medieval archaeology.

The distribution of ploughed fields is another significant biasing factor. It can be seen from Fig. 7.1 that all the fields walked, with the exception of TS5, are located in the southern half of the study area. This was unavoidable and simply reflects the distribution of fields under arable agriculture at the time the field work was carried out. In effect though, the northern half of the study area has been almost totally neglected. Unfortunately even where fields had been ploughed, not all were accessible. An un-cooperative farmer refused access to fields lying between the village and the river.
On a micro-scale there are, of course, the biases affecting each individual field walked (Mills, 1985, 44). Included in these is the condition of the fields themselves. The general condition of the fields in terms of ploughing and sowing was recorded at the time of walking along with the weather conditions. These variables were used to monitor the pick up rates and to establish whether they had any noticeable effect on the recovery of material. Most of the fields were walked in ideal conditions, with the field having been ploughed and harrowed. The fields were therefore relatively flat with clods well weathered and broken down. Field TS3 had only been ploughed for two days when walked, but although no finds groups were recorded, a number of single finds was recovered. It is possible that some finds were missed in the large clods left from ploughing. At the time of walking field TS4 was also very recently ploughed and the large clods in conjunction with the steep gradient of the field at its southern end made walking the field difficult. This may explain the very few finds recovered from this field, although some fields (TS5, TS14 and TS11) were walked in ideal conditions and still produced very few finds and some produced no lithic material at all (TS9 and TS10).

A final consideration has to be the experience of the fieldworkers themselves (Hazelgrove, 1985, 11). If biasing was introduced as a result of different levels of experience, one would expect this to manifest itself as linear distributions of finds along the traverses walked by the most experienced fieldworkers. Although the groups of material found in fields TS8 and TS12 do follow broadly linear patterns, they are not restricted to single traverses, they span between three and six traverses. As each traverse from which this material was picked up was walked by different people, the suggestion of biasing due to experience is largely refuted. That biasing has not been introduced in this way is substantiated by the fact that the people who walked the most productive traverses were also responsible for walking traverses which produced very few or no finds. This implies that, although clusters may follow the layout of traverses to some degree, the overall distribution of material is not the result of observation by people with different levels of experience.

Having considered the processes which may have influenced data retrieval, it is now possible to discuss the results with more confidence. Obviously there is an unavoidable emphasis on the southern half of the study area and therefore any conclusions drawn can only be considered to relate to those areas studied. However, it is hoped that the evidence will help to formulate future research plans in the area to the north.

7.1.11 Discussion

Despite the fact that the NWWS is working on a regional scale, the nature of the material and the density of lithic assemblages found during the NWWS and those found during the course of this research appear similar. At the very basic level, the two chronological periods identified by Middleton et al. do provide suitable divisions for the material from Temple Sowerby (1995, 18-19). However, Middleton et al. also suggest that flakes detached using hard hammers, and occasional use of bi-polar knapping techniques, are diagnostic characteristics of late neolithic-bronze age assemblages (op. cit.). Neither of these observations is apparent in the material from Temple Sowerby. In fact, where evidence of bi-polar knapping has been recorded (and this is only on one core -TS1 group C no.2; Fig. 7.3 no.6), the piece is typologically associated
with the earlier period. These discrepancies between the material from the NWWS and that collected during the course of this research may simply highlight the inter-regional variation in technological traits.

Plate 7.1 Field TS8 taken facing south east showing the distinct soil change below which alluvium has been deposited. This is evident from the darker colour and finer texture of the soil. Field TS1 is marked by a black arrow to show its relative location.

Up to this point the data have been analysed typologically and on this basis have been divided into material broadly associated with the late mesolithic-early neolithic period and that associated with the late neolithic-bronze age. This methodology has proved satisfactory in breaking down the material for descriptive and basic analytical purposes and for identifying spatially discrete clusters in the data. However, the findings are perhaps misleading because this typologically-based analysis fails to account for the chronologically-mixed nature of most of the clusters identified. With the exception of finds groups TS1 Group B, TS5 Group A and TS11 Group A (Appendix 4), which are all broadly associated with the later period, all other groups are typologically mixed. This obviously presents a challenge in terms of interpretation. It is possible that the mixing is the result of reuse of 'old' sites by subsequent cultural groups with the mixing of discrete clusters within the material being the result of ploughing. Alternatively, the mixing of material may suggest a continuity in use, with the adaptation of technological changes as and when they became known or when communities using the site felt they were necessary.
Similarly mixed assemblages are a common feature in the north of England where they have been found in both excavated contexts (Bonsall 1981) and on sites identified through surface scatters (Cherry and Cherry, 1987). The frequency of such sites has been highlighted by Young during his work in the north east of England (1987, 33-37). Young not only provides a brief précis of sites which have, in the past, produced typologically mixed assemblages but has also identified ten such sites in Weardale (op. cit.). In Cumbria the work of the Cherry family on the west coast and on the limestone uplands of eastern Cumbria has clearly shown the commonality of this phenomenon in the county (1963, 1965, 1967, 1969, 1973, 1983, 1984a, 1984b, 1985, 1986, 1987a, 1987b, 1995).

Young (1987, 37) interprets such sites as late, possibly the latest, mesolithic hunter gatherer sites in the area of Weardale. On a similar note, Cherry and Cherry suggest they are "the result of gradual (and possibly selective), adoption of neolithic technology by peoples following a late mesolithic tradition " (1987, 71). Both interpretations indicate that the mixed scatters represent the gradual adoption of technological changes by people who continued to practice a hunter gatherer subsistence strategy. Broadly speaking, it would appear that such sites could be taken, in cultural terms, to represent the mesolithic/neolithic transition and this is something considered by Young (1987, 114).

At Temple Sowerby and in Weardale (Young, 1987, 33) some of these scatters, on the basis of diagnostic tools, appear to extend from the late mesolithic through to the bronze age. It is suggested that despite apparent changes in social structure and possibly subsistence strategies, the same areas of the landscape continued to be important. Whether this was the result of for example, the availability of sustainable resources, territoriality or kinship ties, remains to be seen.

Leaving aside for a moment the composition of the lithic scatters and their relationship to the chronological sequence of activity, it is necessary to consider in more detail the distribution of the material. Distribution of the scatters over the fields walked has already been touched on above, but modern field boundaries per se have no bearing on the interpretation of the data other than providing a basic unit of data retrieval and discussion. For interpretation purposes it is the ‘natural’ elements of the landscape which are more significant to the discussion and in this respect the distribution of the material around Temple Sowerby is particularly interesting. Fig 7.1 illustrates that the greatest concentrations of material are evident in fields TS1, TS8 and TS12. TS8 lies on a natural terrace, on the west side of the River Eden at 105m above OD and is directly opposite field TS1 which sits at a similar altitude at approximately 500m from the river on the east side (Plate 7.1). TS12 is situated on a north-facing slope at between 105m and 115m above OD in a natural alcove of the small valley of Birk Sike. The bottom of this valley is covered in Juncus grass and is currently very wet, with a small area of water standing just down slope from field TS2. The extent of this waterbody is seasonally variable and at the time of fieldwalking was little more than a pond.

The small alcove is 'U' shaped and is bounded on both sides, and around its head, by gently rising slopes. At its north western end the alcove opens out and accommodates a small raised 'island' with Temple Sowerby Moss lying, in a second alcove, to the west of this 'island'. At the northern end of the island, Birk Sike joins
with a small tributary, both of which originate from the higher ground to the east. Birk Sike flows around the south side of the 'island' before continuing on its course, in a north westerly direction, to meet with Crowdundle Beck and, ultimately the River Eden. It would appear from the 'unnatural' course of its flow that Birk Sike has been manipulated and its course altered to follow the line of current field boundaries. Whether its 'natural' course would take it around the north or south side of the island is impossible to determine at this stage but it would, presumably, have curved more sinuously around the edge of the valley.

It is suggested here that the standing water in the bottom of the alcove originated as a 'cut off' lake from the stream but, following subsequent silting, has been reduced to little more than a pond. The extensive mining to the north of the area and the introduction of agricultural field drains will have affected the drainage pattern of the area quite significantly, but clearly this low-lying land receives considerable amounts of both surface and ground water. This is evident from the sustentation of Temple Sowerby Moss, and the vegetation covering the remainder of the low valley. It is impossible, within the limits of this research, to clarify the occurrence of these geomorphological changes let alone suggest a time scale for such events. Nonetheless, it is possible that during the late mesolithic-early neolithic period the small alcove was host to either a more substantial body of standing water or a small mire with some open water. It may be this environment which attracted the late mesolithic-early neolithic communities to its edges. Even if the valley was much as it is now, the small low-lying area would have provided a sheltered haven for both human and animal communities. Any standing water would have attracted animals as a natural drinking venue and it may be this which attracted human communities to its banks (Mellars, 1976, 382). However, both the standing water and Birk Sike itself would have been exploitable resources in their own right.

It is significant that all the other lithic evidence from Temple Sowerby was recovered from fields TS2, TS3, TS4, TS5, TS11 and TS14 (Fig.7.1). TS 2 and TS14 lie either side of field TS12, with TS4 on the opposite side of the valley alcove (Fig 7.1). TS3 is at a similar altitude but is located on the south west facing slopes overlooking the River Eden, approximately 700m from the river itself, and TS 11 lies on the north west slopes overlooking Temple Sowerby Moss. TS5 is in isolation to the north of the village and the significance of this will be returned to later. It is evident that the communities utilising the landscape around Temple Sowerby during the prehistoric period were focusing on the natural waterbodies. The preference for sites around natural waterbodies, particularly when practising a hunter-gatherer subsistence strategy, is in keeping with findings from contemporary ethnographic studies (Tilley, 1994, 38 and 48).

Apart from a single flint core of late mesolithic-early neolithic form, fields TS5 and TS11 only contain material typologically classified as being of early neolithic-bronze age. These findings suggest that there may be some slight diversification in landscape utilisation during the later period which manifests as an expansion to areas away from the edge of the waterbodies. It is clear, however, from the evidence of mixed scatters that despite this subtle expansion the waterside locations remained important. Further field survey in the north of the study area, away from the banks of waterbodies, would be needed to add any substance to such a discussion.
This is perhaps an appropriate time to consider the range of raw materials evident in the lithic assemblage. It has already been suggested that chert plays a more important role in the earlier, blade-type production than it does in the later lithic assemblage. However, the material does continue to be used into the late neolithic-bronze age period. It has also been assumed that the river gravels and drift deposits are the source of this material. It is interesting when we consider the distribution of all chert pieces found in the study area (Fig. 7.14) that once again fields TS1, TS8 and TS12 show clustering of this material. Single pieces are also recorded in fields TS2, TS3, TS11 and TS14 and two pieces were found in field TS4. The high proportion of this material in fields closest to the waterbodies goes some way towards confirmation that the river gravels were providing the source of this material. All the single finds of chert, with the exception of that recovered from TS14 which is a single secondary flake, are diagnostic 'tools' or cores. This would suggest that small scale tool production is being carried out close to the source and only items found to be of particular value either as a finished tool or as a source for future flakes, are being carried further afield. The two tertiary flakes from field TS4 and the secondary flake from TS14 support this evidence as both these fields are located on the banks of Birk Sike valley (Fig 7.1).

Although this appears to highlight the local source and use of chert, it does not account for the overall predominance of pale grey flint in the assemblage. It is possible that this material was also locally available in the river gravels and drift deposits and certainly, where cortex survives, it appears fairly smooth and rounded. However, the distribution of this material (Fig 7.15) does not indicate clustering to the same extent as the distribution of chert (Fig 7.14). Clearly the greatest number of pieces was recovered from field TS2, but TS1, TS3, TS8 and TS12 all contain a significant proportion of the material. Three pieces were found in field TS5 and two from TS11. Again this suggests clustering around the waterbodies but the significant number of pieces found in other fields, further from the water, would indicate that either the working of the material was not restricted to the banks of the rivers, streams or lakes, or that other sources were being exploited. It is worth mentioning that none of the fields containing this material is more than 700m from running water of some form, so even if working is extending away from the banks of the waterbodies, raw material was not having to be moved very far. It is suggested, however, that this material was being brought in from elsewhere. Grey pebble flint is present in significant quantities in similar assemblages collected from sites on the limestone uplands further south in eastern Cumbria (Cherry and Cherry, 1987, 70) and here it is suggested that it originated east of the Pennines.

The presence of good quality flint flakes and tools cannot, however, be explained in the same way and it would appear that some items were being bought in from other areas. Where good quality flint pieces are recorded, with the exception of two, small tertiary flakes, they relate to relatively well made finished tools. In the absence of cores or significant numbers of waste flakes of this material, it is suggested that it is the finished articles rather than the raw material that is being brought into the area. The origin of this material is unknown, but the area around Temple Sowerby would have afforded easy access to a variety of sources. To the south, the route of the River Lyvennet would have enabled easy interaction with the groups on the limestone uplands in the south of the region where Cherry and Cherry have noted extensive settlement.
Fig 7.14 Temple Sowerby: distribution of chert pieces by field.

Fig 7.15 Temple Sowerby: distribution of grey/black flint pieces by field.
evidence from the late mesolithic onwards (1987). It is suggested that the chalk flint identified in this area originated in the Yorkshire Wolds.

To the north, the River Eden would have led to the Solway Firth, but here the access to raw materials appears to have been more restricted and stone tool production is more dependant on volcanic tuff and the coastal and river gravels, although higher quality material is reaching the coast by the late neolithic -early bronze age but in small quantities (Cherry and Cherry, 1987, 70).

The modern A66 which runs from Workington on the west coast to Scotch Corner in the east, follows a natural route which cuts through the Pennines at the Stainmore Pass. This was an important Roman route but may well have its origins in the prehistoric period (Laurie, 1985, 159).

Crowndandle and Milburn Becks both run from the Pennine uplands originating just north of Great Dunn Fell (NY 707327) and just north of Knock Fell (NY 717312) respectively. The becks join to the north west of Temple Sowerby and continue their course until they meet with the River Eden approximately one kilometre north of the village. Both becks would provide natural routes to the Pennine uplands. The source of both becks lie less than 800m from the source of becks which run to the east of the uplands into Teesdale. Occupation of Teesdale during the prehistoric period is clearly documented (Coggins, 1985, 163 - 173) and again suggests another area of possible interaction with groups in different regions. Ease of access to good quality raw materials in each of the regions discussed varies and in many of these areas the resident groups would themselves be dependent on materials or tools coming in from other areas.

Clearly this is a very brief discussion based on general observations of possible communication networks. The subject of human interaction and communication will be dealt with in more detail in Chapter eight.

7. 2 Great Rundale

All peat hags within the five square kilometre study area were walked (Fig. 7.16). Most of the hags run parallel to natural water courses although extensive erosion is occurring in areas away from these. Six discrete clusters of material were found between 40cm and 45cm above the base of the peat. Four of these were located close to each other at the head of a stream, approximately 500m south west of Great Rundale Tarn, the fifth in the eroding south bank of the tarn and the sixth on the north side of a stream to the east of the tarn (Fig. 7.16). All six clusters comprise the same type of material: small flint, chert and limestone chips and flakes. None measures more than 13mm along the longest axis and most are between 4mm and 10mm. The breadth of the pieces covers a similar size range, although some pieces are as small as 2mm across (Plates 7.2 and 7.3).

A total of 1907 lithic pieces was found but no diagnostic tools or flakes were included in the assemblage. Detailed analysis of this material would require microscopic inspection which was considered too time consuming for the limits of this research and for the level of information likely to be gained by such an approach. It was felt that a basic analysis of the material would be adequate to identify any broad patterns in
the assemblage which might in turn allow inferences to be made about the process or processes involved in
its creation.

The assemblage was examined by eye (with the aid of a hand lens of X10 magnification where necessary)
and broken down into basic categories of unclassified, primary/secondary and tertiary flakes and any clearly
'different' pieces were separated out and described in more detail. All but seven of the 'different' pieces were
found, on the basis of length to breadth ratio, to be of 'bladelet' form (see above) and are described as such in
what follows. The overall composition of the assemblage is given in Table 7.8 and this is broken down into
finds groups in Table 7.9. More detailed descriptions of the finds groups and individual descriptions of
'bladelet' pieces are provided in Appendix 5.

<table>
<thead>
<tr>
<th>Chip/Flake type</th>
<th>No. of pieces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclassified</td>
<td>1211</td>
</tr>
<tr>
<td>Primary/secondary</td>
<td>133</td>
</tr>
<tr>
<td>Tertiary</td>
<td>512</td>
</tr>
<tr>
<td>Bladelet flakes</td>
<td>51</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1907</strong></td>
</tr>
</tbody>
</table>

Table 7.8 Great Rundale: composition of the assemblage.

This division of the material is very simplistic but even this proved difficult because, although
primary/secondary flakes were easily identified from the cortical evidence, it was difficult to determine
whether some of the 'unclassified' pieces were tertiary flakes or simply shattered stone. This mainly applied
to the limestone and chert chips, which do not, in general, show clear striking platforms, concoidal lines or
bulbs of percussion. In essence, the primary/secondary and tertiary flake categories contain those pieces
which show evidence of having been struck. This includes pieces which have retained a striking platform,
bulb of percussion or have evidence of flaking on their surface. The bladelet category contains those pieces
which display some form of shaping. This is not to imply that each piece has been individually shaped but
the flakes within this category have common characteristics with each other and are quite different in form
from the rest of the assemblage. Despite being long and narrow, none of the bladelet flakes shows any sign
of having been used. Only four pieces, all from group F, are of an obviously 'usable' form and show any
surface evidence for deliberate shaping (Plate 7.3).

It was possible to establish by eye that most of the bladelet flakes are complete or almost complete. It is not
possible to determine, with any confidence, whether the same applies to the other flake categories.

<table>
<thead>
<tr>
<th></th>
<th>Unclassified</th>
<th>Primary/secondary</th>
<th>Tertiary</th>
<th>Bladelet flakes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>47</td>
<td>8</td>
<td>36</td>
<td>6</td>
</tr>
<tr>
<td>Group B</td>
<td>39</td>
<td>12</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>Group C</td>
<td>6</td>
<td>1</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Group D</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Group E</td>
<td>29</td>
<td>15</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Group F</td>
<td>1085</td>
<td>94</td>
<td>430</td>
<td>32</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1211</strong></td>
<td><strong>133</strong></td>
<td><strong>512</strong></td>
<td><strong>51</strong></td>
</tr>
</tbody>
</table>

Table 7.9 Great Rundale: composition of finds groups.
Fig. 7.16 The micro-region of Great Rundale showing the distribution of archaeological sites.
Table 7.10 Great Rundale: raw materials represented and the percentage of the total.

<table>
<thead>
<tr>
<th></th>
<th>Cream chert/ limestone</th>
<th>Grey chert</th>
<th>Grey flint</th>
<th>Beige flint</th>
<th>Honey brown flint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclassified</td>
<td>973</td>
<td>215</td>
<td>6</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Primary/secondary</td>
<td>29</td>
<td>30</td>
<td>60</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Tertiary</td>
<td>112</td>
<td>202</td>
<td>147</td>
<td>45</td>
<td>6</td>
</tr>
<tr>
<td>Bladelet</td>
<td>18</td>
<td>8</td>
<td>13</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>% of Total</td>
<td>59%</td>
<td>24%</td>
<td>12%</td>
<td>4%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Although some of the pieces are of reasonably good quality flint, 83% of the assemblage consists of locally available cream and grey chert. Table 7.10 illustrates the range of material represented in the assemblage but once again, the division of the material is based on colour and does not portray the full array of tones, texture and quality which is actually present. Dividing this material by eye was difficult because of the size of the pieces and even with the aid of a hand lens, it was difficult to establish whether certain flint chips/flakes appeared to be of a different colour simply because they were thinner and therefore reflected more light. The category of cream chert also includes a small number of limestone chips all of which come under the flake category of 'unclassified' (Table 7.9). Although the amount of limestone has not been systematically quantified it does not appear to contribute more than 1% of the cream chert/limestone category. Table 7.9 shows the range of flake types identified.

During the process of sorting it was noted that a large number of the flakes is 'imperfect', many showing signs of tiny cortical inclusions or hairline cracks in their structure. No attempt was made to systematically quantify the occurrence of these characteristics but it was estimated that one third of 'unclassified', primary/secondary and tertiary flakes displays some signs of 'imperfection'. This is reduced to one tenth in the bladelet category.

7.2.1 Analysis

Initially the assemblage was considered as a whole and any general observations made were tested against the individual groupings of finds. Although the groups are of quite different sizes (Table 7.9), the composition of each group, in terms of flake type, flake size and raw materials, is so very similar that it has been assumed that the same process or processes have been responsible for their creation. It was felt that only an analysis of considerable detail would identify fine variations in the group assemblages. For this reason and because of the very limited analysis carried out here, it was felt that only very basic questions could be asked of the data. What process or processes have been involved in the creation of such an assemblage and when were they carried out?

The most basic observation to be made during the sorting of this material was the distribution of flake types within the raw material categories. This is most clearly depicted in Fig. 7.17, where it can be seen that 'unclassified' flakes make up a significantly larger percentage of the chert material than they do the flint. This applies particularly to cream chert/limestone although unclassified flakes do make up nearly 50% of the grey
Plate 7.2 Examples of different 'flake' types recovered from Great Rundale. (a) Unclassified flakes, (b) Secondary Flakes, (c) Tertiary flakes.
Plate 7.3 Bladelet type flakes recovered from Great Rundale, (a) Bladelet flakes, (b) 'Deliberately' shaped bladelets.
Within the flint categories, 'unclassified' flakes contribute less than 10% to each type. In contrast, primary/secondary, tertiary and bladelet flakes contribute significantly more to the flint categories than they do to the chert. This patterning may be explained in a number of ways and possibly the most obvious is that it is the result of errors in the identification of flake types. As was mentioned above, that there was some difficulty in distinguishing between tertiary flakes and shattered stone particularly within the cream chert category. If this has caused a distortion of the data, it would be expected that all or nearly all cream chert/limestone pieces would fall into the 'unclassified' flake category. Although this raw material is dominated by 'unclassified' flakes, it can be seen that nearly 15% (170 pieces) of the cream chert is comprised of other flake types. 35% of all 'bladelet' flakes, the most clearly defined flake category and that contains the greatest number of complete flakes, are of cream chert, although no bladelet flakes of limestone have been recovered (Fig. 7.18). The fact that other flake types of this material are being identified suggests that the 'unclassified' flakes are correctly identified and that they are unclassifiable because of the lack of visible typological traits in the same way as 'unclassified' flakes of other raw material types have been defined. This is substantiated to some degree by the evidence depicted in Figs. 7.19 and 7.20. In these graphs the assemblage is broken down into respective finds groups. It is clear from Fig. 7.19 that within the groups the distribution of raw material types reflects that of the overall assemblage, with a dominance of cream chert, followed by grey chert, grey flint and beige flint. The relative proportions of the material types vary from one group to another and not all groups contain all raw materials, but the general sequence of dominance is reflected in all six groups.

When compared to Fig. 7.20, which shows the flake type distribution within each group, it becomes clear that those groups which contain the highest relative percentages of cream chert, specifically groups B, C, D and E, also contain the lowest relative percentage of 'unclassified' flakes. It should perhaps be noted that groups C and D are particularly small and may not prove representative, but groups B and E are of an average and comparable size. It would appear, therefore, that the distribution of flake types and raw materials within the assemblage as a whole and within the individual groups is the result of a prehistoric cultural process or processes and not a modern cultural bias caused by errors in flake identification.

An alternative explanation for the patterning in the assemblage is the availability of raw materials. Cream and grey chert are locally available as stream gravel or as bands within local outcrops of limestone. The relative abundance of the material may simply mean that more of this material was used because it was more readily available and that less care was needed in working chert because there was little reason to conserve it. Chert is anyway more difficult to work than flint as it fractures in a less predictable manner and consequently the ratio of waste to implements is far greater than that of flint. Clearly no diagnostic implements are available from Great Rundale to test this but, if it is assumed that the group assemblages represent debitage from some form of stone working process, then clearly greater quantities of chert waste are present.

The provenance of the raw material may also explain some of the patterning in the assemblage. If, as suggested above, chert seams within limestone were being exploited, the extraction of the chert would involve the removal of the limestone 'coating'. This is not to imply that mining extraction was necessarily
Fig. 7.17 Great Rundale: percentage of flake types by raw material.

Fig 7.18 Great Rundale: percentage of bladelet flakes by raw material.
Fig. 7.19 Great Rundale: percentage of raw material within each finds group.

Fig. 7.20 Great Rundale: percentage of flake types within each group.
being carried out, as large chunks of limestone would have been accessible in one form or another. Today large pieces of limestone are available as scree on the upper slopes of the Pennines, but during the prehistoric period, when the area was covered in open woodland, this is likely to have been on a considerably smaller scale. Nonetheless, the thin soils would have exposed areas of the underlying bedrock and the numerous streams in the area may also have eroded large chunks of the rock and exposed pieces containing suitable chert bands. The removal of the limestone 'coating' could at least account for the limestone fragments recovered in the assemblage from Great Rundale.

Possibly associated with this explanation is the relatively low percentage of primary/secondary flakes of chert material recorded. If chert was being extracted from the limestone, it is unlikely to display a cortex in the same way as, for example, pebble chert or pebble flint which have been exposed to the elements and various types of weathering. This would apply particularly to cream chert which is of a very similar colour to the parent material so, even if some limestone remained adhered to the chert, it may not be visible with the naked eye on pieces of the size recovered from Great Rundale. Only on an exposed face would the chert display an obvious cortex and this may account for the few cortical pieces identified within the chert categories.

In contrast, a relatively high percentage of cortical flakes is recorded in the flint categories, some with a white chalky cortex and others with a grey pitted cortex (Appendix 5). Independent of whether the flint derives from pebbles or from nodules, the cortical flakes would not only be more clearly identifiable than those of chert, but any working of the flint would produce considerably more cortical flakes than a similarly sized piece of extracted chert. Clearly if the chert derives from pebbles, then the number of cortical flakes would, again assuming a similarly sized pebble and the same stone working technology, be comparable.

Up to now little consideration has been given to the provenance of the flint component of the assemblage. As at Temple Sowerby no flint is locally available, so the presence of it at Great Rundale can only be explained in terms of human action: the flint must have been transported to the site. On the basis of cortical evidence two different types of flint are recognised from the assemblage, that with a white chalky cortex and that with a grey pitted cortex. Although three different colours of flint were found, there does not appear to be any correlation between colour and cortex type.

Where the pitted grey cortex is present the cortical surface is generally smooth and rounded, suggesting that these flakes derive from pebble flint. Those flakes with a white chalky cortex have presumably derived from chalk deposits. It is impossible to determine precisely where the flint has come from, but it is clear that both types must have travelled some considerable distance to the site. Flint deriving from both chalk and pebble deposits was recorded by Cherry and Cherry (1987, 70) in the limestone uplands of Eastern Cumbria. Here it is suggested that the material derives from the east of the Pennines and specifically, in the case of the chalk flint, from the chalk and boulder clay deposits of the Yorkshire Wolds (op. cit.). It is possible that the material found at Great Rundale derived from the same sources.
Whatever the source, some material was being brought considerable distances to the area. Considering the weight of the stone, the topography of the terrain and the distances to be carried, the value placed on this material must have been quite considerable. Leaving aside, for the moment, any social context which may make this material desirable, the limited availability, the physical properties, and the workability of flint, may all contribute to the value placed on it. The significantly smaller quantities of flint present in the groups may not only reflect the availability of the raw material, the predictability of the stone during working but also the level of care taken in working the resource. The very limited number of ‘unclassified’ flint flakes suggests that few errors were made in the process of working and this is possibly a direct reflection of the level of value placed on the resource (Magne 1989, 19).

In summary, from the limited evidence available it would appear that some form of stone working process was being carried out within the micro-region around Great Rundale. It is suggested that the group assemblages recovered from Great Rundale represent the debitage resulting from this working. The heterogeneous mix of flake type, flake size and raw material is common to all the finds groups and implies that the same process or processes were responsible for all six clusters of material. It is proposed that at least some chert was being extracted from the local limestone, but flint, brought in from other areas, was also being used for this purpose. It is suggested that both material types were being subjected to the same process or processes and that variations in the distribution of flake categories within the groups are a consequence of the type of raw materials being used, the predictability of these when worked, and the level of care employed in their working.

7.2.2 Cultural context and chronology

All the clusters were found between 40cm and 45cm above the base of the blanket peat which, if compared to the dates determined for the pollen core from Great Rundale (Table 6.0), places the assemblages in a late neolithic/bronze age context (c. 2624 - 2514 cal. BC). This assumes, however, that the spread of blanket peat was simultaneous over the whole area, but Johnson and Dunham have shown that peat development over Moorhouse Nature Reserve, the edge of which lies approximately 2km north of the study area, was effected by very localised climatic and topographical conditions (1963, 145). Although the formation of blanket peat began on the lower slopes at c. 5000 BC, it may have started later on higher ground such as Knock Ridge, situated approximately 2km north east of Great Rundale Tarn. This is clearly the case at Great Rundale, where radiocarbon dates provide a basal date of c. 3495 Cal. BC. Because it has been shown that the spread of blanket peat was not necessarily simultaneous across the whole of the area, a late neolithic/bronze age context for the lithic material recovered from the study area could be erroneous particularly as the clusters of material were picked up between 400m and 700m from the pollen sampling site. Obviously the greater the distance between the dated sample and the archaeological site, the higher the risk of error.

Although no radiocarbon dates are available for the Moorhouse pollen cores, microlithic flake tools were found in the peat at Hard Hill, Upper Moss Flats and Teeshead (Johnson and Dunham, 1963, 154). Pollen analysis at Hard Hill has shown that these flakes occur at a horizon which is in the latter part of Zone VIIa, c. 3000 BC (Godwin, 1956).
The material from Great Rundale does not contain any diagnostic artefacts, and is typologically very different to that found at the above mentioned sites, but the small number of microlithic bladelet type flakes, evident in varying quantities in five of the clusters, does suggest a late mesolithic-early neolithic date (Plate. 7.3). On this evidence it is proposed that a late mesolithic/early neolithic context is most likely for this material, although the evidence of continuity in stone working technology is so common in the north of England that a later date cannot be ruled out (cf. Young, 1987, 33-37; Bonsall, 1981; Cherry and Cherry, 1987, 71).

7.2.3 Discussion

Although it has been suggested that some form of stone working was being carried out in the area around Great Rundale, no attempt has been made, so far, to establish what process, or processes were involved. This is partly due to the absence of diagnostic tools and clear typological traits on which such an analysis could be built. Although attempts have been made at identifying technological traits from archaeological debitage, material application of the theories and methodologies put forward tends to depend on the identification of striking platforms, interior surfaces and edge detail of flakes (Sullivan and Rozen, 1985; Cotterell and Kamminga, 1987). This was not possible with the material recovered from Great Rundale, where a large proportion of the finds consisted of 'unclassified' flakes. Besides, in the sources quoted, little consideration is given to the size of stone flakes and chips and this is clearly one of the most distinguishing features of the assemblage from Great Rundale. I would suggest that the key to understanding the origins of this assemblage lies in the very limited size range of the flakes which must be a consequence of the formation process.

A search of published sources has identified only one vaguely similar archaeological assemblage. This example comes from the late Magdalenian open-air hunting camps of the banks of the Seine at Pincevent (Newcomer and Karlin, 1987). Although obviously much earlier in date, some of the illustrated chips and flakes (op. cit., 34-53, Figs. 4.2-4.4) are comparable in form to some of those identified during the course of the current research.

The most closely comparable material comes from the experimental work of Baumler and Downum (1989). Their work was aimed at investigating morphological variability within a given size class of small sized debitage. The assemblage was generated experimentally by two fundamentally different activities in lithic reduction: 1. core reduction/flake production and 2. tool manufacture/retouch. The main concern of the experimental work was to develop a means for interpreting an assemblage of small sized debitage recovered from a Late Palaeolithic site in Lower Australia (op. cit., 102).

Unfortunately, despite detailed description of their material, and careful analysis of their findings, no illustrations or photographs accompany Baumler and Downum's (1989) work, so it is difficult to physically compare the material, but based on the written descriptions a number of comparable characteristics is clear. An important feature of their work is that their experiments were based on the use of chert (and obsidian) and a blade type technology (op. cit., 103). Clearly these variables are comparable to the characteristics identified
in the assemblage from Great Rundale. It is recognised, however, that many different forms and qualities of chert exist and the resulting debitage from the working of any one type may be different.

Experimental stone working is very valuable in identifying how certain tool types were produced and what debitage results from a particular type of technology. However, there are clearly many problems in comparing debitage created through experimentation and that recovered archaeologically. The most obvious of these is that debitage from experimental knapping is a known quantity, it is the complete assemblage, from the working of a particular material type using a particular technology. In contrast it is impossible to know whether an archaeological assemblage is 'complete'. Did all the pieces, which originally formed part of that assemblage, remain at the site? If so were all the pieces recovered during the archaeological investigation? This is particularly relevant to the current research where the material was found eroding from peat. Although the peat sections were cleaned back to ensure that all visible components were collected, it is possible that some material had already eroded out and was subsequently lost in the stream beds. It is also possible that further components of the assemblage lie further 'inland' from the edge of the streams/tarn and were not picked out by simply cleaning back the peat section.

The mix of raw materials in the groups from Great Rundale also indicates that more than one action was involved in the creation of the assemblages. It is possible that two pieces of stone were being worked, at the same time, using the same technology, by two different people, but the mix of raw materials does confirm that the debitage in each group assemblage is the result of working more than one piece of stone.

With so many unknown 'quantities' it would be impractical to compare, for example, the relative percentages of flake types produced through experimental knapping with those found in the archaeological assemblage. However, one very valuable contribution of stone working replication is that it provides material against which archaeological assemblages can be compared. This in turn allows inferences to be made about the technology used in the production of the assemblage. Ideally several analogous examples should be used to compare and contrast with the archaeological sample. Unfortunately, in the case of the material from Great Rundale, only the work of Baumler and Downum (1989) has been found to produce material which is comparable. Obviously this in itself is useful and provides the basis for the following discussion but it is quite probable that more than one type of technology or stone working activity could produce similar material. For this reason the inferences made below are open ended and may need to be revised in the light of new research.

Another problem in comparing the core reduction debitage from the experimental work of Baumler and Downum and the material from Great Rundale is the fact that the cores used in the experimental work were previously decorticated (1989, 103). Cores were prepared in this way because the archaeological material, which the experiment was set up to test, contained no cortical flakes. Clearly this is at variance with the assemblage recovered from Great Rundale where primary/secondary flakes contribute 7% of the total and this should be remembered throughout the following discussion.
Having collected all the debitage from the experimental knapping, Baumler and Downum split the debitage into five size categories to identify whether the core reduction and tool production processes produced different distributions within the flake size categories (>12.5mm, 12.5-6.3 mm, 6.3-4mm, 4-2mm and 2-1mm) (1989, 104). The clearest pattern to emerge was that very few pieces of debitage as large as 6.3mm were generated by scraper manufacture. Core reduction, on the other hand, produced significant quantities of debitage in all size classes, both large and small (op. cit.) although only in one episode of core reduction using chert did flakes greater than 12.5mm contribute more than 10% of the total debitage (op. cit.).

When these findings are related to the material from Great Rundale, certain similarities can be identified. The most obvious is the size of the flakes produced. Although no attempt was made to measure all the pieces recovered from Great Rundale, the general size range for the material was identified (13mm-4mm) and can be seen to be comparable to that produced during the experimental knapping. Some smaller pieces were found at Great Rundale, but these are relatively few. The clear difference between the experimental assemblages and those recovered from Great Rundale is that no flakes over 13mm were found in the latter assemblages.

It is interesting that...

"...both core reduction and tool manufacture generate large amounts of small-sized debitage. It is not the presence of small flakes that distinguishes most tool manufacture activities from core reduction and other early reduction efforts, but the absence of larger debitage" (Baumler and Downum, 1989, 105).

On this basis the material from Great Rundale is most closely comparable to the debitage produced through the scraper production process. However, it is acknowledged that Baumler and Downum’s reference to 'larger debitage' relates to pieces over 6.3mm and in the context of Great Rundale this relates to pieces over 13mm. The size of the flakes may well be material specific, but it should be noted that flakes in the size category 12.5mm - 6.3mm were not totally absent from the debitage produced through scraper production experiments using chert (op. cit., Table 1, 104).

Later in the analysis Baumler and Downum focus on the largest sample for both reduction processes (4-2mm size class) and they divided this into classes of complete flakes, broken flakes and shatter (1989, 105). From this it can be seen that ‘shatter’ is produced in large quantities only during the core reduction process. Although it is recognised that these flakes are smaller than the majority recovered from Great Rundale, the physical description of 'shatter' (op. cit. 107) suggests this flake category is comparable in form to the 'unclassified' flake category used in the current research. The relative quantity of unclassified flakes recorded from Great Rundale implies that the material is also closely comparable to the debitage produced through the core reduction process.

It is interesting that Baumler and Downum suggest that poor quality material with "voids and natural fracture planes" (1989, 107) might be expected to elevate percentages of shatter during core reduction. It is also suggested that flawed material is more likely to be encountered during core reduction than tool retouching. The 'imperfections' recorded in much of the material from Great Rundale, combined with the high proportion
of 'unclassified' flakes, therefore enhance the suggestion that core reduction was being practised within the study area. But why, if core reduction was being carried out, were no larger pieces recovered? Two possibilities can be suggested. Newcomer and Sieveking (1980) have carried out experiments to look at differences in the scatter patterns of debitage, in particular the effect the working position of the knapper has on scatter patterns. It is clear from their work that the position of the knapper is influential in flake scatter patterns, but perhaps of more relevance to the present research is the fact that small flakes and chips always land at the outer extremes of the knapping site. This, as might be expected, is a common feature of all the patterns depicted (1980, Figs 2-8). Could this explain why only small flakes and chips were recovered from Great Rundale? Is that which has been recovered simply the 'outside edge' of the assemblage? All the groups of material were recovered from eroding peat adjacent to streams or, in the case of Group E adjacent to Great Rundale Tarn. Unless those responsible for working the material were actually sitting, or standing on the banks of the stream/tarn, it could be supposed that the centre of the 'site', and consequently the larger flakes, lie slightly further 'inland' from the edge of the stream/tarn but were not picked up by simply cleaning the peat section.

A second possible explanation is provided by Newcomer and Karlin (1987) from their work on the late Magdalenian open-air hunting camps on the banks of the Siene at Pincevent. At the site "...concentrations of debitage chips are very common and often associated with the other waste from blade making like core tablets, crested and broken flakes and discarded cores" (1987, 35). However, "...when such chips are found without the larger waste pieces, as was the case in Habitation 1, the best interpretation is that the larger pieces were swept up to clear a domestic area and that only the hard to pick up chips remain as evidence of blade making here".

Until now emphasis has been placed on the 'unclassified' component of the Great Rundale assemblage, with little reference given to the primary/secondary cortical flakes, tertiary flakes and the 'bladelet' type flakes. This is partly due to the absence of recognisably similar flakes in the assemblages to which the Great Rundale material has been compared, but clearly the presence of these in the assemblage cannot be ignored. Newcomer and Kalins' (1987) work at Pincevent has focused on the interpretation of the most common form of artefact found at the site, flint chips. Again, experimental work was carried out to replicate the type of blade cores and tools found at the site and subsequently the waste left after such activities. By comparing experimental and Palaeolithic chips they were able to confirm a distinction between retouch and debitage chips and could isolate two different types of debitage chips associated with blade production (op. cit., 31). The first of these are formed when facetting the platform surface. These are typically short and fan shaped, with the distal end formed by a hinge fracture. Although hinge fractures were not systematically recorded for primary/secondary and tertiary flakes recovered from Great Rundale, some of these categories do contain clearly 'fan shaped' flakes and the majority are short squat pieces. Could at least some of these flakes be the result of striking platform preparation?

The second type of debitage chip identified by Newcomer and Karlin (1987, 103) is made when removing overhangs on the front of the core between blade removals. These generally have small butts, feathered
edges, parallel or converging lateral edges and straightish profiles \( (\text{op. cit., 35, Fig. 4.3}) \). These flakes are by far the most clearly comparable to the 'bladelet' type flakes identified from Great Rundale.

Although the level of analysis of the material from Great Rundale has been relatively simplistic the division of the assemblage by flake type has enabled some inferences to be made. It has already been suggested, from the evidence of a small number of limestone chips in the assemblage, that at least some chert was being extracted from bands in the local limestone and that flint derived from both pebble and chalk deposits was also being used. Both material types appear to have been subjected to the same process or processes. Comparison of the material with debitage from experimental knapping suggests that the assemblage from Great Rundale is the result of core preparation, reduction and maintenance, specifically in the context of a blade type technology. It is possible that the different flake categories represent different stages in this process with the 'bladelet' type flakes representing the 'fine tuning' and maintenance of the core. From the absence of larger flakes it is suggested that either only part of each debitage scatter was recovered during the field survey or that some form of site clearing process was in operation which resulted in larger flakes being removed. Only test pitting in areas further from the edge of the peat would be able to confirm which of these scenarios is correct and unfortunately this was not possible during the course of the research.

Until now little consideration has been given to the distribution of the group assemblages from Great Rundale (Fig. 7.16). It has been noted that all the groups of material were retrieved from eroding peat adjacent to streams or, in the case of Group E, Great Rundale Tarn, but this has not been discussed in any detail. The first consideration has to be whether the distribution of 'sites' is a direct reflection of peat erosion patterns rather than a 'true' distribution of stone working areas. Erosion of the blanket peat is evident throughout the study area, but is emphasised in areas adjacent to the Tarns and running water. From this aspect it is clear that the distribution of the material recovered does correlate with the areas available for the field survey. However, wherever it was possible, hag walking was also carried out in areas away from the water bodies (Fig. 7.16) but no material was recovered from these areas. Although it cannot be assumed on this negative evidence that the 'sites' are unique to waterside locations, it was felt, on the absence of evidence from other areas, that the distribution is not solely a product of differential recovery and that water-side locations were being selected for the stone working activities.

It is of course possible that some sites have been eroded away and either re-buried beneath peat 'slumps' or eroded into the stream beds where, based on the size of the lithics recovered, they would not have been found during the course of the survey.

It is implied above that locations were selected for the stone working activities, but this may not be strictly true. Binford's study of the Nunamiut Eskimos identified that within hunter gatherer subsistence strategies raw materials used in the manufacture of implements are normally obtained incidentally to the execution of basic subsistence tasks. 'Procurement of raw materials is embedded in basic subsistence schedules' (1979, 259). Clearly this suggests that those carrying out the stone working at Great Rundale were doing so during quiet periods within their subsistence practices. In their interpretation of the Langdale axe production sites,
Bradley and Edmonds argue that seasonal subsistence activity provided the most plausible context for the first discovery of the Group VI rock (1993, 140). Tuff was being used in the coastal settlements during the mesolithic period, but analysis of this material revealed it had been obtained in the form of small pebbles which could have been collected from the streams originating in the Cumbrian Massif. It is suggested that the parent rock was discovered by following these streams back to their source during periods of summer upland grazing (*op. cit.*, 141).

A very similar model can be proposed for the communities utilising the east Cumbrian landscape. It has been shown that at Temple Sowerby pebble chert was being used for the production of tools in both the late mesolithic-early neolithic and the late neolithic-bronze age periods. Greater emphasis was placed on chert in the earlier period for use in a blade type technology. The hunter/gatherer societies exploiting this material in the lowland areas were probably doing so in the winter months, but were moving into the upland areas in the summer months for hunting or upland grazing. Following streams would have provided an obvious route into the upland areas. Crowdundle Beck originates 400m south west of Tees Head in the uplands and flows into the River Eden a similar distance north of the Temple Sowerby study area and provides one of many examples of a natural route way into the Pennine uplands. Swindale Beck and Great Rundale Beck, which join the River Eden approximately 2km south of the Temple Sowerby study area, offer alternative routes.

Unfortunately the acidic soils of the area are not conducive to the preservation of animal bone, so it is difficult to determine what type of fauna was being hunted, but some evidence is available from the upland area. During the survey of Moorhouse Nature reserve, six horn sheaths of cattle were found in the blanket peat and a further five were obtained from the general vicinity of the reserve (Johnson and Dunham, 1963, 158). Although no radiocarbon dates are available from the peat, the horn sheaths have been dated, on the basis of Godwin’s pollen zonation (1956), to both Zone VIIa, the Atlantic period, and Zone VIIb, the sub-Boreal age. Two types of horn sheath have been identified: those of *Bos taurus primigenius* were found at Hard Hill (NY 727331), Teeshead (NY 701340 and 699340), Netherhearth Flats (NY 746314) and Burnhope Seat (exact findspot unknown); and those of *Bos taurus taurus* were recovered from Hard Hill (exact find spot unknown), Ireshopeburn Moor (NY829357) and Priorsdale (exact findspot unknown).

It is interesting that the horn sheaths of *Bos taurus primigenius*, the wild cattle species, are all found in late Atlantic contexts (c. 3000 BC), whereas those of *Bos taurus taurus*, the subsequent domesticate, were found in Sub Boreal contexts (c. 3000 - 500BC) (*op. cit.*, 159). The dating of contexts using pollen zonations is problematic particularly when determining the Atlantic/Sub Boreal transition. Traditionally the elm decline is seen to mark this transition, but with the determination of more and more radiocarbon dates the dating of the elm decline has been shown to vary from place to place and in some areas is difficult to identify at all. At Great Rundale the elm decline is not a clearly defined episode (Fig 6.1a and 6.1b). Elm never contributes more than 4% of the total land pollen percentage and only drops to below 1% at c. 149 Cal. BC. However, at Hard Hill and Tees Head, microlithic tools were found in association with the *Bos taurus primigenius* horn sheaths (Johnson and Dunham, 1963, 155) and on typological grounds indicate a late mesolithic-early neolithic context.
In addition to those found in association with the horn sheaths, a further eight microlithic blade type tools have been recovered from the reserve (op. cit.). The total assemblage

“comprises thirteen pieces of struck flint and five flakes of banded chert. The flint is mainly buff-grey in colour with white mottling and is similar to that found in the Cretaceous chalk deposits of south-east Yorkshire... The chert is of a fine grain, banded black and grey-buff in colour... (and)... is similar to that found in the Four Fathom Limestone, particularly in the vicinity of Swindale Beck Head” (op. cit. 156).

As mentioned above, Swindale Beck is one of the obvious routes into the uplands from the area around Temple Sowerby.

The colour descriptions of the chert from Great Rundale and that recovered from Moorhouse Nature reserve are different, but this is assumed to be the result of different perceptions of colour by the respective authors. Although no black chert was found at Great Rundale, the cream and grey chert may well equate with the grey-buff coloured material from Moorhouse. This serves to illustrate the problem in using colour as a diagnostic characteristic of stone assemblages. The absence of black chert at Great Rundale may be due to the difficulty in spotting black chert in peat, particularly when the flakes are as small as those recovered from the site. Black chert, is however, present in the assemblage from Temple Sowerby (Table 7.2).

What is clearly significant about the chert flakes from Moorhouse is that they have been identified as ‘banded chert’ originating from the Four Fathom Limestone. This substantiates the suggestion made above that the assemblage from Great Rundale, found just 1km south of Swindale Beck Head, was the result of working banded chert. Another comparable feature is that both the microliths recovered from Moorhouse and the material found at Great Rundale appear to have been produced using a blade-type technology. It is also worth noting that the assemblages from both surveys were found within the peat stratigraphy and not, as is more common, from the surface of the mineral soil underlying the peat (cf. Raistrick, 1933; Spratt and Simmons, 1976; Walker, 1957).

The presence of microliths at the same depth in the peat as the horn sheaths from Hard Hill and Teeshead indicates that wild cattle were being hunted, or at least that their carcasses were being processed, in the area of the Moorhouse Nature reserve. This was presumably carried out by groups from bases in the uplands. The open hazel, alder, birch and oak woodland around Great Rundale (Fig 6.1a and 6.1b) would have provided the ideal environment for wild cattle (Smith, 1992, 63) during summer months when the mixed deciduous forests of the lowland areas may have become too dense for their grazing habits. The pollen evidence from Temple Sowerby, however, does not indicate a particularly dense vegetation cover during the early neolithic period (Table 6.11). An alternative deterrent to the grazing of low lying habitats may have been provided by the attentions of mosquitoes, midges and other biting insects. This is known to be one of the major factors which stimulates red deer and other animals to migrate into upland environments during the summer months (Mellars, 1976, 383).
The methods of hunting employed may also provide important information about the location of 'sites' in this upland area. Simmons suggests that humans might seek to attract game to sites where killing was relatively easy and suggests such a site would be "open and attractive to wild animals by virtue of providing food and/or water and would possess good cover for the hunters from more than one side, to take account of varying wind directions" (1996, 144). From this point of view the open woodland, streams and tarns in the area around Great Rundale would provide a natural focus for hunting groups. Smith explains that hunting wild cattle is likely to have involved "stalking and shooting at close quarters with a bow and arrow ... while animals could be speared if caught in dead-fall traps or mired in boggy ground" (1992, 63). It is the latter point which is perhaps of most significance here. The horn sheaths and microlithic blades from the Moorhouse Nature reserve (Johnson and Dunham, 1963, 155) and the lithic assemblages from Great Rundale were all found stratified in the peat, indicating that peat had begun to develop in areas of the Pennine uplands at this time. Judging from the variation in peat development noted by Johnson and Dunham (1963, 145), this was not simultaneous over the whole area, so were areas of peat being selected for the purpose of hunting game? Although none of the horn sheath finds was made within the study area, Great Rundale Tarn and incidentally, Seamore Tarn and Little Rundale Tarn are the nearest bodies of still water and may have been natural foci for animals and, subsequently, humans to congregate. Certainly, areas of peat adjacent to water bodies have a tendency to become 'soggy' and this may have contributed to the selection of 'sites' for stone working activities.

By returning to Binford's study of the Nunamiut Eskimos (1979, 259), it might be possible to suggest that the stone working was being carried out on the banks of Great Rundale Tarn, and the streams radiating from it, whilst waiting for game to 'come to them'. Raw material could be carried the short distance from Swindale Beck Head for preparation or reduction during quiet periods of subsistence activities. Some of this material may have been transported to the lowland areas for use during the winter months. "The greater the distance between source and anticipated locations of use, the greater attempt to reduce the bulk of materials transported" (Binford, 1979, 260).

The finds of horn sheaths belonging to *Bos taurus taurus*, the domesticated species of cattle, cannot be ignored. Although found in later contexts than their wild ancestors, it is perhaps no coincidence that examples of horn sheaths of *Bos taurus taurus* were found in similar locations, specifically at Hard Hill (although their exact findspot is unknown) (Johnson and Dunham, 1963, 160). It would be a natural progression for human groups to use habitats, known from experience to be preferred by wild cattle, to graze domesticated species. The continued use of the upland areas from the late mesolithic-early neolithic period through to the bronze age equates with the evidence from Temple Sowerby, where it is suggested that despite changes in social structure, and possibly subsistence strategies, the same areas of the landscape remained important.

7.3 Howgill Castle

At Howgill, aerial photographic (AP) survey has identified a number of features within the micro-region which did not previously appear in the archaeological record (Fig 7.21). These take various forms but by far
the largest category comprises linear earthworks. Two forms of these were recognised: the first includes the features to the north and north east of Hill Plantation (Fig. 7.21, site no. 460) and those to the north east of Swinethwaite Plantation (Fig. 7.21, site no. 461), which appear as low, wide banks with evidence of a narrow ditch on the uphill side of the bank; the second group, to the north west and south west of Pondfield Plantation (Fig. 7.21, site. no. 462), appears as lower and narrower banks with no evidence of a ditch.

The linear earthworks do not appear to form a regular layout, generally they do not respect contours and in many places very deliberately cross contours. Where the earthworks come into contact with the valley mires, standing water and water courses, they do seem to respect these in one way or another. In at least two areas the banks terminate at the edge of the mire but align with another bank on the opposite side.

The second largest category of features to be recorded from aerial photographs at Howgill is ridge and furrow (Fig. 7.21). This is evident in the form of both earthworks and crop marks. Judging by its width and 'S' shaped profile, the ridge and furrow is believed to date from the medieval period, and therefore falls outside the scope of this research. However, because of its physical relationship to some of the linear earthworks, the areas of ridge and furrow were plotted in the hope that they could offer a relative date for other earthworks. This is certainly the case in the areas to the north west and south west of Pondfield Plantation where the ridge and furrow can be seen to overlie sections of the linear earthworks (Fig. 7.21 site no. 462).

In the north east corner of the micro-region, a number of other features was recorded from APs, but these could not be clearly defined from the photographs. The regularity of stone suggested deliberate construction, but the vegetation and disturbance from modern field drainage meant that definition was impossible.

To the north east of Hill Plantation there are no clear relationships between the linear earthworks and the ridge and furrow. In some areas the ridge and furrow appears to abut the linear banks and could be taken to be later or at least contemporary with them, but the relationship is not consistent. The linear banks are far more extensive than the ridge and furrow and some areas of ridge and furrow are visible in isolation. In some places, particularly either side of Mudgill Sike (Fig. 7.21), the linear boundaries are constructed on such steep slopes that cultivation would have been virtually impossible. The raised ground on the north side of Mudgill Sike is very flat on top and is clearly defined by a boundary bank which curves around the hill top. The fact that this was cultivated during the medieval period is not surprising considering the restrictions of the local topography. The naturally raised terrace is one of very few flat, relatively well drained, areas in the vicinity. Other areas of ridge and furrow to the north east of Hill Plantation are located on the lower gentle slopes which are today prone to waterlogging. On this evidence it is tentatively suggested that the boundaries do not relate directly to the ridge and furrow and where they do have a physical relationship it is coincidental. It is suggested that the boundaries predate the ridge and furrow but cannot be ascribed to a particular cultural period at this stage.
Fig. 7.21 Micro-region of Howgill Castle and the distribution of archaeological sites.
It is interesting that the boundary banks to the north east of Hill Plantation and Swinethwaite Plantation (Fig. 7.21 site no.'s 460 and 461 respectively) are different in form from those south east and north east of Pondfield Plantation.

The fields in which the latter occur have been 'improved' in recent times and therefore subjected to shallow ploughing. This will have contributed to the erosion of the boundary banks and left a more subdued profile, but this does not account for the absence of a ditch. At this stage it is impossible to know whether the different boundary types were contemporary but had different functions, or whether they functioned in much the same way but at different periods in time.

Land division boundaries are notoriously difficult to date because they are often very extensive but depend on the spatial and stratigraphic associations with other classes of monument for dating purposes. Occasionally the buried landsurface beneath the boundaries will provide a *terminus anti quem* either in the form of carbonised material or buried artefacts, but this is rare. At Howgill the problem of dating is exacerbated by the fact that the surviving boundaries are disjointed, so the limited, relative dating, methods applied to the boundaries around Pondfield Plantation cannot be applied to those around Hill or Swinethwaite Plantations. The apparent lack of earthwork or cropmark evidence between Pondfield and Hill Plantations and to the north and south of Burney Hill (Fig.7.21) can be explained by the installation of modern field boundary drains. From the air these appear as closely spaced linear features which criss cross the underlying earthwork and crop-mark remains of ridge and furrow. Although the ridge and furrow is apparent, it is not possible to plot the layout of this or any other features in detail.

7.3.1 Field survey

Field survey was carried out to test the findings of the aerial photographic survey. The whole of the micro-region was walked and any archaeological finds and features recorded. With the exception of a polished stone (?)pendant (Fig. 7.22) recovered from a sheep erosion path on the south side of Burney Hill (Fig. 7.21, site no. 459), no other artefacts were recovered. This was not unexpected because the whole of the area is given over to rough pasture and is not therefore conducive to the recovery of surface artefact scatters.

The (?)pendant measures 3.7cm by 2.1cm by 0.4cm thick, is of a fine grained, blue grey, slate or schist, and has been carefully polished and shaped. The pendant is damaged at one end and has a drilled perforation bored from the upper surface at the other. It appears that the perforation was completed from the underside where there is further evidence of drilling but with less symmetry around the hole opening, in effect producing a lop-sided hour-glass section to the hole. Evidence of a second perforation can be seen on the edge of the broken end. This may suggest that the process of perforation was responsible for breaking the pendant or that the process created a weak spot across which a fracture travelled and eventually caused the object to break. Small fresh breaks indicate a small amount of relatively recent damage. The object is difficult to date because of its provenance, but it can be compared to a similar, although slightly longer, example from Upper House Farm, Derbyshire (Hart, 1985, 57, Fig.3.4). This example was found as part of a surface artefact scatter but was associated with flakes of polished stone axes and pot sherds identified as being of Ebbsfleet
style Peterborough Ware (*op. cit.*). Another two examples were recovered from the eastern chamber of a megalithic chambered cairn at Dyffryn Ardudwy, Merioneth, Wales (Powell, 1973, 26, Plate XI: Lynch, 1969, 155). Unfortunately one of these was recovered from the loose filling of a cavity left by a fallen orthostat and the other from a disturbed, mixed, deposit in the chamber. The result is that neither can be directly associated with other datable finds, but it is interesting that the example from Derbyshire and the two from Wales are all found in relation to late Neolithic finds or structures.

With evidence of a hole at both ends, the artefact recovered during the course of this research may be interpreted as a wrist guard, an artefact generally associated with the early bronze age. This was an idea put forward for the Welsh examples, although Powell (1973) was unable to find any comparisons and Lynch concludes that the two objects were too fragile both in section and strength of body to have served this purpose (1969, 29).

Fieldwalking also picked up 'new' structural features. At NY 68923051 evidence of a sub-circular, stone built, structure with what appear to be linear walls radiating from the southern side was documented (Fig. 7.21, site no. 463). These features correlate with the undefined features identified from APs but unfortunately the surface vegetation of tussock grass and ferns made it difficult to define the structure even on the ground. Adding to the difficulty in defining the structure was the modern field drainage system. Gullies running north east to south west across the area had been dug and stone which had been dug up in the process was laid to the side of the gullies, in effect forming 'linear stone features'. These accidental features were in places difficult to distinguish from the 'intentional' features. The only means of recording the structure in detail would be through excavation which, considering the terrain, the time limitations and accessible labour, was unfortunately beyond the scope of this research.
One of the main reasons for walking the micro-region was to confirm, or refute, the linear features and ridge and furrow recorded during the AP survey. The conditions were ideal for this purpose. During the period of field survey a light snow shower highlighted the earthwork features in the area particularly around Hill Plantation and Burney Hill. The scale of preservation was particularly notable.

Where the linear earthworks come into contact with the valley mires it was not, however, clear whether the banks originally continued across the valley but had subsequently been covered in peat. Some peat had certainly formed across the terminus of the earthwork on both sides of the mire just north of the pollen sampling site. A series of cores taken across the mire did, however, confirm that the banks did end at the edge of the mire.

Respect of the mires and water courses may be explained by the fact that these topographical features served as natural, functional substitutes for the linear banks. In any case it would be physically very difficult to construct the earthworks on the wet and boggy environment of the mire surface and impossible across running or standing water.

Unfortunately, the field survey work was unable to provide additional dating evidence for any of the features recorded during the AP survey. As a result it was decided that three small scale excavations would be carried out in an attempt to retrieve some form of dating evidence and to record the construction matrix of the linear banks.

### 7.3.2 Excavation

Three rectangular trenches were excavated. Two were located on the boundaries around Hill Plantation and the third on the boundary running north west from Pondfield Plantation.

**Trench 1**

Trench 1 was located at NY 66802975 at the edge of an area where ridge and furrow overlies a linear boundary. It was hoped that this would not only indicate the level of damage caused by medieval cultivation but would also confirm the relationship between the two earthwork features.

The trench measured 3m north east to south west and 1.5m south east to north west and was deturfed by hand. This revealed a uniform mid-brown sandy clay which extended diagonally across the trench (Fig. 7.23a). A band of small stones was confined to this layer and both corresponded to the line of a medieval cultivation ridge.

On removal of the sandy clay layer (context 101), a mid/light brown context (102) was encountered running east from the centre of the trench for 2.5m. This in turn overlay context 103, a light brown/tan clay similar in extent to 102 but with its western limit only partly overlying 105. To the east this context merged into the disturbed material defining the medieval cultivation furrow.
Plan 1: On removal of (101)

Plan 2: On removal of (102)

Plan 3: On removal of (103)

Fig. 7.23 Howgill Castle plans of Trench 1 excavation.
Fig. 7.24 Section through Trench 1.
Removal of 102 and 103 exposed context 105, a dark yellow/brown sandy silty clay clearly running north to south across the trench. On excavation it was clear that this represented the fill of a trench. The fill was not a uniform matrix: whilst the lower fill was largely clay, the upper fill consisted of large round, sub-round and subangular stone with an intermittent spread of carbonised material around and below these stones. The latter probably represents a buried turf layer. This layer of stone and carbonised material was level with 104 and 106, the sterile grey layers to the west and east of 105 respectively. Both appeared to represent the contemporary land surface, although 104 contained heavy mottling.

The excavation revealed three phases of activity. The first phase comprises a shallow trench cut into the natural sub soil possibly as a foundation for a stone built boundary. If this is the case, the boundary must have been removed and the trench infilled prior to the construction of the overlying bank. The second phase of activity is represented by the construction of the bank. The fact that the buried land surface on either side of context 105 does not appear to have been covered in turf suggests that the surface vegetation was cleared prior to the construction of the bank. It is possible that the turf and remaining stones from the original boundary were scraped into the trench in order to level the ground surface. The bank itself has a matrix of sandy clay mixed with small fragments of quartz, limestone and sandstone. The fact that the construction material spreads to the east of the trench and is mixed, is probably the result of 'drag' from the final phase of activity, medieval cultivation (Fig. 7.23b). Ridge and furrow lies to the east and slightly overlies the bank, with no evidence of this on the west side. However, the western edge of the bank is less clearly defined on the surface and in section appears to be due to a greater depth of turf and topsoil (Fig. 7.24). This would suggest that, although medieval cultivation practices have degraded the bank on the eastern side, it is modern pasture improvement techniques which have spread both the bank matrix and the medieval ridge and furrow to the west.

**Trench 2**

The largest trench (Trench 2) was located at NY 67972995, at a right angled bend in a linear bank to the east of Hill Plantation. It was hoped that a trench spanning the angle of the bank would not only help in the understanding of the construction of the boundary but would also establish whether the two boundaries were contemporary or successive. It was also hoped that some form of dating evidence would be recovered.

The trench measured 6m north east to south west by 8m north west to south east. Tuft was removed by hand to expose context 203, a stony silty sand which formed the upper surface of the bank matrix. The bank measured approximately 5.5m wide and appeared to have been constructed as a single event. The ditch did not appear as an obvious feature at this time. A section 1.5m wide was excavated across the full width of the trench to determine the matrix of the feature. Layers were removed in sequence and both north- and south-facing sections were drawn (Figs. 7.25a and 7.25b). Context 203 was removed in 10cm spits. On removal of the first 10cm, context 213 was encountered, a humus rich, fibrous deposit which spread east for approximately 2m from close to the middle of the bank (Figs. 7.25a and 7.25b). The extent of this deposit was greatly reduced in the northern half of the trench where it appears as a spread approximately 60cm long (Fig. 7.25b). Below 213 was 214, an orangy brown silty sand layer containing small limestone chips and
Fig. 7.25 Sections through Trench 2, Howgill Castle.
lenses of dark loamy soil was encountered. At its western extent 214 was found to overlie 203. The main deposit was very similar in character to context 203, with the darker lenses probably being the result of animal activity, particularly moles.

The removal of 214 revealed 205, another shallow humus rich deposit, very similar in character to 213 but underlying 203. Context 203 was completely removed to reveal 206, a very similar deposit to 203, but containing more frequent limestone chips and a greater clay component.

The trench needed to be extended by 1.3m to the north west to include the ditch profile. Due to time constraints only the north west corner of the trench was extended. On excavation the ditch was found to be only 70cm wide and 65cm deep (to the current ground surface). The ditch was filled with contexts 203 and 206, both of which spread continuously from the west and east. The base of the ditch was lined with 212, a sandy silty clay which appears to have been cut into to produce the ditch. A mound of the same deposit is evident to the east of the ditch profile (Fig.7.25b) and may have been placed as the primary construction deposit for the bank.

In conclusion it is suggested that context 205 represents a turf layer, probably the original buried land surface, and 203, 206, 210 and 212 the bank construction material. Judging from the extent of 205 it would appear that the turf was cleared prior to the construction of the bank and that 206 was placed directly on the cleared ground surface and followed by 203. The difference between 203 and 206 is so subtle that it may simply be the result of mixing by animal activity. The bones of a mole's jaw were found adjacent to the large limestone boulder visible in the north west facing section (Fig. 7.25a).

Downslope of the mound the stratigraphy is interesting and is interpreted as phases of instability and stability. A period of erosion is represented by 214, a deposit very similar to 203 but more mixed in character. This overlies both the original turf layer 205 and 203 and appears to have resulted from a slump of bank construction material down hill. This 'event' is followed by a period of relative stability when a second layer of turf (213) was able to become established. This forms over the redeposited material (214) and, at its western edge, over 203 the bank construction material, although this is only evident in the north west facing section (Fig.7.25a). Another phase of instability is represented by the erosion of context 203, which again appears to move downhill covering the second turf layer (213). The contemporary turf layer must represent a second, relatively stable, phase.

The fill of the ditch suggests that during periods of instability bank material also slumped to the west, almost levelling the upper edge of the ditch with the bank. The interleaving of contexts 220 and 221 with 203 and 206 indicates that the ditch was also receiving erosion deposits from the steep slope to the south of the bank.

Whether these phases relate to climatic epochs or phases of landuse is unclear. The fact that the second turf layer (213) is not evident across the full width of the bank indicates that it had been removed either intentionally prior to erosion or as a result of erosion. Either way, the removal of turf would perpetuate the
momentum of the erosion particularly on the steep slopes both above and below the linear bank. A combination of a wet climate and the grazing of stock may well have initiated the phases of edaphic instability. Trample and grazing would serve to remove the turf layer, particularly in wet conditions, with the ground then being prone to colluvial action down slope. Unfortunately no dating evidence was retrieved during the excavation.

**Trench 3**

A third trench (Trench 3) at NY 67832998 was positioned on the same boundary bank as Trench 2 but at the terminus adjacent to the valley mire, approximately 110m north east of the pollen sampling site. It was thought that if the physical relationship between the mire and the linear banks could be established it might be possible to suggest a relative date for the linear banks. Because of time limitations it was decided to excavate only to the upper surface of the boundary bank. It was assumed the matrix of the bank was much the same as that revealed in Trench 2.

![Fig. 7.26](image)

**Fig. 7.26 Howgill Castle: terminus of a linear boundary, Trench 3.**

Trench 3 measured 3m north west to south east by 1m north east to south west. The surface vegetation was different in the two halves of the trench. The north eastern side was covered in rough pasture grass, whilst the south western side was covered in peat and tussock grass. The surface vegetation was removed by hand. The turf and topsoil on the northern side were found to be approximately 9cm deep and the peat on the southern side 15cm deep. Context 301, a light orangy brown sandy clay, was encountered beneath both vegetation types and was comparable to context 203 in Trench 2 (Fig. 7.25a and b).

On removal of the surface vegetation it was evident that the boundary bank was sloping down towards the south western half of the trench and curving towards its terminus (Fig. 7.26). Although the very tip of the bank was not revealed it was clear that the boundary bank terminated at the edge of the valley mire. The 15cm of peat lying on top of the boundary has obviously formed since the construction of the bank. The radiocarbon date of 3577 cal. BC, which was determined from a sample taken at a depth of 23-24 cm in the pollen core, offers a terminus ante quem for the construction of the boundaries. However, it is not possible to establish at what point since the early neolithic date the bank was constructed. The 15cm of peat lying over
the terminus of the boundary bank has probably formed since the medieval peat cutting, but may represent an expansion in the width of the valley mire in relatively recent times.

On morphological grounds the earthwork boundaries may be described as prehistoric linear boundaries as defined by the Monuments Protection Programme Monument Class Description (Raymond, 1987). The main components of these features are described as earthworks comprising single or multiple banks and ditches. The examples at Howgill conform to Raymond's description, which states that where banks survive they are of simple dump construction and are usually located on the downhill side of the ditch. Raymond also records that banks rarely exceed a height of 0.5m or a width of 3m and, although they will have been much reduced from their original profile, the size of the ditch means that it is unlikely that the banks were ever massive features (op. cit.). The Monument Class Description also suggests that the ditches are the most likely feature to survive with measurements ranging between widths of 1.5m and 6.0m and depths of 0.4m and 2.0m. At Howgill the ditch is less prominent than the bank and is so slight by comparison it is difficult to believe that the ditch provided all the material used in the bank construction.

Clues to the date of the boundaries at Howgill can only be conjecture based on evidence from other areas. In Yorkshire for example field systems and land boundaries are recorded for the first time in c. 1400bc when creation of the boundaries coincides with the appearance of the first major defended settlements such as Thwing (Manby, 1979). In other areas the relationship between linear earthworks and earlier bronze age round barrows has been noted (cf. Laurie, 1985, 115-135: Bradley et al., 1994) and used to provide relative dating evidence for the boundaries. Unfortunately, though, the chronological evidence is generally spatially separated and is not sufficiently refined to allow for the monitoring of modifications to established boundaries. Raymond's synthesis of evidence for prehistoric linear boundaries indicates that the origins of this monument class lie towards the end of the earlier bronze age, with their development and use continuing during the iron age (1987). Individual sites remained in use for varying lengths of time, with some systems continuing in use from the bronze age into the iron age, whilst others were only constructed in the late iron age and provide little evidence to suggest that they occupied a significant position in the landscape after this period.

Higham (1978) has recorded a number of dyke systems in North Cumbria, two of which fall just outside the study area. At Shap Wells (NY 579091) the close association between a small hillfort and neighbouring dykes suggest here at least dyke construction predates the Roman occupation (op. cit., 143). Although acknowledging the lack of direct evidence, Higham suggests that it is likely that many of the dykes and their associated celtic fields and settlements already existed in the pre-Roman iron age. It is interesting that at Dufton (NY 702232), just 6km south of Howgill in the Pennine foothills, an "incomprehensible tangle of dykes suggest abandonment and later reconstruction or modification of dyke systems which have only survived in limited sections" (op. cit.). The physical description of the remains at Dufton certainly indicates similarities to those recorded at Howgill. Again Higham (op. cit.) suspects a pre-Roman iron age date for these examples.
It is interesting that the boundaries at Howgill survive as prominent features of the landscape. Even taking account of the level of erosion noted in the section of Trench 2 (Fig. 7.25 a and b), the boundaries around Hill Plantation would not have offered a physical deterrent to either animals or humans. No evidence was found to suggest that a timber palisade or hedge, which may have presented a physical barrier, was part of the boundary construction. The slight nature of the boundaries suggests they did not have a defensive purpose. Raymond suggests that prehistoric linear boundaries were probably regarded in a holistic way as symbols, often with religious associations, for the societies who built them (1987). They were a means of minimising friction between neighbours and in some areas as barriers against straying or raiding of cattle. From the association of dykes, settlements and celtic fields in north Cumbria, Higham argues that groups of households were sharing responsibility for and the benefit from the enclosures, which themselves are indicative of a community with an expanding population capable of collective decisions and actions (1978).

Spratt suggests that the boundaries on the North Yorkshire Moors represent farm or ‘estate’ boundaries in a predominantly pastoral economy (1981). In other cases, particularly in Wessex, the boundaries have been found to overlie earlier field systems and have been taken to indicate a major change in land-use and land organisation, perhaps as a result of climatic and economic change (Raymond, 1987). Alternatively the boundaries may represent an attempt to establish territories under conditions of communal competition. Some of the dykes seen to delimit areas of specific landuse, such as those on the southern boundary of Wykeham Forest, Yorkshire, seem to define an area given over to pastorialism and ceremonial burial under both round and square barrows (Spratt, 1989).

Manby (1979) suggests the development of linear boundaries is characteristic of an emerging centralised authority which developed side by side with new forms of land control. Pierpoint (1981) argues that such a major transformation in social structure and in the relationship between land and society is a result of pressure from an increasing population at a time when agricultural land was, if anything, decreasing because of environmental deterioration. The second millennium witnesses a deterioration in the upland landscape, with the development of moorland peats and significant evidence of population increase. Development of physical boundaries to divide up the land at this time implies that “the old system of ritualised power was no longer adequate - some kind of enforced power replaced it - the new world of land boundaries, fortifications, bronze weaponry and centralised authority” (op. cit., 53).

The peat cutting activities of the medieval period mean that the vegetation history data are unable to offer clues to the type of landuse or social structure which may have necessitated the construction of extensive land boundaries at Howgill. The archaeological excavations indicate that the boundaries were built on a land surface cleared of vegetation and there is no evidence of tree throws or root disturbance to suggest that the vegetation preceding the construction of the bank was one of woodland. At both Great Rundale and Bank Moor the early bronze age is a period of open woodland with evidence for human interference at both sites. This continues into the later bronze age and ultimately the iron age when at Great Rundale the area witnesses an almost complete degradation of woodland and Bank Moor is characterised by an open grassland environment. This generalised vegetation history indicates that at two other micro regions within the study...
Fig. 7.27 The micro-region of Bank Moor showing the distribution of archaeological sites.
area the vegetation would have been open and therefore conducive to the construction of extensive linear boundaries. However, the mainly local and extra-local pollen catchment at both these sites makes it impossible to predict the vegetation cover during the same period at Howgill.

What may be possible is to extend beyond the study of linear boundaries *per se* to the study of complete territories, as Spratt has done in the Tabular Hills, north east Yorkshire (1989). Bradley suggests it is only at this level of discussion that there can be much prospect of relating such material to the broader pattern of settlement (1994). In the case of Howgill it may be that clues to the date and construction of the linear boundaries lie in the D shaped enclosure recorded to the east of Swinethwaite Plantation (Fig. 7.21 site no. 297) or the scanty evidence of settlement remains which were recorded in the north east corner of the micro-region. Only more extensive investigations will be able to shed light on the construction of the earthworks. At present we can only suggest that the boundaries were constructed sometime from the early bronze age and the late iron age.

The stone boundaries to the north and south of Pondfield Plantation (Fig. 7.21 site no. 462) are even more difficult to date. Again, stone boundaries may well date from bronze age, but all we can say in this case is that they predate the medieval ridge and furrow which is overlying the remains of the boundary.

### 7.4 Bank Moor

Due to time limitations it was not possible to carry out primary field work in the micro-region around the Bank Moor pollen sampling site. This region was selected for exclusion on the basis that it had, in the recent past, already been part of a systematic field walking project, the results of which were easily accessible (Cherry and Cherry, 1987). It was felt that the quality of archaeological data available would be comparable to that collected as part of this research in the other micro-regions. The micro-regions would still therefore be comparable in the final analysis.

The archaeological record around Bank Moor (Fig 7.27) is discussed in detail in Chapter eight, where the integrated archaeological and palynological data are considered in conjunction with what was already known about the micro-regions and the study area as a whole. This will enable the questions presented in Chapter five (Fig 5.1) to be addressed.
ARCHEOLOGICAL AND ENVIRONMENTAL INTEGRATION: THE ENHANCEMENT OF THE PREHISTORIC LANDSCAPE

The previous chapter described the results of both the archaeological and palynological analysis carried out as part of this research and the conclusions reached. The intention of this chapter is to combine this evidence with what was already known about the micro-regions and the study area as a whole and to try and address the questions presented in Chapter five (Fig. 5.1).

8.1 The effects of preservation

One of the aims of this research is to integrate archaeological and palynological data in order to reconstruct the prehistoric landscape. The first obstacle encountered was the difference in preservation of archaeological and palynological evidence. This is particularly evident in the truncation of the pollen cores at both Temple Sowerby and Howgill Castle, as a result of medieval peat cutting. At Howgill this has ensured that there is very little if any temporal overlap between the archaeological and palynological record (Fig. 8.1). At Temple Sowerby only with the tentative use of the peat accumulation rate (Fig 6. 4) can the vegetation history be extended back from the middle of the late mesolithic to include the early mesolithic. As discussed, the pollen profile has been truncated before the end of the early neolithic precisely at the time when material artefacts appear in the archaeological record. Only at Bank Moor does the temporal span of the vegetation history completely overlap with that of the prehistoric archaeological evidence and this is discussed in more detail later.

Despite the limited extent of the temporal overlap, the data can be used in a complimentary fashion. Because the archaeological data collected is known to relate to the same geographical space as the palynological evidence, the records serve to compliment each other. At Temple Sowerby, for example, it may not be possible to reconstruct the vegetation history of the bronze age but the artefactual evidence shows quite clearly that the area was being utilised at this time. Similarly, the vegetation history indicates some heathland manipulation during the early mesolithic, but this period is not represented in the recovered artefactual evidence. Spatial integration of the two data types does allow one to suggest that there is settlement continuity within the micro-region from the early mesolithic through to at least the late bronze age. The pollen evidence simply poses a challenge to the archaeologist to locate the material remains relating to this period of landscape utilisation. In the same way the archaeological record poses a challenge to the palynologist to find a suitable sample site which covers this period.

8.2 Intra-regional variation: a true reflection of human activity?

The results of the palynological and archaeological investigations indicate a level of intra-regional variability within the study area, but in order to assess the extent of this it is necessary to consider these results in
Fig. 8.1 The temporal span of the archaeological and palynological records before and after the current research.
relation to what was already known about the prehistoric landscape. The following section takes each micro-region individually and attempts the reconstruction of the prehistoric landscapes using an integrated approach.

8.2.1 Temple Sowerby

On the typical stagnogley and alluvial soils which overlie the buried red sandstone geology around Temple Sowerby the archaeological evidence has indicated prehistoric activity from the late mesolithic to the late bronze age. It is suggested from the field walking evidence that during the late mesolithic-early neolithic the river terraces were important and formed the focus of activity (Fig. 7.1). In fact, taken in isolation the archaeological evidence could indicate that the river terraces were selected for activity (whatever form this might have taken) almost to the exclusion of other areas investigated within the micro-region. The palynological evidence compliments this by indicating that the increasingly closed and expanding mixed deciduous woodland was also being exploited at this time. In conjunction with the microscopic charcoal evidence the pollen data suggest that throughout the late mesolithic the woodland understorey was being subjected to forest fires. Although it has been suggested that this was a deliberate attempt to promote new growth attractive to game or for driving game towards hunters, it is difficult to prove intention in these circumstances and some of the fires may have started by accident either by humans or natural agents. In the case of Temple Sowerby, however, peaks in charcoal of the larger particle size correspond with troughs in the levels of *Calluna* pollen, but levels of pollen from other taxa do not appear to have been affected. Such evidence is used here to argue that the burning was carried out in a fairly controlled and deliberate manner.

From a study of the published evidence for forest burning in pre-neolithic contexts, Mellars has identified a clear geographical pattern (1976, 33). Most of the available evidence comes from upland localities in the northern and western areas of Britain, usually above 305m OD. Exceptions to the rule generally come from sites located on the poorer quality sandy soils of southern England. Temple Sowerby is situated at 110m OD and therefore falls outside the general distribution identified by Mellars, but the sandy soils developed from northern drift deposits and the underlying Triassic Red Sandstone may have been a determining factor in the use of fire at these sites. Mellars (1976, 33) explains that the better drained soils, more open tree canopies and richer ground vegetation of the woodlands which developed on the poorer quality soils of lowland Britain would have been more analogous to those characteristic of upland areas and accordingly much more vulnerable to the effects of fire. At Temple Sowerby the quantity and diversity of herb and shrub pollen indicate that the woodland canopy was fairly open and certainly by the early neolithic the vegetation at Temple Sowerby was more comparable with that at Great Rundale at 699m OD than at any of the other sites studied. The fact that pine is present in the canopy would also increase the susceptibility of the woodland to accidental or deliberate use of fire.

Although the pollen data has been truncated at the early neolithic level, artefacts recovered from Temple Sowerby indicate a continuity in the use of the area until at least the late bronze age. By this time activity areas are less concentrated around the water bodies and more focused on slightly higher better drained areas. This change of focus may be taken to indicate a move towards economic diversification. The better drained soils would certainly have been more conducive to arable agriculture and evidence of cereal cultivation in
Cumbria and Northern England during the late neolithic - bronze age is widely available (cf. Walker 1966; Chambers, 1978)

Arguments for the expansion of arable agriculture during the bronze age may be substantiated by the two stone axe hammers recorded in Temple Sowerby. Bradley has argued that in Cumbria there may be a relationship between the distribution of perforated stone mace heads and axe hammers and areas used for cereal growing (1972, 201-202). Both have lowland distributions and are frequently found in isolation which, Bradley argues, substantiates the idea that mace heads may sometimes have functioned as digging stick weights and axe hammers as the tips of ards. Bradley does, however, question whether this was their only or original function but cites evidence from Gwithian in Cornwall where a broken axe hammer was found in an ard furrow (Thomas, 1970, cited in Bradley, 1972, 201). Bewley suggests a similar use for axe hammers but argues that the similarities in the distribution of axe hammers and polished axes suggest that if the axes were used in the Neolithic for felling trees, then axe hammers were perhaps used as tips of ards, and suggests a continuity of land use from clearing to cultivation on particular pieces of land (Bewley, 1994, 60).

In Weardale Young (1987, 32) has shown a contrast in the distribution of the polished neolithic axes which are all found around and above 307m and the perforated material which, with one possible exception, comes from below 307m on the terraces and lower slopes. The evidence is again used to suggest that perforated stones, particularly mace heads in this case, may have functioned as digging stick weights.

The occurrence of chronologically mixed assemblages, however, in both river terrace contexts and on the slightly higher better drained areas around Temple Sowerby may indicate that the bronze age economy was not entirely arable. The sites close to waterbodies clearly remained important but hunting and possibly pastoral farming may also have played an important if not dominant role. Artefacts recovered from Skirwith Moor (site no 305), just 4km north of Temple Sowerby, on the northern edge of the study area, do support the assumption that hunting was playing an important role in this area. A total of 31 arrowheads including 16 barbed and tanged and 15 leaf-shaped examples was found along with 4 flint knives, 7 scrapers and 5 polished stone axes (Cherry and Cherry, 1993). In functional terms, with the exception of the polished stone axes which may have been used for the purpose of woodland clearance, all these artefact types can be associated with hunting animals or the preparation of skins and carcasses. The inclusion of both leaf-shaped and barbed and tanged arrowheads in the scatters indicates activity spanning from the early neolithic to at least the early bronze age. The lack of arrowheads from Temple Sowerby may suggest that hunting was not practised within the micro-region itself at this time. However, it is unlikely that arrowheads would be recovered from the area of the moss because any artefacts dating to this period will either have been removed through the process of peat cutting or in areas which have escaped the cutting will have been buried within the peat. Skirwith Moor and other moorland areas to the east are within easy walking distance of Temple Sowerby and would probably fall within the site catchment of any communities based around the area.

Direct evidence of settlement around Temple Sowerby during the prehistoric period is not available, but manipulation of the woodland throughout the mesolithic may indicate at least a certain degree of sedentism if
only on a seasonal basis at this time. The preference for riverside locations during this period is well documented (Bewley, 1994) and accessibility to a variety of resources would make the area around Temple Sowerby a potential base camp for communities. The physical remains of such a settlement are not, however, available.

Evidence of settlement may lie in the cropmarks identified from aerial photographs, particularly the D shaped enclosures recorded in fields TS 1 (Fig. 7.1 site no. 464) and TS 11 (Fig. 7.1 site no.5), both of which are very similar in form, with suggestions of hut circles attached to the internal face of the enclosure. Settlements of this nature are generally considered to be Romano-British in date, but the very limited excavation of crop mark sites and the overall morphological diversity that is now being identified (cf. Bewley, 1993) make it difficult to assign the sites to any particular cultural phase. Field walking did not identify concentrations of artefacts in these areas but it may be significant that, with the exception of a core which shows evidence of both blade and flakes having been removed, all artefacts from TS11 are late neolithic - early bronze age in date. In field TS1 with the exception of group B (Appendix 3) and two isolated finds, all the groups are chronologically mixed. Only excavation would allow the detailed analysis of the underlying archaeological deposits.

8.2.2 Howgill Castle

As at Temple Sowerby, the soil around Howgill is also typical stagnogley formed from northern drift deposits overlying the red sandstone geology. Here in the foothills of the Pennines the soil is thinner and the ground steeper leading to a current land use of permanent pasture and coniferous plantation. Such landuse negates the possibilities of fieldwalking as a field survey technique, but is conducive to the preservation of earthwork remains. As discussed above (Chapter seven), the study of the aerial photographs identified a number of earthwork features in the micro-region and has potentially extended the period of human activity in the area. Unfortunately the lack of direct dating evidence and the fact that none of these features can be easily classified on morphological or other grounds into one particular cultural phase make their interpretation difficult. It has been argued that the land division boundaries were constructed some time from the late bronze age to the iron age, but the current level of knowledge cannot narrow it down any further. Likewise, although the stone pendant found at Howgill (Fig.7.22) appears typologically to date to the late neolithic, its lack of archaeological context means that little confidence can be placed on this date.

Interpretation of the palynological evidence is equally problematic, not least because the pollen core has been truncated from the end of the early neolithic. It is clear that from c.7316 cal. BC, the open Coryloid and Betula woodland was becoming increasingly mixed, with Pinus, Ulmus and Alnus becoming established. By the late mesolithic the density of the woodland had increased, but by c. 6400 cal. BC openings large enough to encourage the light-demanding Rosaceae species to appear for the first time are evident. The early neolithic environment is dominated by dense woodland, but cereal type pollen is evident from c. 4009 cal. BC and is associated with a slight increase in the diversity of herb taxa including the appearance of Calluna.
In summary, although the archaeological potential of the micro-region around Howgill Castle is not in doubt the field survey carried out over the course of this research merely forms a starting point from which discussion about land division and landscape utilisation can begin. There is a need to extend beyond the constraints of the micro-region in the hope that dating evidence may be provided by the association of the boundaries to other datable monuments.

8.2.3 Great Rundale

According to the palynological evidence the hill peats overlying the gritstones around Great Rundale have been developing since the end of the early neolithic. The radiocarbon dates suggest that at the sample site peat development began c. 3350 cal. BC, but timbers of *Salix* and *Betula* protruding from beneath the peat indicate that trees had colonised the area prior to this.

The archaeological evidence, however, has identified activity areas associated with late mesolithic - early neolithic stone tool production/modification. These were found between 40cm and 45cm from the base of the peat which according to the peat accumulation rates gives a date of between c.2624-2514 cal. BC, a late neolithic context. Although a later use of a blade type technology cannot be ruled out, it is argued that peat accumulation was not consistent over the upland areas and this is something already noted by Johnson and Dunham (1965, 145). It is interesting that Cherry recovered blade-type flint artefacts from within the peat between the head waters of the Tees and Crowdundle Beck, just a few hundred meters from Cross Fell (Unpublished note on SMR no 3923). Two groups of flint were found within a few meters of each other and these too have been interpreted as possible mesolithic flint working sites (site no. 262).

With the exception of the lithic scatters, the archaeological evidence is restricted to two cairns, one of which (site no. 157, Fig.7.16) is the most northerly in a widely spaced line of cairns running north east to south west from High Scald Fell to Brownber Hill. The line runs between Great Rundale Beck to the south and Swindale Beck to the north. The line marks the division between the two watersheds and begs the question of whether it functioned as a political or territorial boundary in a similar way as those identified on the North Yorkshire Moors (Spratt, 1981).

The second round cairn lies in isolation roughly equal distance from Seamore Tam and Great Rundale Tam (site no 158 Fig. 7.16). Isolated cairns are generally associated with either bronze age burial or field clearance, but without archaeological excavation it is often difficult to distinguish between the two types. Although it would be impossible to identify individual events or series of events from the temporal resolution of the palynological record, it may be possible to suggest that the cairn relates to a period of human activity identified in the pollen record at c.1473 cal. BC. At this time a peak in cereal pollen, preceded by relatively high levels of charcoal in both size classes (but particularly the larger size), indicates activity in the locale of the sampling site. At this time the overall diversity of herbaceous species was declining and this poses the question of whether some of the local 'open areas' were being turned over to small scale or temporary cereal cultivation at the expense of other herbaceous habitats. However, the increasingly open vegetation at Great Rundale at this time would be more conducive to the influx of pollen from a regional source and it is
possible that the cereal pollen has been transported to the site from elsewhere. Certainly, cereal cultivation would not be possible on the peat and there is no evidence to suggest that areas of mineral soil were still available by this time. It is possible, however, that the cereal pollen entered the palynological record through other forms of human activity, either domestic or ritual, both of which could also account for the high levels of charcoal.

It may also be significant that four of the six lithic scatters lie just 250m to the east of this cairn. Although it has already been argued that the lithic scatters are late mesolithic-early neolithic and the cairn bronze age, we could be looking at further evidence of continuity in the selection of specific areas for activity. The cairn is situated at the very edge of the scarp at 699m OD and is the highest point between Knock Fell to the north and Mirton Fell to the south. It is possible that the visibility of the cairn was an important factor in prehistory. Intervisibility of arable areas through the use of mounds, particularly in areas where usable land was limited, is something considered by Young (1987, 32) in Weardale. The notion of intervisibility may equally apply to areas around Great Rundale where the cairn (site no. 158, Fig 7.16) would be visible from many parts of the Eden Valley. Although there is now no obvious association between the isolated cairn and the line of cairns to the north, it is possible that they relate and played a significant role as land boundary markers during prehistory.

By the end of the bronze age Calluna and Sphagnum spread whilst Betula and Quercus decline never to recover and after a peak at c. 959 cal. BC Coryloid declines. Following the woodland clearance in the early stages of the late bronze age the overall pattern of the vegetation is of expanding heathland.

With regards to the archaeological record it would appear that the prehistoric activity around Great Rundale ended during the bronze age, but the palynological record provides further clues to human activity after this cultural phase. Further opening of the vegetation cover at Great Rundale is evident from c. 183 cal. BC, with significant reductions in all tree species and Coryloid. This corresponds with increases in Gramineae, Calluna and Plantago lanceolata. Although the expansion of plantains and other herb taxa may be explained in terms of human intervention, the evidence is scant, but by c.100 cal BC an increase in charcoal coincides with a reduction in Betula, Alnus, Quercus, Coryloid and Filicales. In response Gramineae, Cyperaceae, Calluna and Pteridium expand suggesting renewed human activity. An increase in the frequency and quantity of cereal pollen may be taken to suggest a phase of arable agriculture, but as discussed above it is unlikely that cereal cultivation would be possible on the peat. It is possible that the introduction of the cereal pollen into the palynological record was still the result of human action.

8.2.4 Bank Moor

Bank Moor has proved to be the ideal site from both a palynological and archaeological point of view. The temporal span of the pollen overlaps that of the archaeology and as a whole provides a type site for assessment of the methodological approach adopted.
From the early mesolithic the surrounding vegetation was one of open grassland with small stands of *Betula* dominated woodland. By the late mesolithic open grassland was rich in herbaceous taxa and the small woodland stands more mixed. From c.5900 cal. BC high charcoal levels are recorded in the pollen core but these do not correlate with fluctuations in the local vegetation. The majority of the charcoal is recorded in the smaller size class and probably originates from more distant fires. It is interesting that it is within a late mesolithic context that burning of the woodland understory is recorded at Temple Sowerby. This is not to imply that the charcoal has originated from Temple Sowerby, but it does substantiate the suggestion that burning of vegetation, particularly woodland understory, was widely practised within the study area during the late mesolithic.

From an archaeological perspective it would appear that the area surrounding Bank Moor was being exploited during the late mesolithic. Although only one damaged microlithic back blade (Cherry and Cherry, 1987, 23 Fig 10, no.17) has been recorded within the micro-region, Cherry and Cherry have found a number of artefacts with mesolithic affinities (1987, 70) on the limestone plateau around the micro-region. Flint and chert microliths and micro burins were recorded at Windrigg Hill 6 (NY 579517), Wickers Gill 2 and 3 (NY 564121 and NY 564122 site no's. 379 and 380 respectively) and Kemp Howe 5 (NY 565130, site no. 383). Microliths and bladelet cores were recovered from Gamelands 2 (NY638085, Cherry and Cherry 1987, 34), and microliths from Tam Moor 4 (NY666082, op. cit., 40) and Ray seat 2 and 7 (NY 691068 and NY 684074 respectively, op. cit., 51 and 54), all of which lie just outside the study area. In all these cases, though, the artefacts have been found associated with those of neolithic form and are therefore difficult to associate exclusively with mesolithic communities.

In the early stages of the early neolithic there is an increase in trees and a reduction in herbaceous pollen, which is largely due to a peak in *Betula* with a corresponding reduction in *Corylus* and Cyperaceae. This is reversed in the later stages of the early neolithic when grasses spread beyond previous levels.

At this time the archaeological evidence within the micro-region is limited. Leaf-shaped arrowheads, a form which is generally considered to be an early neolithic form (Edmonds, 1995, 45), have been recovered (Fig. 7.27, site no's. 419 and 434) but are associated with chronologically-mixed scatters. It is interesting that the example from site 419 is made from chert and is associated with microliths and blades, precisely the characteristics used to identify late mesolithic - early neolithic lithic assemblages at Temple Sowerby. Such a date for site no. 419 is substantiated by the presence of heavily grit-tempered pottery, which is considered by Manby to be of neolithic type although it is not possible to be more specific (Manby In Cherry and Cherry, 1987, Appendix 1, 75). Cherry and Cherry also suggest a strong neolithic affinity on the strength of a fragment from the butt end of a polished axe of volcanic tuff (1987, 23) but this piece could be residual. The leaf-shaped arrowhead from site 434 (Fig. 7.27) is associated with undiagnostic flakes of various forms.

Further evidence of early neolithic utilisation of the landscape may come from the site of Raise Howe cairn (Fig. 7.27, site no. 179). The site is situated on the summit of a local high point and includes a largely turf covered, slightly mutilated, oval mound. The cairn is constructed of earth and limestone rubble, measures
approximately 9.5m by 8m, and survives to a height of approximately 1m. Although it is acknowledged that the cairn is slightly mutilated, its recorded oval shape could be of particular importance. Bradley and Edmonds consider slightly oval mounds or large circular mounds to be an early prototype of the long barrow (1993). The long cairn at Raiset Pike has been shown to comprise two earlier sub-circular cairns (Masters, 1984, 62). Each of the earlier monuments contained a burial trench which, from the description, is similar in form to the mortuary structures found on the Yorkshire Wolds (Clare, 1979). One of these had been set on fire and in common with other earlier neolithic practice elsewhere, the human remains from these deposits seem to have been disarticulated.

Another oval cairn was recorded by Greenwell (1877, 389; CLXXIV) in the parish of Crosby Garrett, approximately 3 miles to the south east of Bank Moor. Here, scattered and disturbed bones, both burnt and unburnt, of twelve interments were recorded in the southern half of the cairn. Distinct inhumation burials of two adult males were also located, one associated with a bone pin and two boars tusks and the second with an antler and mace head. Such a sequence is similar to that recorded at Whitegrounds barrow in the East Riding of Yorkshire (Brewster 1984). Here, the first period of activity which included the deposition of disarticulated bones in a form of mortuary house is dated to c. 3800 BC. Subsequent use of the site involved the excavation of a grave to house the articulated body of an adult male, accompanied by a jet belt ornament and a specialised type of polished flint axe of local manufacture. This happened c. 3300 BC (op. cit.).

Cremation of neolithic burials is not common in the north but is almost entirely absent south of Yorkshire where most comparable sites are located (Higham, 1986). In this sense Raiset Pike and Crosby Garrett show traits typical of the region but in other respects the evidence is unusual. Within the primary deposits only adult males are represented but within the secondary deposits children predominate. This representation is comparable to that at West Kennet long barrow (Piggott, 1962, 79) and Fussells Lodge long barrow (Ashbee, 1970) in the south of England, possibly indicating a network of long distance social interaction between occupants of the limestone ridge around Bank Moor and those in the south of England.

Other monuments on the limestone ridge to the west of Bank Moor may also date to the later stages of the early neolithic or possibly the beginning of the late Neolithic. Of particular significance here is the relatively recently discovered enclosure at Howe Robin (NY 62451043), approximately 2.5km south west of Bank Moor. The enclosure is protected by a massive stone wall up to 5m thick with an external segmented ditch. The site has been compared to the large defensive enclosure at Carn Brae, Cornwall (Ellwood pers. comm.). If such an analogy can be accepted, the site raises important questions about the social organisation of the neolithic communities living in the area. A number of ideas has been put forward regarding the function of such enclosures and although most of these are based on evidence from the south of England, there is a number of recurring themes developing from this research. Some sites, including Carn Brae, have produced evidence to suggest that they played a domestic role. Some of the enclosures contain quite extensive occupation areas and a large number of artefacts and provide the only evidence for nucleated settlement at this time (Bradley, 1984, 27). If the sites were inhabited, their scale and appearance certainly suggest that some groups had assumed a prominent place in society.
Their association with death and burial is also an important theme and has been discussed in detail elsewhere (op. cit., 31). The enclosure at Howe Robin is surrounded by a number of ring cairns and other monuments although the direct association is difficult to prove (Turnbull, 1997, 43). In Wessex the relationship between enclosures and burial monuments has led Renfrew to suggest (1973) that each enclosure dominated a specific territory defined by a cluster of burial mounds.

Perhaps of greatest significance with regard to the enclosure at Howe Robin is the connection made between the availability of raw materials and the location of enclosures. Bradley outlines two forms of association: "a general coincidence of location between southern enclosures and areas with accessible raw materials; and evidence that at least some artefacts were being made or finished on these sites" (1984, 27). Because of the lack of excavation or detailed field investigation such a relationship is difficult to establish at Howe Robin. It is, however, significant that it is during the later stages of the early neolithic that the importance of both the Langdale axe factories and the Eden Valley increased (Bradley and Edmonds, 1993). Based on the distribution of roughouts, large important ritual monuments, and the provenance of hammer stones recovered from the axe production sites, Bradley and Edmonds have proposed that by the end of the fourth millennium BC the larger production sites at Langdale were supplying roughouts to the Eden Valley for the purpose of polishing and finishing (1993, 150). The importance of the Eden Valley at this time may have been based on the long distance contacts that could be established through the region, particularly with regard to the major routeways through the Pennines. The national distribution of Langdale axes and other goods emphasises the extent of communication networks that had been established by this time (op. cit., 45).

The number of polished and roughout axes recorded along the limestone ridge and the large number of fragments of polished tuff recovered during Cherry and Cherry's work (1987) in the area certainly illustrate the movement of these artefacts across the region. Howe Robin is situated in an area which was clearly important to communities at this time and would have offered a prominent position at the very head of the Lyvennet valley for the control of such products. The scale of the monument, and its position on the crest of the ridge overlooking the watershed, may well be significant in any discussion about its use in the finishing and possibly the distribution of group VI axes. The open vegetation would certainly be conducive to the display and visibility of the monument over large areas of the valley to the north.

During the late neolithic the vegetation history indicates an overall reduction in the diversity of taxa but *Pteridium* is more frequent and *Selaginella* increases considerably, indicating an increasingly open environment. After c.2941 cal BC high levels of charcoal in the larger size class indicate the local use of fire either accidentally or intentionally. High levels of charcoal are recorded into the first half of the second millennium BC, although levels are not continually high throughout this period. This may imply a cyclical process but only high resolution pollen analysis would be able to substantiate this suggestion.

A corresponding decline in Cyperaceae pollen indicates that it was the sedges that were most affected by the fires. The expansion of wetland plants on the surface of the mire, throughout the period of high charcoal
levels, provides the only apparent evidence of the effects of burning on the surrounding landscape. It would appear that the removal of the surface vegetation served to increase surface water and created an increasingly wet environment. The pollen core lithography substantiates this, with the arrival of a finely stratified blue/grey organic clay into the peat deposit, the result of a process which is indicative of erosion of the surrounding basin.

As discussed above it is difficult to establish whether the use of fire in prehistory was deliberate or the result of uncontrolled natural fires. However, in the case of Bank Moor the very sudden and dramatic increase in charcoal deposition and the general maintenance of levels from the middle of the third to the middle of the second millennia BC does suggest a period of purposive activity. If, as suggested, one accepts that the clearance of the surface vegetation was deliberate, it clearly raises questions about the utilisation of the landscape around Bank Moor at this time. Clearance of sedges would not be necessary for the purpose of grazing and there is no evidence at this time for the cultivation of cereal crops which may require ground surface preparation.

By c.1950 cal. BC cereal type pollen is recorded for the first time albeit in very low quantities and not continuously in the pollen profile. Although herbs become increasingly diverse they decline overall whilst aquatics continue to rise until c. 1654 cal. BC and coincide with a greatly reduced pollen concentration. The first appearance of cereals coincides with a drop in the level of the larger charcoal particles but a slight increase in the levels of smaller charcoal particles. The reappearance of cereals at c.1388 cal. BC again corresponds with a significant drop in charcoal levels this time in both size classes. This could be interpreted in two ways: firstly that cereal cultivation was carried out on a fairly small scale, close to the sample site but did not involve the use of fire; or that cereal cultivation was practised at sites some distant from the sample site and therefore had a minimal impact on the vegetation record at the sample site. There is of course the possibility that higher resolution pollen analysis could identify cyclical patterns in the charcoal and cereal pollen record but on the current evidence it would appear that the cereal cultivation is not related to the microscopic charcoal record.

Within the micro region the chronologically-mixed artefact scatters, particularly those around the southern boundary (Fig. 7.27, site nos. 427, 433, 428, 432, 420, 422, 434, 417, 435 and 418), all relate to the late neolithic - bronze age periods. The two polished axes and a roughout of Langdale Group VI material (site no 176) date to the neolithic but a stone axe hammer recorded from the same location was in fact found in isolation and its exact provenance is unknown. Although documented on the SMR as the same site (SMR no. 1719), the axe hammer should be considered separately and on typological grounds dates to the bronze age.

Based on the distribution of leaf-shaped and petit tranchet derivative arrowheads recovered from the limestone ridge as a whole, Cherry and Cherry have identified that artefact scatters with distinct neolithic affinities are generally, although not exclusively, found in more sheltered situations on the lower slopes between 270m and 340m OD (1987, 71). Here the amount of occupation debris as a whole is generally greater than on the
higher sites and suggests the scatters represent domestic occupation. The distribution of barbed and tanged arrowheads on the other hand have led to the suggestion that there was a change of use of the uplands from the neolithic into the bronze age, with less emphasis on occupation and more on hunting (op. cit.). Bradley has argued that arrow heads are unlikely to be concentrated over arable fields or in thick woodland and suggests that their distribution might best reflect areas where tree cover was sufficiently thin to allow the efficient use of the bow (Bradley, 1972, 197). Use of the area for hunting is substantiated by the evidence of scrapers which, although not uncommon on the habitation sites attributed to the neolithic, are the principal tool form on sites associated with barbed and tanged arrowheads. The use of the area around Bank Moor for hunting during the bronze age is quite possible: the open landscape with small stands of mixed woodland would have provided habitats for a variety of fauna.

A change of landuse during the bronze age is supported by other forms of evidence, but the general impression is one of landuse intensification and diversification. Within the micro-region the most prominent form of archaeological evidence is provided by the numerous bronze age burial mounds (Fig. 7.27, site nos. 207, 206, 229, 175, 179 and 195). These lie at between 230m and 320m OD and form two distinct groups. The first group is situated in the eastern half of the micro-region and is positioned on the edge of the east facing scarp. The second group which includes sites 177, 179 and 195 lies in the western half of the study region and is positioned on the crest of the west-facing slope. Site 179 occupies the highest local point at 325m. Three more cairns have been identified by Cherry and Cherry (1987, Fig. 9) but these have not been confirmed as burial monuments. Site 455 falls into the eastern group and is situated on the edge of the eastern facing scarp. Sites 456 and 457 are both situated at approximately 315m OD and follow the line of the west facing scarp edge. It is interesting that the two groups of cairns mark the upper edges of two distinct water sheds: the River Lyvennet to the west and Scale Beck to the east, both being large tributaries of the River Eden. The marking of watersheds by a series of inter-visible round barrows has been used in support for the hypothesis that a natural system of territorial boundaries was in use during the Bronze age in the North Yorkshire Moors (Spratt, 1981, 95), the Peak District (Hawke-Smith, 1981, 57), and Weardale (Young, 1987, 30). Certainly the open landscape around Bank Moor would have provided few obstacles in the form of trees to impair visibility over quite considerable distances within the respective watersheds. Judging from the pollen profile from Bank Moor and that recorded at Sunbiggin Tarn (Webster, 1969), it seems that much of the limestone plateau was open and this may account for the area being selected for the construction and display of monuments.

Turnbull and Walsh have argued for the deliberate positioning of other monuments along the Lyvennet valley (1997, 13). Oddendale stone circle (SMR no. 1575, NY 592 129), for example, which lies approximately 5km to the west of Bank Moor, is situated within a few meters of the ridge of the watershed. The monument appears to have been deliberately positioned to command, and to be visible from, the Lyvennet valley to the exclusion of the view to the west, of the Lownther Valley and the lower parts of Wet Sleddale. The same has been shown to apply to other stone circles and cairns in the area (op. cit.).
Further evidence of landscape utilisation around Bank Moor during the bronze age comes from the caim field (Fig. 7.27, site no. 224) which is situated approximately 305m OD on the edge of a small raised area in the north west corner of the micro-region. The monument is simply recorded on the SMR as a caimfield with no detailed description of the number, size or layout of cairns present and unfortunately, the vertical aerial photographs available for this area were not of a large enough scale or adequate clarity to pick up the caimfield.

Groups of cairns are generally interpreted as an inevitable stage in the agricultural development of an area where, following perhaps many years of cultivation, stone clearance becomes necessary as a result of progressive soil deflation and impoverishment (Fleming, 1971). Other interpretations suggest caimfields are the result of stone clearance from a plot of ground prior to agricultural use.

Where sites have been recorded in detail and partly excavated, in addition to the presence of clearance cairns many caimfields have been shown to contain one or more burial monument, usually a round barrow or ring cairn (cf. Jobey, 1981). These can often be identified by their larger size, more careful construction, or the presence of some distinctive architectural feature such as a cist within the mound or a kerb around the edge. Small poorly preserved burial monuments will, however, look very similar to clearance cairns as field monuments and it may not always be possible to distinguish between the two (Raymond, 1988, 7).

At Birrell Sike, Cumbria, Richardson found each excavated cairn to be of a different construction, some retaining the old ground surface, others not (1982, 20). One example had a genuine kerb and core and included the intentional deposition of a piece of polished shale and a stone blade. Although Richardson specifies that the cairn was built for a specific purpose, he also states that it was not sepulchral or constructed during field clearance. At Bamscar, Walker concluded that the cairns were not clearance heaps but were raised for reasons unknown (1965). Despite this diversity recognised from the excavation of some caimfields, Bradley’s statement of 1972 still holds strong: "the status of the stone cairns in highland Britain still remains uncertain and while a number do include burials, some connection with land clearance is often hard to reject" (1972, 196).

Although questions have been raised about the date of caimfields (Yates, 1984, 231), most excavated examples place them within the bronze age. Radiocarbon dates from charcoal recovered from the buried land surfaces below clearance cairns at Millstone Hill in Northumberland and Birrel Sike in Cumbria have produced dates of 1690+/- 90 bc (2088 cal.BC; Har 1942; Jobey 1981, 35) and 1690+/- 100 bc (Birm 1063; Richardson, 1982, 21) respectively and therefore place them in a late neolithic - early bronze age context. If we accept that caimfields are generally associated with field clearance, a date in the late third or early second millennium BC does correspond with the date of c.1950 cal. BC recorded for the first appearance of cereal pollen in the pollen profile from Bank Moor. It is of significance that the primary analysis of a fragment from the butt end of a polished stone axe recovered from site no. 419 (Fig. 7.27) suggests that this piece may have been used as a hoe (Davis, no. 52: In Cherry and Cherry, 1987, 81).
Deposits of charcoal or burnt earth are recorded at a number of mound and cairn sites in the Cumbrian area, notably, Hawshead Moor, Birkrigg, Sunbrick (Dobson, 1927) Bolton Wood (Spence, 1937), Barnscar (Walker, 1965) and Birrel Sike (Richardson, 1982). At Birrel Sike Richardson found charcoal in varying quantities in all four cairns excavated, either in or below the body structure (1982). This he attributes to being the result of funerary or ceremonial rites or vegetation clearance in the vicinity. What is interesting is that where the old ground surface survives beneath the cairns there is no evidence of it having been burnt (op. cit., 21). This is in contrast to the evidence from Barnscar, Cumbria (Walker, 1965) and Millstone Hill, Northumberland (Jobey, 1981), where carbonised material from immediately beneath cairns is interpreted as the residue from previous burning off of the vegetation.

Although the lack of excavation of the cairnfield makes it impossible to identify the precise make up of the cairns at Bank Moor, it may be suggested that the high levels of charcoal in the pollen profile are related to the burning of the surface vegetation prior to the construction of clearance cairns. However, as discussed above, there appears to be a negative correlation between the high charcoal levels and the appearance of cereal pollen, so it seems unlikely that burning activities were associated with the cultivation of cereals. It could be argued, however, that the thin soils meant stone clearance was necessary prior to cultivation and that the burning of the surface vegetation was a prerequisite for stone clearance. In this scenario high charcoal levels would appear prior to the deposition of cereal pollen in the pollen profile. The main difficulty in testing such a theory is the temporal resolution of the pollen data. The 8cm interval between pollen readings fails to document between 300 years (above 128cm) and 500 years (below 128cm) of the vegetation history between samples, depending on the peat accumulation rates in the different sections of the pollen diagram (Table 6.1). Although high resolution pollen analysis was not intended to form part of this work, it would be the next stage of research and may help further to integrate some of the activities that are hinted at in the current pollen profile and the archaeological record.

Further evidence of agricultural practices is provided by the survival of regular field systems (SMR nos. 4280) on the limestone plateau to the west of the Bank Moor micro-region. Small scale excavation at the site (NY 56401090) has identified two distinct areas, east and west (Turner, V. 1984). The western area is a field system within which are more than 50 cairns and circular banks interpreted as hut circles. The eastern area contained seven possible hut circles some cairns and linear banks (Turner, V. 1984). It is unclear whether the field system was laid out deliberately in a designed arrangement or whether it was produced by field clearance which created linear field boundaries as opposed to more random cairn fields. Just 3.5km west of Bank Moor, to the south of Oddendale and positioned between the Seal Howe group of cairns (SMR no's. 1578, 1579 and 1580) and the River Lyvennet, is an extensive system of small rectilinear fields defined by low banks of boulders (NY59601250; SMR no. 3530). In places the field boundaries underlie cairns which on the evidence of size appear more akin to burial than field clearance monuments. Turnbull and Walsh suggest from this evidence that the Lyvennet Valley was agriculturally exploited up to the zone of cairns and other monuments close to the watershed (1997, 15) and that the monuments themselves were possibly erected on worked out ground at the very limit of the exploited area. Jobey also suggests that three cremation cairns on Millstone Hill, Northumberland, were erected on land which had been previously cultivated and abandoned (1981, 39). It
is interesting in this context that in the south west of the Lake District Bradley has noted that all the main regions with cairnfields are now seen to occupy likely pastoral territories (1972, 201). Their height range in this area is thought to have been defined by arable areas in the lower fields and limited by peat formation on more upland soils which had been exploited in the neolithic period (op. cit.). Although he warns that such an argument cannot be used to explain all cairnfields, Jobey does use the evidence that cairns were erected on land which had been previously cultivated and abandoned to illustrate the potential of the area for a more permanent form of settlement by the late third or even early second millennia BC (1981, 81).

Direct evidence of settlement and field systems within the micro-region of Bank Moor has been recorded by Cherry and Cherry (1987, 25). The settlement (Fig.7.27, site no. 458) comprises a single hut circle situated among low linear stone banks running on a slight south-west facing slope immediately adjacent to the edge of an area of limestone outcrop (op. cit. Fig 12). Approximately 250m north of the hut circle and field system is a cairn. Field walking on Gaythorn Plain has recovered numerous flint flakes, flint artefacts and heavily grit-tempered pottery (Fig.7.27, site nos. 417 and 418), but the artefact scatters are chronologically mixed and cover the period from the late neolithic to early bronze age (op. cit. 22 and 23). There is also no direct association between the artefact scatters and the settlement site, so such a date cannot, on this evidence alone, be ascribed to the settlement site.

Approximately 700m west of the pollen sampling site at Bank Moor is another settlement site (Fig.7.27, site no. 196; SMR no.1744). This covers approximately 2 acres and is of irregular form (RCHME 1936, 87, No.31). The main enclosing wall has been destroyed in places by a modern wall to the north east. Entrances are difficult to identify, but there is suggestion of one on the south west where there is an unusually large orthostat. Internally there are circular huts, cattle pens, and enclosures. The SMR records the site as being of a typical Romano-British form, but the overall lack of excavation of these monuments and the increasing inter and intra regional diversity of prehistoric settlement forms being identified (cf. Bewley, 1994a; 1994b) suggest that at least some of the settlement sites in the region may have earlier origins. The aceramic nature of the pre-Roman iron age in north west England has long been recognised and has resulted in the native iron age population being poorly recorded in the archaeological record. On this basis the lack of artefactual evidence cannot be used to support the idea that there was no occupation of the area during this time. The pollen evidence does not offer any clues either, cereal pollen disappears from the profile from the beginning of the iron age, and there are few changes in the pollen profile to indicate anthropogenic influences on the vegetation at this time. The natural surface vegetation would have anyway provided easily accessible dry pasture and if a pastoral economy was practised it may not be evident in the pollen record.

Charcoal in the larger size class is recorded throughout the pollen profile until the beginning of the iron age when not only is it inconsistently present but when it is recorded it is at significantly reduced levels. This pattern is reflected in the quantities of charcoal recorded in the smaller size class too, although this size class is represented consistently throughout the iron age.
In terms of the settlement (Fig. 7.27, site no. 196) it is difficult to substantiate a Romano-British date. One would expect that a settlement so close to the sampling site would have some impact on the local archaeological, palynological or charcoal record. Even if the occupants of the settlement practised a pastoral economy, it would be expected that domestic fires would introduce large-size charcoal particles into the sample site. The size of the settlement and the substance of the stone structures suggests the settlement would have been occupied on a permanent as opposed to a seasonal basis and therefore increases the expected input of charcoal into the pollen sampling site. Towards the end of the iron age charcoal in the smaller size class increases but the larger size class remains unaffected.

If, as is argued, the pollen sampling site is mainly receiving pollen from local and extra-local sources and that charcoal in the larger size class is indicative of local fires, it may be suggested on the strength of the microscopic charcoal that the settlement was most actively occupied during the middle to late bronze age. It is difficult to identify any other phase in the vegetation history and charcoal evidence that would correlate with evidence of a permanent settlement in the immediate vicinity. There is the possibility, of course, that the settlement is post-Roman in date and is represented in the charcoal record above 41 cm, a section not analysed as part of this research.

The settlement is situated on a slight south-west facing slope approximately 270 m above sea level and approximately 800 m south of the cairnfield (Fig. 7.27, site no 224). The hut circle and field system recorded by Cherry and Cherry (1987, 25) are 850 m south south west (Fig. 7.27, site no 458) of the larger settlement. Although it is difficult at this stage to assign dates to any of these sites, such settlements would provide a domestic context for the communities which are quite clearly utilising the limestone uplands during the bronze age period. The existence of numerous burial mounds, cairn fields and the considerable number of barbed and tanged arrowheads and scrapers confirm the utilisation of the limestone uplands at this time at least for the purpose of burying the dead and hunting and possibly small scale cereal cultivation. As far as the archaeological, palynological and charcoal record are concerned, it would appear that Bank Moor was never previously or has since been more intensively utilised than it was in the late third or early second millennium BC.

By c.1442 cal. BC, following the period in which it is suggested that fire was used to clear the surface vegetation, Corylus was able to regenerate beyond previous levels. This rise coincides with a drop in Betula, but the woodland is compensated to some degree by a rise in Pinus. Areas of woodland remained the same in terms of spatial extent but open grassland decreases rapidly. Grasses, sedges and the general diversity and quantities of other herbaceous species decline along with the quantities of aquatic species. A peak in bracken and the survival of some light demanding herb species indicate the woodland is still open, but a marked peak in Filicales show that on the whole the canopy created a shady environment. The closed vegetation would have reduced surface water and subsequently erosion of the surrounding soils. This is indicated by a reduction in aquatic species and a change in the lithographic profile.
Corylus continues to expand until c.1174 cal. BC, after which it declines gradually. At this time Alnus replaces Betula as the dominant woodland species, but increased diversity of the woodland is also evident. An increase in grasses and sedges marks the re-establishment of open grassland community. Cereal is present throughout most of the late bronze age, suggesting some arable agriculture, but the lack of other anthropogenic indicators and very little charcoal make interpretation difficult.

During the iron age there is a continued opening of the vegetation, with a return to the open, rich, grassland environment of the mesolithic and neolithic periods but, with greater quantities of shrubland species and with Alnus as the dominant woodland species.

As previously discussed, with regard to the archaeology, the iron age is traditionally represented by the numerous, what are continually referred to as Romano-British settlements. However, there is considerable debate over the origins of these settlements and although the limited excavations that have been carried out often recover evidence of Romano-British occupation, none has been intensive enough to necessarily identify earlier occupation levels. In all other respects the Romano British period remains elusive in the area.

To summarise, in the area immediately peripheral to Bank Moor, loose finds provide ample evidence of at least a transitory human presence from mesolithic times to at least the early part of the late bronze age. The finds supplement the considerable evidence of the burial record in the late neolithic and bronze age. The evidence of cairnfields, field systems and settlements may indicate more intensive development of these uplands by the late third or early second millennium BC. The later stages of the late bronze age, from the middle of the second millennium onwards into the iron age, do not appear to have had much impact on the archaeological, palaeoenvironmental or charcoal record in the immediate area of Bank Moor. This is not to imply that the utilisation of the moorland did not continue, just that its impact on the records is not obvious.

The openness of the landscape around Bank Moor throughout prehistory is interpreted as being primarily due to a combination of altitude and thin soils which restricted the growth of woodland. This open area, however caused, may have been selected on the basis of this attribute for the purpose of ritual and domestic activities during the neolithic and bronze age with intensification of activity in the late third/early second millennium BC. The concentration of human activity may well have delayed further vegetation change and served to maintain the open landscape. If this is the case, it certainly illustrates how natural ecological diversity, human activity and the subsequent pathways of vegetation change are all inter-related.

8.3 Natural and cultural landscape diversity

In terms of the archaeological record, the number and type of sites recorded within the micro-regions (with the exception of Bank Moor) have been increased and the chronological span of human utilisation of the landscape extended considerably (Fig. 8.1). This in itself answers the question of whether the patterns of distribution that were evident in the archaeological record were a 'true' reflection of human activity areas or the result of differential preservation, destruction and recovery (Fig. 5.1). Clearly, the results of the limited fieldwork carried out through the course of this research have shown that much of the distribution, both
spatial and chronological (with the exception perhaps of the iron age), can be explained by the distribution of research and fieldwork in the past. This is not to imply that the archaeological record within the micro-regions is now definitive, simply that additional material can be recovered relatively easily in these previously 'blank' areas.

Although the archaeological fieldwork was restricted by limitations of time, the results have identified a number of interesting patterns in the data. Possibly the most relevant in the context of the current discussion is the dissimilarity from one micro-region to the other. The differences in the form of the sites (i.e., artefact scatters, crop marks or earthworks) can be largely attributed to the current land use patterns and the suitability of the different micro-regions to particular methods of archaeological data retrieval.

The development and utilisation of the landscape as inferred from this evidence does, however, suggest a dissimilarity between the micro-regions. The level of dissimilarity is perhaps best illustrated by an assessment of the natural and cultural landscape diversity in the study area for a particular time slice. It is hoped that this can then be tested against the regional scale vegetation variation as mapped by Bennett (1989) and the regional synthesis advanced by Greig (1996). Bennett's map (1989) was constructed from selected published pollen diagrams supplemented by inference from climate and soil patterns of the British Isles. The map is partially dependent upon ecological inference and is therefore open to independent testing. Greig's (1996) synthesis divides England into seventeen regions, of which the study area largely falls into GB-q, the Lake District. The study uses key pollen sites within each region to summarise ecological changes.

8.3.1 Site similarities and vegetation diversity 4300-3200 cal BC

Due to the different timespans of the vegetation history within the micro-regions, only one period could be used for intercomparison of all four areas of eastern Cumbria. This period is approximately 4300 -3200 cal BC, the early Neolithic. This is also taken to be comparable with the nominal 5000bp (uncalibrated) time slice used by Bennett (1989) in his map showing the distributions of the seven main woodland types, plus unforested areas for the British Isles at this time.

The summary of vegetation types during the early neolithic (Table 6.11) shows clearly that the sites had different principal pollen influxes during this period. Differences between the sites are even more marked when the proportion of each pollen type is compared (Fig 8.2) and the palynological richness (number of pollen types) is considered (Table 8.1). Whilst all the sites are different, Bank Moor is most dissimilar to any of the other sites. This was confirmed statistically using correlation and principal components analysis, the results of which form the basis of a separate paper (Skinner and Brown 1999). The scale of difference between the sites appears comparable with the variation in both Greig's Cumbrian Region (1996) and north west England as a whole. The key sites for Cumbria reveal woodland mixtures most similar to Temple Sowerby and Great Rundale Tarn.

In the North Yorkshire moors region (GB-r), Greig recognises an upland/lowland difference in vegetation; the lowlands were dominated by *Quercus, Alnus* and *Ulmus* woodland, with small amounts of *Tilia*, whilst the
uplands were covered by open woodland of *Quercus* and *Corylus* together with herb and heath communities. For the Peak District and the Pennine Uplands (GB-o) Greig (1996) states that "regions of base rich soils show usually earlier (than other sites) and greater woodland clearance and farming with signs of secondary *Fraxinus* woodland and calcicolous grasslands" (Greig 1996, 53). This is in contrast to the northern Pennines and north eastern lowlands, where Turner and Hodgson (1979) have shown that the spatial variation in the Boreal forest was related to altitude and soils as was the Mid-Flandrian forest.

At Bank Moor and Great Rundale, where the pollen profiles continue into the bronze age and iron age, the different characters of the sites persists. At Bank Moor during the late bronze age the landscape remained largely open but with some development of *Alnus* and *Corylus* woodland in the depression floor. In contrast, after partial deforestation, acid heath and blanket mire developed around Great Rundale and Cross Fell (Turner 1984). The development of blanket mire continued into the iron age at Great Rundale but at Bank Moor the vegetation returned to the open, rich, grassland environment of the mesolithic and neolithic periods but with greater quantities of shrubland species and with *Alnus* as the dominant woodland type.

What this analysis highlights is that the intra-regional variation recorded within eastern Cumbria is at least as great as the variation encompassed by three of Greig's regions covering northern England (1996). As identified by Turner and Hodgson (1983) in the northern Pennines, the variation is clearly related to a combination of altitude/climate and soil type.

In theory an alternative explanation for some variation in the vegetation cover during the early neolithic is human impact. However, as discussed in Chapter six and above, the human impact on the vegetation does not appear to have had a major affect in any of the micro-regions at this time. Bank Moor seems never to
Table 8.1 Pollen types present at sites and combinations of sites at greater than 1% TLP.

<table>
<thead>
<tr>
<th><strong>Present at all sites</strong></th>
<th><strong>Present at TS, BM, GRT</strong></th>
<th><strong>Present at HC and GRT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Betula</td>
<td>Present at TS and BM</td>
<td>Present only at TS</td>
</tr>
<tr>
<td>Pinus</td>
<td>Present at TS and BM</td>
<td>Present only at TS</td>
</tr>
<tr>
<td>Ulmus</td>
<td>Present at TS and BM</td>
<td>Present only at TS</td>
</tr>
<tr>
<td>Quercus</td>
<td>Present at TS and BM</td>
<td>Present only at TS</td>
</tr>
<tr>
<td>Alnus</td>
<td>Present at TS and BM</td>
<td>Present only at TS</td>
</tr>
<tr>
<td>Corylus</td>
<td>Present at TS and HC</td>
<td>Present only at BM</td>
</tr>
<tr>
<td>Gramineae</td>
<td>Present at TS and GRT</td>
<td>None</td>
</tr>
<tr>
<td>Cyperaceae</td>
<td>Present at TS and GRT</td>
<td>None</td>
</tr>
<tr>
<td>Calluna</td>
<td>Present at TS and GRT</td>
<td>None</td>
</tr>
<tr>
<td>Present at TS, BM, HC</td>
<td>Present at BM and HC</td>
<td>Present only at HC</td>
</tr>
<tr>
<td>Salix</td>
<td>Present at BM and HC</td>
<td>Present only at HC</td>
</tr>
<tr>
<td>Chenopodiaceae</td>
<td>Present at BM and HC</td>
<td>Present only at HC</td>
</tr>
<tr>
<td>Filipendula</td>
<td>Present at BM and HC</td>
<td>Present only at HC</td>
</tr>
<tr>
<td>Umbelliferae undif</td>
<td>Present at BM and HC</td>
<td>Present only at HC</td>
</tr>
<tr>
<td>Present at BM, HC, GRT</td>
<td>Present at BM and GRT</td>
<td>Present only at GRT</td>
</tr>
<tr>
<td>Plantago lanceolata</td>
<td>Present at BM and GRT</td>
<td>Present only at GRT</td>
</tr>
<tr>
<td>Rumex acetosa</td>
<td>Present at BM and GRT</td>
<td>Present only at GRT</td>
</tr>
<tr>
<td>Rosa t.</td>
<td>Present at BM and GRT</td>
<td>Present only at GRT</td>
</tr>
</tbody>
</table>

Table 8.1 Pollen types present at sites and combinations of sites at greater than 1% TLP.

have developed a woodland cover and although the charcoal record clearly shows an increase in burning, this does not occur until later in the Neolithic and Bronze Age (Fig 6.0a and 6.0b).

When compared to Bennett's (1989) map of forest types in the British Isles a major element of the inferred vegetation missing from eastern Cumbria is the upland Pinus-dominated zone. This is missing from both the mountain front (Howgill) and the lower limestone plateau (Bank Moor). This is possibly because of the steepness of the mountain slopes at Howgill, which rises 600m in 4km, and the over-riding effect of moisture stress on the limestone around Bank Moor. This complies with Pennington's observation that in contrast to Betula, Ulmus and Quercus, which are climatically controlled, the behaviour of Pinus at this time was edaphically controlled (1970, 58). However, as a whole the pattern of vegetation in eastern Cumbria is not dissimilar to Bennett's (1989) but that from eastern Cumbria shows that the impact of geological and/or soil control was greater at the sub-regional scale.

This study suggests that Eastern Cumbria had a spatially varied Mid-Holocene vegetation, with a degree of variation in vegetation types comparable to that of the whole of northern England. The vegetation pattern broadly supports Bennett (1989) in that it does seem to reflect a combination of altitude, geology and/or soils. This raises the possibility that the major scale of natural vegetation variation in this part of England and elsewhere, may have been intra-regional, with secondary inter-regional variations resulting from the general W/N - E/S gradient of the British climate (Skinner and Brown, 1999). In this respect the results are in agreement with Turner and Hodgson (1983), who have shown that the spatial variation in the vegetation of the northern Pennines was greater than temporal variation in the early-mid Holocene and that most of the spatial variation can be explained by differing local climate and edaphic conditions. The spatial variation was
therefore at the geological/landscape unit scale and generally associated with variations in forest richness, particularly of the ground flora.

Such variation in the vegetation cover would offer a diverse range of opportunities for human communities occupying the area. The suitability and selection of areas for particular activities will change according to the importance of the activity or area to the social systems in operation at any one time. Such processes of change can explain the variability recorded in the spatial distribution of archaeological remains and the differences evident in the human/environment interaction identified throughout the study area.
CONCLUSION

In some ways it may be expected that in a topography as varied as that covered by Eastern Cumbria there would be variation in the natural and cultural development of the landscape. Such expectations are fuelled, at least in part, by the diversity documented in the vegetation history and archaeological record from the western side of the county, particularly in and around the central massive of the Lake District. What comes as a surprise, perhaps, is the scale of diversity that has been recognised in the relatively small study area of Eastern Cumbria.

In this final chapter I will summarise the findings of this research in terms of our understanding of the prehistoric landscapes and then look at the implications of these findings for the region, the methodology and landscape archaeology in general.

9.1 The prehistoric landscape: implications for the region

This research started with an almost blank archaeological canvas in all of the micro-regions with the exception of Bank Moor. Knowledge of the palaeoenvironmental record was only marginally more advanced with a dated diagram from Temple Sowerby (Pierce, 1986). It was not intended in a study proposed to last just three years, to provide a definitive prehistory for the region. However, the intention was to provide a very concentrated assessment of the prehistoric landscapes within the micro-regions. It was hoped that these local explorations would provide templates upon which a regional picture of landscape development could be built.

It has been demonstrated through the integration of the archaeological and palynological records, that in the late mesolithic-early neolithic period there were communities in the Eden Valley probably practising a hunting, gathering and fishing economy. The relatively sheltered area around Temple Sowerby could have provided a base camp for these activities and although potential areas of occupation have been identified these have not yet been substantiated by material evidence. At this time use was also being made of the Pennine uplands, probably during the summer months, and primarily for the purpose of hunting migratory herds. During periods of activity in the upland area, locally available chert and some imported flint appears to have been exploited.

In the south of the study area artefactual evidence indicates that the open landscape of the limestone uplands was also being used for the purpose of hunting/gathering. By the neolithic period the more sheltered slopes were being selected for what appears to have been, more permanent occupation areas. The higher, more visible, areas of the limestone ridge were utilised for the construction and display of large ritual and burial monuments.
The increase in the amount of good quality flint present in artefact scatters of neolithic/bronze age date, from both Temple Sowerby and the limestone ridge, implies an increased emphasis on communication networks, particularly trans-Pennine links. Similarities in the structure and use of burial monuments between those on the limestone ridge and those in southern England may be used to substantiate the idea that long distant communications with groups outside the area were also well established. The scale of these communications is perhaps most clearly illustrated by the national distribution of Group VI axes (Bradley and Edmonds, 1993, 45, Fig 3.1). The evidence recovered through the course of this research certainly supports Bradley and Edmond's assertion that the Eden Valley increased in importance towards the end of the early neolithic and the beginning of the late neolithic (1993, 152). This importance was possibly due, at least in part, to its position in relation to major routes through the Pennines.

By the late neolithic - early bronze age, changes in the distribution and structure of artefact scatters indicate some changes in the exploitation of the area around Temple Sowerby. Movement onto the better drained soils implies that there was possibly a change in the economic strategies employed by the communities in this area. Substantiated by the presence of stone axe hammers, it is suggested that the move was for the purpose of arable agriculture.

In the limestone uplands, around Bank Moor, the increased presence of charcoal fragments indicates some clearance of surface vegetation with the use of fire from the late neolithic. Although the reasons for this cannot be established at this stage it does indicate an intensification in use of the area in the late third and early second millennium BC. Such intensification is emphasised by the number of burial mounds and the cairnfield constructed within the area of Bank Moor (Fig. 7.27). It is suggested, on the basis of the charcoal evidence, that the settlement sites also relate to this period, although this cannot at this stage be supported by palynological or further archaeological evidence. The distribution of barbed and tanged arrowheads on the limestone ridge indicates that hunting continued to play a significant role in the economy of these communities.

In the Pennine uplands the bronze age witnessed the deliberate clearance of shrubland species, leading to the spread of open grassland and heath, possibly for the purpose of grazing. Around this time cairns were constructed on the edge of the scarp and in a linear arrangement running down the western edge of the Pennines. The fact that these do not relate to any obvious routeways suggests that they may have formed part of a political or territorial boundary. Such an argument is also proposed for the linear boundaries at Howgill and the arrangement of many bronze age monuments on the limestone ridge in the south of the study area. As is apparent in many other areas at this time, it would appear that by the bronze age territoriality had become an important consideration within the social system of the time.

As is the case in much of Cumbria, the iron age seems to escape detection as far as the archaeological record is concerned. If, as is suggested by the SMR, the numerous settlement sites in the study area are of Romano-British date, it is difficult to explain how the number and density of these settlements have not had a greater impact on the archaeological record in one form or another. At Bank Moor at this time there was further
opening of the woodland, but it is difficult to establish whether this was intentional or the cumulative affect of previous activity in the area. Fire does not appear to have been used and the felling of trees and shrubland by hand may not be immediately apparent in the pollen record except, perhaps, as a reduction in the pollen of the species being removed. Clearance of woodland and shrubland is also apparent in the Pennine uplands during the second half of the first millennium BC and may be associated with small-scale cultivation of cereals. The difficult conditions, in terms of blanket peat development and the exposed nature of the area, would presumably have made this difficult, however.

9.2 Implications for the use of pollen analysis in landscape archaeology

In addition to improving the knowledge and understanding of the prehistoric landscapes of eastern Cumbria, this research has shown that within the study area the influence of human activity on the development of vegetation during the prehistoric period was local in origin and did not result in large scale vegetation changes. These happened only gradually and in some places are difficult to identify at all. For this reason alone it is suggested that palynologists concerned with the recognition and reconstruction of prehistoric landscapes should be promoting the use of small basins, charcoal analysis, and soil samples, in an attempt to strengthen the reflection of human behaviour provided in the pollen record. It is suggested that a series of pollen sites reflecting the extra-local vegetation will be more use in interpreting the prehistoric landscape than a similar number of dispersed sample sites which have a regional pollen catchment.

Quite clearly the numerous pollen sites from the western side of Cumbria provide a regional picture of the vegetation development in the area and this in itself is important to understanding the basic development of the region. This work has also been able to identify inter-regional variability in vegetation development but it is impossible, from this evidence, to identify the spatial scale of the variability. The sites studied as part of this research provide a concentrated sample of the vegetation histories within the micro-regions. Admittedly, there are insufficient sites here to enable a reconstruction of the vegetation development over the whole of the study area, but the analysis of more cores, particularly along the Lyvennett Valley or between Temple Sowerby and Great Rundale, for example, would almost certainly start to identify the interfaces between the different vegetation types and possibly those between different areas of human activity.

Edwards (1989) made a distinction between 'on-site' and 'off-site' pollen analysis, suggesting that pollen profiles on sites of past human activity would, in theory, be expected to provide the fullest and most sensitive records of this activity. As Edwards points out, however,

"if the assumption is made that prehistoric people no more wished to live on a peat bog than we would today then the chances are that they preferred dry land sites (that is apart from sites which could be made dry via such constructions as trackways and crannogs)" (op cit, 62).

In practice, therefore, such sites would not provide suitable waterlogged deposits for the preservation of pollen and although acid soils may contain pollen, taphonomically the soil pollen record can be partial and difficult to interpret. On the basis of this Edwards recommends the use of 'off-site' samples despite the degree of uncertainty regarding the precise location of any activity that may be registered in the fossil record (op cit).
Off-site sample areas should be: "...as close as possible to the past activities which it is desired to monitor in order to optimize the fossil cultural pollen signal" (op cit, 62). The proximity of a pollen sampling site to human activity is important for the simple reason that the impact of this activity is more likely to be reflected in a site close to the activity than one at considerable distance from it. It is argued here, however, that it is equally, if not more, important that the pollen catchment is both local and extra-local in scale. A pollen site close to an area of human activity is only useful from an archaeological point of view if it can be shown that the pollen record obtained relates to the spatial area covered by the archaeological remains. If the pollen record is diluted by large quantities of regional pollen rain, it would be significantly more difficult to distinguish the relevant local or extra-local components.

Edward's approach is also difficult to apply in areas where the existing archaeological record, usually based on the SMR, shows archaeologically blank areas. In theory these areas would remain unstudied, palynologically, until archaeological research had been carried out and provided evidence for human activity areas for which the pollen work could then be employed to interpret. In this sense palynological investigations are employed as an adjunct to archaeological investigations. As the current research has shown, particularly at Temple Sowerby and Great Rundale, the palynological record can be as important as the archaeological record in trying to recognise, reconstruct and understand human activity in the area during the prehistoric periods. What has also been highlighted by the current research is that, certainly within eastern Cumbria, and presumably in other areas of similar or less diverse topography, there appear to be very few areas of the landscape which will not, given the appropriate form of field survey, produce an archaeological record. If the spatial scale of the palynological work can be fairly closely defined, then archaeological field work within that area will ensure the compatibility of the data sets. A combination of both palynological and archaeological investigation should form the basis of landscape studies.

The current research has also made a significant contribution to the assessment of the level of site similarity and vegetation diversity over the study area. As discussed, the study indicates that eastern Cumbria had a spatially varied mid-Holocene vegetation with a degree of variation in vegetation types comparable to that identified for the whole of Northern England. This work and that of Turner and Hodgson (1983) therefore calls into question the applicability of regional study areas that are not based on topography and geology and particularly the usefulness of the key site approach (cf. Greig, 1996). The limitations of regional studies would be reduced if sub-regional causes of vegetation variation are accounted for in their selection.

If even a broad relationship exists between palynological richness and species richness, then the mid Holocene open areas, especially those on limestone and at relatively low altitudes, must have been characterised by high biodiversity, possibly associated with grazing and human disturbance. These areas may have acted as refuges for late glacial species which were shaded out from most of Britain until forest clearance allowed them to spread back out into the landscape. These species are associated with human activity, as pasture or arable indicators, and are one cause of the increase in palynological diversity commonly seen during deforestation events (Moore, 1973).
These findings support the thesis that the intra-regional scale of vegetation variation, related to altitude and soil type, was the overriding control on species diversity in the natural woodlands of the British Isles before widespread human impact. If the spatial diversity and patterning of the wild wood were greatest at the local or extra-local scale, this again implies that pollen sites with a regional catchment bias will be less effective than sites with a small catchment bias for the spatial analysis of archaeological data. It does, however, go some way towards validating the use of lithology or soil type as is common in GIS modelling. The role of both natural and human disturbance in the maintenance of this diversity needs to be addressed at this local/extra-local scale.

In summary it is argued that at the local and extra-local scale pollen data provides a common denominator between nature and culture. It can provide vegetation history data at a spatial resolution which is comparable with that of archaeological data. Although problems of pollen preservation must be taken into account, pollen evidence can not only identify periods of human interference to compare with the archaeological evidence but can, in its own right, suggest human activity areas where archaeological evidence is limited or non-existence.

9.3 Recommendations for future work

Of perhaps greatest importance is the need to increase the number of micro-regions, particularly along the Lyvennet Valley and between Temple Sowerby and Great Rundale, for example. As suggested above, a build up of micro-regions would, it is hoped, start to identify interfaces between vegetation types and human activity areas. A number of potential sites has already been identified during the site selection process for the current course of research. Small sample sites thought to be dominated by local and extra-local pollen catchment are available at Hardendale Fell (NY 579122), Morland Moor (NY 617178), Cliburn Moss (NY 578357), Woodside Low Moss (NY 584298) Wythwaite Farm (NY 653319) and Cross Fell (NY 692344).

Once this work has been carried out it is proposed to focus in more detail on some of the palynological horizons which indicate human activity areas. Fine resolution pollen analysis on the sections of the cores showing high charcoal levels, particularly in the late neolithic and bronze age horizons at Bank Moor, would be particularly beneficial. This would also apply to the late mesolithic activity suggested in the core from Temple Sowerby, although in this case it would be preferable to find a ‘new’ sample site in an area less likely to have been subjected to medieval peat cutting. The fine resolution analysis would, it is hoped, provide more detailed information about the character of these activity horizons and the impact they had on the pollen record. To integrate such detailed pollen data with the archaeological record, however, the resolution of the archaeological data would also need to be improved. At Bank Moor detailed investigation of the cairnfield, settlements and field systems in particular, including perhaps some sample excavation, would go some considerable way towards phasing some of these activity zones.

With regard to the existing micro-regions, each one would benefit from further archaeological field investigation. At Temple Sowerby test pitting in the alluvial deposits along the edge of the River Eden would help to assess the level of alluvial deposition and the impact that this is likely to have had on the recovery of artefacts. Further field walking in the fields to the south west and north west of Temple Sowerby
village, as and when the fields become available, should also help to substantiate or refute some of the observations made from the data recovered so far. Excavation of at least one of the D-shaped enclosures, identified from aerial photographs as crop mark settlement sites (site no's. 5 and 464 Fig. 7.1), should help to understand the construction and date of these structures.

At Great Rundale further investigation of the peat erosion scars may help to identify more activity areas. It would also be useful to obtain radiocarbon determinations for the peat horizons from which the lithic scatters were recovered. This would provide the opportunity to establish whether what appears to be a blade type technology was continuing in use into the later neolithic or bronze age.

At Howgill there is a need to identify another pollen sampling site in an area less likely to have been subjected to peat cutting. A number of small hollows was noted close to Milburn Beck and Knock Ore Gill but these have not been sampled to test their suitability for the project. With regard to the archaeology it would be essential to follow the linear boundaries outside the constraints of the micro-region in the hope that the relationship between these and other monuments may offer at least a relative date. It is imagined that by identifying the extent and complete layout of the boundaries further clues as their function and interpretation may also come to light.
APPENDICES
## Summary of soils from solid rocks

<table>
<thead>
<tr>
<th>Map symbol</th>
<th>Soil Association</th>
<th>Soil Type</th>
<th>Characteristics</th>
<th>Land use</th>
</tr>
</thead>
<tbody>
<tr>
<td>313c</td>
<td>Crwbin</td>
<td>Brown ranker, a subgroup of Lithomorphic soils.</td>
<td>Shallow, free drained loamy soils over solid limestone on moderate to steep slopes. Rendzinas, with dark coloured top soils occur intermittently with rock outcrops or exposures of limestone pavement. Deeper free draining brown soils with slightly acid top soils and distinct yellowish brown subsoils form part of this association.</td>
<td>Stock rearing on herb rich grassland provide good quality grazing.</td>
</tr>
<tr>
<td>611c</td>
<td>Manod</td>
<td>Typical brown podzolic soil, subgroup of Podzolic soils.</td>
<td>Free draining, fine loamy or fine silty brown podzolic soils over bare rock. Shallow soils in places broken by local outcrops of solid rock.</td>
<td>Stock rearing and woodland in the uplands.</td>
</tr>
<tr>
<td>631a</td>
<td>Anglezarke</td>
<td>Humoferric podzol, subgroup of Podzolic soils.</td>
<td>Free draining, very acid, coarse, loamy soils over sandstone, with a bleached subsurface horizon. Some shallow soils with a peaty or humose surface horizon. Rocks and boulders locally.</td>
<td>Dry moorland habitats of poor grazing quality. Coniferous woodland or recreation.</td>
</tr>
<tr>
<td>631f</td>
<td>Crannymoor</td>
<td>Humoferric podzol, subgroup of Podzolic soils.</td>
<td>Well drained sandy soils, mostly under woodland and very acid with a bleached subsurface horizon. Associated with sandy soils affected by groundwater.</td>
<td>Coniferous woodland and dry lowland heath habitats; recreation; some cereals</td>
</tr>
<tr>
<td>721c</td>
<td>Wilcocks</td>
<td>Cambic stagnohumic gley soils, subgroup of Surface Water Gley Soil.</td>
<td>Poorly drained, seasonally waterlogged fine loamy and fine loamy over clayey upland soils with a peaty surface horizon.</td>
<td>Wet moorland habitats of moderate and poor grazing value. Some improved grassland. Coniferous woodland, military and recreation use.</td>
</tr>
<tr>
<td>Map symbol</td>
<td>Soil Association</td>
<td>Soil Type</td>
<td>Characteristics</td>
<td>Land use</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------</td>
<td>----------</td>
<td>-----------------</td>
<td>---------</td>
</tr>
<tr>
<td>541o</td>
<td>Malham 1</td>
<td>Typical brown earth soil, subgroup of Brown Earths</td>
<td>Well drained silty soils over limestone. Some soils with a seasonally wet peaty surfacel horizon and thin ironpan. Bare rock locally</td>
<td>Stock rearing on permanent grassland; some winter cereals and some herb rich habitats of moderate grazing value; coniferous forest; recreation.</td>
</tr>
<tr>
<td>541q</td>
<td>Waltham</td>
<td>Typical brown earth soil, subgroup of Brown Earths</td>
<td>Well drained fine loamy soils over limestone, locally deep. Shallow loamy soils in places. Bare rock locally</td>
<td>permanent grassland with stock rearing.</td>
</tr>
<tr>
<td>541r</td>
<td>Wick 1</td>
<td>Typical brown earth soil, subgroup of Brown Earths</td>
<td>Deep, well drained coarse loamy and sandy soils, locally over gravel. Some similar soils affected by groundwater. Slight risk of water erosion.</td>
<td>Stock rearing and dairying.</td>
</tr>
<tr>
<td>551a</td>
<td>Bridgnorth</td>
<td>Typical brown sands, subgroup of Brown Sands</td>
<td>Well drained sandy and coarse loamy soils over soft sandstone. Occasional deeper soils. Risk of water and wind erosion.</td>
<td>Cereals and potatoes, horticultural and fruit crops; some permanent grassland and woodland on steep slopes.</td>
</tr>
<tr>
<td>711n</td>
<td>Clifton</td>
<td>Typical stagnogley soils, subgroup of Surface Water Gley Soils</td>
<td>Found underlain by or adjacent to Triassic red sandstone outcrops. Rusty, mottled sandy-clay loam topsoils, dark greyish brown in colour passing down into a strongly mottled, reddish brown, sandy clay loam.</td>
<td>Ideally suited to grass. Where drainage is good (in relatively drier areas) the fertile soils support a variety of crops.</td>
</tr>
<tr>
<td>713e</td>
<td>Brickfield 1</td>
<td>Typical Cambic stagnogley soil, subgroup of Surface Water Gley soils</td>
<td>Slowly permeable, seasonally waterlogged with fine loamy texture. They are surface water gleys and commonly have greyish brown to dark grey, mottled, sandy clay loam topsoils. Moderate rainfall and runoff from adjacent slopes causes surface water problems.</td>
<td>Stock rearing on permanent or short term grassland and wet moorland of moderate and good grazing value. Some cereals in drier areas.</td>
</tr>
<tr>
<td>713g</td>
<td>Brickfield 3</td>
<td>Typical Cambic stagnogley soil, subgroup of Surface Water Gley soils</td>
<td>Slowly permeable seasonally waterlogged fine loamy, fine loamy over clayey and clayey soils.</td>
<td>Stock rearing and some dairying on permanent grassland; grassland and winter cereals in drier lowlands.</td>
</tr>
<tr>
<td>811a</td>
<td>Enborne</td>
<td>Typical alluvial gley soil, subgroup of Ground Water Gley Soils</td>
<td>Fine, stoneless, loamy and clayey soils subject to periodic flooding and water table fluctuation. Found in flat areas with a risk of flooding.</td>
<td>Permanent grassland with stock rearing and dairying. Some arable agriculture in areas where risk of flooding is low.</td>
</tr>
<tr>
<td>1011b</td>
<td>Winter Hill</td>
<td>Raw oligo-amorphous peat soils, subgroup of Peat Soils</td>
<td>Thick, very acid, raw peat soils. Laminated with fibrous and semi fibrous layers passing down to black amorphous peat at 3m. Near the base is occasional woody material, chiefly birch and pine. The surface horizon is usually reddish black very thin humified peat with abundant fibrous roots. Perennially wet and eroded in places.</td>
<td>Wetland habitat of poor grazing value. Used for the planting if coniferous forest and for military use.</td>
</tr>
</tbody>
</table>
Lithostratigraphic units recorded at each pollen sampling site. Descriptions are based on the standard system of Troels-Smith (1955).

<table>
<thead>
<tr>
<th>Depth cm</th>
<th>Nig</th>
<th>Strat</th>
<th>Elast</th>
<th>Sicc.</th>
<th>Humo</th>
<th>Components and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-15</td>
<td>3.5</td>
<td>+</td>
<td>2</td>
<td>1.5</td>
<td>Th + (b)</td>
<td></td>
</tr>
<tr>
<td>15-24</td>
<td>1.5</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>Th + (b)</td>
<td></td>
</tr>
<tr>
<td>24-75</td>
<td>2.5</td>
<td>+</td>
<td>2</td>
<td></td>
<td>Lim 0. Alternation of light and dark deposits. The lenses start at 30cm and appear at approximately 8cm intervals. Precise boundaries were not recognised.</td>
<td></td>
</tr>
<tr>
<td>75-108</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2.5</td>
<td>Th (b)</td>
<td></td>
</tr>
<tr>
<td>108-125</td>
<td>1</td>
<td></td>
<td>2.5</td>
<td>2</td>
<td>1</td>
<td>Th L. Mainly herbaceous material but increasingly woody with depth. Upper boundary Lim 3</td>
</tr>
<tr>
<td>125-182</td>
<td>0.5 - 3</td>
<td>1.5 - 2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>Th (b). No major stratigraphic change but there is evidence of hummocks within the stratigraphy.</td>
</tr>
<tr>
<td>182-186</td>
<td>3.5</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>Th</td>
<td></td>
</tr>
<tr>
<td>186-188</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td></td>
<td>Th (Sh, Ag, Ga). Colour 2.5y 3/1.5 very dark grey. Suggests increased humification.</td>
<td></td>
</tr>
<tr>
<td>188-216</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
<td>Th (b). Colour 2.5y 4/3 Olive Brown.</td>
<td></td>
</tr>
<tr>
<td>216-248</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Increasingly laminated and darker towards the base. Colour at the top 5y 6/3 pale olive, colour at the bottom 5y 4/2 olive grey. A narrow grey clay band appears within this horizon between 243 cm and 245.5 cm (colour 5B 4/1 dark blueish grey).</td>
<td></td>
</tr>
</tbody>
</table>

Lithostratigraphic units recorded at Temple Sowerby.
### Lithostratigraphic units recorded at Bank Moor.

<table>
<thead>
<tr>
<th>Depth cm</th>
<th>Nig</th>
<th>Strat</th>
<th>Elast</th>
<th>Sicc.</th>
<th>Humo</th>
<th>Components and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>Th (b). A dark brown fibrous moss and root peat with a silt and clay component.</td>
</tr>
<tr>
<td>20-28.5</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>Grey (5y 5/2 greyish olive) silty clay with fine organic matter</td>
</tr>
<tr>
<td>28.5-45</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>Th. Dark olive black some silt</td>
</tr>
<tr>
<td>45-63</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>Dark grey (5y 3/1 olive black) organic clay rich silt. Peaty layers. Increasingly green with depth.</td>
</tr>
<tr>
<td>63-78</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>Grey (5y 3/1, olive black) silty clay with organic fragments</td>
</tr>
<tr>
<td>78-105</td>
<td>3 - 4</td>
<td>2</td>
<td>+</td>
<td>1</td>
<td>2</td>
<td>Tb (t). A silty moss peat with wood fragments. The lower boundary is gradual over 4 cm. Nig. 3 applies to a depth of 91 cm after which deposit changes to Nig. 4. Wood up to 3cm in diameter.</td>
</tr>
<tr>
<td>105-115</td>
<td>3 - 4</td>
<td>2</td>
<td>+</td>
<td>1</td>
<td>2</td>
<td>Dark grey /black (5y 3/1 olive black) silty clay. Organic content becoming more clay rich with depth.</td>
</tr>
<tr>
<td>115-147</td>
<td>3 - 4</td>
<td>2</td>
<td>+</td>
<td>1</td>
<td>2</td>
<td>Thick blue grey clay with wood. Clay laminated, laminations very fine N5/5B5/1. Becoming increasingly darker and organic rich with depth.</td>
</tr>
<tr>
<td>147-186.5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>Light brown/grey clay rich peat. Clay increasing to base</td>
</tr>
<tr>
<td>186.5-198</td>
<td>2-2.5</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>Dark grey brown organic rich clay</td>
</tr>
<tr>
<td>198-217</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>Mid/light brown clay with occasional organic fragment. Gritty in top 6cm but decreasing with depth</td>
</tr>
</tbody>
</table>

### Lithostratigraphic units recorded at Great Rundale.

<table>
<thead>
<tr>
<th>Depth cm</th>
<th>Nig</th>
<th>Strat</th>
<th>Elast</th>
<th>Sicc.</th>
<th>Humo</th>
<th>Components and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-60</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>Th 2-3 (Tb 1-2). Dark/mid brown peat - grass/phragmites/calluna.</td>
</tr>
<tr>
<td>60-90</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>Tb 3, (Th 1). Dark brown peat. Charcoal flecks</td>
</tr>
<tr>
<td>90-120</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>Tb 2 (Th 3) +T1. Dark brown peat. Charcoal flecks</td>
</tr>
<tr>
<td>120-154</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>Tb 3 (Th 1) +T1. Dark/mid Brown peat</td>
</tr>
<tr>
<td>154-195</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>Tb 3 (Th 1) +T1. Calluna stem. charcoal flecks throughout.</td>
</tr>
<tr>
<td>Depth cm</td>
<td>Nig</td>
<td>Strat</td>
<td>Elast</td>
<td>Sicc.</td>
<td>Humo</td>
<td>Components and Description</td>
</tr>
<tr>
<td>----------</td>
<td>-----</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>5-15</td>
<td>0-1</td>
<td>1-2</td>
<td>Th 3</td>
<td>(+Tb)</td>
<td>rootlets. Dark Brown/black.</td>
<td></td>
</tr>
<tr>
<td>15-19.5</td>
<td>0-1</td>
<td>2</td>
<td>Th 2</td>
<td>(+Tb)</td>
<td>Light brown/olive</td>
<td></td>
</tr>
<tr>
<td>19.5-31</td>
<td>1</td>
<td>2</td>
<td>Th 2</td>
<td>(+Tb)</td>
<td>Dark Brown</td>
<td></td>
</tr>
<tr>
<td>31-38</td>
<td>1-2</td>
<td>2</td>
<td>Th 2</td>
<td>Light grey brown. Band of silty peat 31-32cm - light grey brown, more compact.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38-74</td>
<td>2-3</td>
<td>2</td>
<td>Tb 3</td>
<td>(Th 1-2)</td>
<td>Dark brown, banded silty peat. Bands at 51-52cm, 54.5-56cm, 59-60cm, 63-64cm. Bands = mid brown silty peat, more organic matter + charcoal flecks.</td>
<td></td>
</tr>
<tr>
<td>74-97</td>
<td>2-3</td>
<td>2</td>
<td>Th 3</td>
<td>(Tb 1)</td>
<td>Mid to dark brown, diffuse banding at 77.5-79cm. Large timber from 81.5-83cm. Dark brown/black band 84.5-85cm with charcoal flecks.</td>
<td></td>
</tr>
<tr>
<td>97-102</td>
<td>1-2</td>
<td>2</td>
<td>Th 2</td>
<td>(Tb2)</td>
<td>Light brown silty peat.</td>
<td></td>
</tr>
<tr>
<td>102-114</td>
<td>1</td>
<td>2</td>
<td>Th 3</td>
<td>(+Tb)</td>
<td>Dark brown</td>
<td></td>
</tr>
<tr>
<td>114-132</td>
<td>1-2</td>
<td>2</td>
<td>Th 3</td>
<td>(+Tb)</td>
<td>Light brown 'sloppy', silty, peat. Phragmites stem 115.5cm.</td>
<td></td>
</tr>
<tr>
<td>132-170</td>
<td>3</td>
<td>3</td>
<td>Th.</td>
<td>Mid brown, silty clay with organics. Large wood frags. at 133-134cm, 134-136cm, 147-149cm, 156-157cm, 163-166cm. Sand with a medium/coarse component between 152and 163cm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>170-180</td>
<td>2</td>
<td></td>
<td>Tl.</td>
<td>Silty light grey clay with small wood frags. and some fine sand. Medium sized wood frags between 158-164cm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>180-193</td>
<td>2-3</td>
<td>3</td>
<td>Tl.</td>
<td>Light brown/grey silt rich clay with fine sand component. Large timber at 182-186cm. Increasingly dark in colour to base. Sand component increasingly coarse to base.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>193-197</td>
<td></td>
<td></td>
<td>Dark brown/grey with light grey bands at 193-193.5cm, 196-197cm. Silty clay with grit, organics and coarse sand.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>197-206</td>
<td>0-1</td>
<td>3</td>
<td>Th.</td>
<td>Dark brown silty peat with grit with large wood frag. at 195-206cm. Increasing silt to base.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>206-225</td>
<td>0</td>
<td></td>
<td>Light blue grey clay. Silty with grit increasing in size with depth particularly after 213cm. Carbonate nodules, colour bands include white and yellow grit.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lithostratigraphic units recorded at Howgill Castle.
APPENDIX 4

FINDS INVENTORY

All flint details and descriptions are made looking at the dorsal face, unless otherwise stated, with the bulb of percussion and bulbar scar at the bottom of the reverse side. Overall size of cores is given in ‘characteristics’ section of the tables. Length (L), Breadth (B) and Thickness (T) measurements for cores relate to the largest flake scars. All measurements are in mm and where

TEMPLE SOWERBY
TS1 - Temple Sowerby field 1 (NY 612 264)

Location: This field is located 300m north of Skygarth Farm, on a natural terrace, 115m above OD but sloping slightly to the north east and to the south west where it over looks the River Eden.

Conditions: Fieldwalking was carried out in ideal, dry, conditions, the field having been ploughed and chain harrowed for approximately two weeks.

Finds: A total of seventeen pieces of flint were recovered from the field. These form three discrete clusters: With two isolated finds.

Group A, which contains a total of seven pieces, is centred at NY 61192651 and covers an area of approximately 50m x 90m.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool Flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11e</td>
<td>Cream/beige chert</td>
<td>Retouched Bladelet</td>
<td>Complete tertiary flake containing sandy inclusions (cortex). Struck from a faceted platform, retouched along upper right edge. Bulb and bulbar scar retained. Slight damage to upper left hand edge.</td>
<td>32</td>
<td>17</td>
<td>5</td>
<td>1.88</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>9g</td>
<td>Cream/beige chert</td>
<td>Blade</td>
<td>Imperfections of cortex material clearly evident. Diffuse bulb of percussion, plain butt. Broken along complete length and across distal end.</td>
<td>24</td>
<td>12</td>
<td>4</td>
<td>2</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>10f</td>
<td>Dark brown flint</td>
<td>Tertiary</td>
<td>Very pronounced fracture at bulbar end but badly damaged.</td>
<td>15</td>
<td>11</td>
<td>4</td>
<td>1.36</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>10g</td>
<td>Dark grey/ black chert</td>
<td>Tertiary</td>
<td>Fragment of chert flake.</td>
<td>9</td>
<td>9</td>
<td>3</td>
<td>1</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>11e</td>
<td>White flint</td>
<td>Tertiary</td>
<td>Very small burnt flake.</td>
<td>14</td>
<td>12</td>
<td>7</td>
<td>1.17</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>11e</td>
<td>Cream/brown chert</td>
<td>Tertiary - bashed lump</td>
<td>Evidence that a number of flakes have been removed from it but fragment very small.</td>
<td>11</td>
<td>10</td>
<td>3</td>
<td>1.10</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>11f</td>
<td>Dark grey/black flint</td>
<td>Core frag.</td>
<td>Cortex evident on one side. Fragment of flint core but very badly damaged.</td>
<td>19</td>
<td>18</td>
<td>12</td>
<td>1.06</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>
**Group B**, which contains a total of six pieces is centred on NY 61372653 and covers an area of approximately 30m x 70m.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidenc e</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16d</td>
<td>Dark grey/olive translucent flint</td>
<td>Thumbnail scraper</td>
<td>Cortical platform, diffuse bulb. Retouch on left and right sides, slight damage at distal end.</td>
<td>18</td>
<td>19</td>
<td>6</td>
<td>0.95</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>18d</td>
<td>Dark grey/olive translucent</td>
<td>Knife</td>
<td>Triangular shaped flint knife. Secondary flake, plain platform, bulb of percussion and bulb scar retained. Upper part of dorsal face facetted from direction of platform, cortex survives on right hand side point. Left hand side broken, but retouched along broken edge on bulb face. Retouched along distal end (bulb face). Point broken.</td>
<td>22</td>
<td>44</td>
<td>7</td>
<td>0.55</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>19d</td>
<td>Pale grey flint</td>
<td>Scraper</td>
<td>Scraper produced from secondary flake. Retouched along right edge and distal end, cortex over most of dorsal face. Transverse fracture has removed bulb of percussion, broken on left side.</td>
<td>20</td>
<td>35</td>
<td>4</td>
<td>0.57</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>19d</td>
<td>Black chert</td>
<td>Tertiary</td>
<td>Tertiary flake</td>
<td>25</td>
<td>22</td>
<td>10</td>
<td>1.14</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>19d</td>
<td>Cream/brown chert</td>
<td>Secondary</td>
<td>Very small secondary flake</td>
<td>15</td>
<td>6</td>
<td>7</td>
<td>2.5</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>17d</td>
<td>Brown chert</td>
<td>Core frag</td>
<td>Fragment of core but details obscured, badly damaged</td>
<td>20</td>
<td>18</td>
<td>1</td>
<td>1.1</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

**Group C**, which contains a total of four pieces is centred on NY 61212641 and spans an area 30m x 30m.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidenc e</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8c</td>
<td>Pale grey flint</td>
<td>Thumbnail</td>
<td>Tear drop shaped scraper, reuse of core fragment (?). Retouched along distal end, triangular in section. Clearly defined impression of bulb of percussion on bulb face.</td>
<td>24</td>
<td>5</td>
<td>12</td>
<td>4.80</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>9c</td>
<td>Pale grey/white flint</td>
<td>Core</td>
<td>Creamy white burnt flint core. Plain butt, (?) bi polar, narrow flakes having been removed. 21mm x 18mm</td>
<td>18</td>
<td>7</td>
<td>7</td>
<td>2.57</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9c</td>
<td>Pale grey flint</td>
<td>Core frag</td>
<td>Cortical butt, flakes removed. Damaged.</td>
<td>18</td>
<td>7</td>
<td>7</td>
<td>2.57</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>9c</td>
<td>Pale grey flint</td>
<td>Retouched tertiary</td>
<td>Retouch on distal end of bulb face. Plain butt, damage bulb. Small flake.</td>
<td>20</td>
<td>18</td>
<td>1</td>
<td>1.1</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>
Single finds. Two isolated flint flakes were found approximately 60m and 100m west of Group C.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/stint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/B A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1d</td>
<td>Pale grey flint</td>
<td>Secondary</td>
<td>Cortex retained. Transverse fracture. Found 100m west of Group C.</td>
<td>19</td>
<td>22</td>
<td>7</td>
<td>0.86</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4c</td>
<td>White flint</td>
<td>Tertiary</td>
<td>Plain butt, central rib on dorsal face. Transverse fracture, post burning. Found 60m west of Group C.</td>
<td>27</td>
<td>23</td>
<td>7</td>
<td>1.17</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

TS2 - Temple Sowerby field 2 (NY 625 266)

Location: This field is located 450m north east of Spitals at 125m above OD. It slopes to the north east, by approximately 20m.

Conditions: Fieldwalking was carried out in ideal, dry, conditions, although the north east edge of the field was too boggy to walk. Field was very recently ploughed.

Find: A total of eleven pieces of flint were recovered from the field. These appear to be scattered throughout the field although greater concentration is found in the eastern half.

These are described as single finds.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/stint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/B A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2d</td>
<td>Pale grey flint</td>
<td>Tertiary</td>
<td>Rectangular in shape, broken transversely at distal end.</td>
<td>19</td>
<td>22</td>
<td>7</td>
<td>0.86</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5a</td>
<td>Pale grey flint</td>
<td>Tertiary</td>
<td>Long, narrow flake with plain butt, broken tip and plough damage to edges.</td>
<td>30</td>
<td>15</td>
<td>9</td>
<td>2</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9h</td>
<td>Dark grey flint</td>
<td>Secondary</td>
<td>Cortical butt. Broken along the length of the right side, suggestion of retouch on left side.</td>
<td>18</td>
<td>11</td>
<td>6</td>
<td>1.64</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>9h</td>
<td>Pale grey flint</td>
<td>Secondary</td>
<td>A core trimming/rejuvenation flake, struck to remove spur and cortical inclusions. Long narrow flakes removed from surface.</td>
<td>16.5</td>
<td>12</td>
<td>7</td>
<td>1.38</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>11e</td>
<td>Pale grey flint</td>
<td>Rejuvenation</td>
<td>Contains large cortical inclusions. Long and narrow, and short flakes have been removed prior to patination. 34mm x 29mm</td>
<td>25</td>
<td>16</td>
<td>7</td>
<td>1.56</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>13f</td>
<td>Cream/brown chert</td>
<td>Modified pebble</td>
<td>Circular scraper, with plain butt, bulb and bulbar scar retained. Central ridge on dorsal face, retouched around right side and distal end, damaged along right side.</td>
<td>23</td>
<td>25</td>
<td>6</td>
<td>0.92</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>15c</td>
<td>Pale grey flint</td>
<td>Secondary</td>
<td>Inverse bulb of percussion on dorsal face. Cortex on right side, fractured transversely.</td>
<td>15</td>
<td>14</td>
<td>5</td>
<td>1.07</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>15g</td>
<td>Pale grey flint</td>
<td>Secondary</td>
<td>Tertiary flake with cortical inclusions. Evidence of long, narrow flakes having been removed.</td>
<td>20</td>
<td>12</td>
<td>8</td>
<td>1.67</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>16e</td>
<td>Dark grey flint</td>
<td>Tertiary</td>
<td>Tertiary flake with plain butt, bulb and bulbar scar retained. Central ridge on dorsal face, serrated along upper left side. Broken at distal end, damaged on right side. Serration’s smooth.</td>
<td>27</td>
<td>23</td>
<td>7</td>
<td>1.17</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

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[Table content continues...]

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[Table content continues...]

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[Table content continues...]

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[Table content continues...]
TS3 - Temple Sowerby field 3 (NY 618 263)

**Location:** This field is located 750m east of Skygarth Farm on a south west facing slope overlooking the River Eden.

**Conditions:** Fieldwalking was carried out in dry but grey and overcast conditions but north east corner of the field very wet. Field was very recently ploughed.

**Finds:** A total of eight pieces of flint were recovered from the field. These appear to be scattered throughout the field and are therefore described as single finds.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B Blade evidence</th>
<th>Late Neo/B A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7a</td>
<td>Fawn flint</td>
<td>Tertiary</td>
<td>Broken transversely at distal end.</td>
<td>18</td>
<td>17</td>
<td>4</td>
<td>1.06</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>19a</td>
<td>Dark grey flint</td>
<td>Retouched secondary</td>
<td>Cortex covers most of dorsal face. Flake is a broken section from a larger implement/flake. Retouch on one edge of dorsal face with plough damage to edges.</td>
<td>51</td>
<td>29</td>
<td>9</td>
<td>1.76</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>20b</td>
<td>Pale grey flint</td>
<td>Tertiary</td>
<td>Bulbar end of flint flake. Broken transversely.</td>
<td>17</td>
<td>16</td>
<td>3</td>
<td>1.06</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>22c</td>
<td>Black flint</td>
<td>End scraper</td>
<td>Covered in cream cortex on dorsal face. Heavy duty, blade like flake broken transversely at bulbar end. Retouched on distal end.</td>
<td>49</td>
<td>22</td>
<td>13</td>
<td>2.23</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>26a</td>
<td>Pale grey chert</td>
<td>Core</td>
<td>Single platform worked part way round circumference. Pebble flint. Blade and flakes removed. 20mm x 27mm</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>28c</td>
<td>Grey flint</td>
<td>Tertiary</td>
<td>Flint flake. Broken transversely.</td>
<td>16</td>
<td>21</td>
<td>2</td>
<td>0.75</td>
<td>Y</td>
</tr>
<tr>
<td>7</td>
<td>29c</td>
<td>Pale grey flint</td>
<td>Tertiary</td>
<td>Most of bulb surviving. Bulbar impression on dorsal surface.</td>
<td>13</td>
<td>11</td>
<td>4</td>
<td>1.18</td>
<td>Y</td>
</tr>
<tr>
<td>8</td>
<td>32a</td>
<td>Pale grey flint</td>
<td>Core frag</td>
<td>Part of a core from which long narrow blade like flakes have been removed. Badly damaged. 35mm x 20mm</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TS4 - Temple Sowerby field 4 (NY 629 269)

**Location:** This field is located 350m north west of Halefield Farm on a south west facing slope, on the north side of the valley of Birk Sike.

**Conditions:** Fieldwalking was carried out in dry but grey and overcast conditions. Field had only been ploughed for two days. Soil was very clay rich and difficult to walk.

**Finds:** A total of two pieces of flint were recovered from the field. These were found close to each other and are described as a group.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B Blade evidence</th>
<th>Late Neo/B A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8a</td>
<td>Translucent olive/brown flint</td>
<td>Thumbnail scraper</td>
<td>Flint with black and cream inclusions. Complete thumbnail scraper with flat bulbar face and convex dorsal face. Retouched around full circumference. Very ornate piece, unique flint type.</td>
<td>17.5</td>
<td>19</td>
<td>8</td>
<td>0.92</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>8b</td>
<td>Translucent chocolate brown flint</td>
<td>Tertiary usable</td>
<td>From bi-polar core. Broken along upper left and upper right edges. Flint type unique, very good quality. Two bladelet flakes removed from dorsal face - usable flake.</td>
<td>36</td>
<td>16</td>
<td>6</td>
<td>2.25</td>
<td>Y</td>
</tr>
</tbody>
</table>
TS5 - Temple Sowerby field 5 (NY 612 275).

**Location:** This field is located 700m south west of Acorn Bank Cottages on fairly level ground 105m above OD.

**Conditions:** Field walking was carried out in dry bright conditions. Field had been ploughed some time and was easy to walk.

**Finds:** A total of five flint pieces were found. Three pieces were found close together and are described as a group, the others are described as single finds.

**Group A,** which contains three pieces is centred at NY 61172750, and covers an area of approximately 44m x 30m.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool Flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/B A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8f</td>
<td>Pale grey flint</td>
<td>Secondary</td>
<td>Secondary flint flake with cortical butt and huge fracture at distal end.</td>
<td>25</td>
<td>16</td>
<td>10</td>
<td>1.56</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8f</td>
<td>Black chert</td>
<td>Tertiary</td>
<td>Very small flake with plain butt and white quartz inclusion in centre of dorsal face.</td>
<td>11</td>
<td>10</td>
<td>4</td>
<td>1.1</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>10f</td>
<td>Dark grey chert</td>
<td>Tertiary</td>
<td>Badly damaged with no diagnostic features.</td>
<td>16</td>
<td>11</td>
<td>9</td>
<td>1.45</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

**Single finds.** These flints were found approximately 150m to the north east of Group A (single find no.1) and 60m south east of Group A (single find no. 2).

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool Flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/B A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3b</td>
<td>Dark grey flint</td>
<td>Tertiary</td>
<td>Badly damaged with huge fracture on (?) distal end.</td>
<td>18</td>
<td>14</td>
<td>6</td>
<td>0.78</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10d</td>
<td>Dark grey flint</td>
<td>Retouched flake</td>
<td>Dappled with white inclusions. Small triangular shaped fragment broken along one edge, retouched along other two sides.</td>
<td>16</td>
<td>20</td>
<td>4</td>
<td>0.8</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>
Group A, which contains ten pieces is centred at NY 60502620, and covers an area of approximately 44m x 200m.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B Blade evidence</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7b</td>
<td>Dark grey chert Retouched bladelet</td>
<td>Bulb and bulbar scar retained, notched along right edge, tip of distal end broken. Tertiary flake</td>
<td>30</td>
<td>10</td>
<td>4</td>
<td>3</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>7c</td>
<td>Dark grey/ brown flint Thumbnail scraper</td>
<td>End scraper with flat bulbar face and convex dorsal face. Retouched around three sides broken on fourth. Good quality flint.</td>
<td>19</td>
<td>22</td>
<td>6</td>
<td>0.86</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>8b</td>
<td>Brown/grey flint Tertiary</td>
<td>Flint flake. Broken in several areas.</td>
<td>16</td>
<td>21</td>
<td>3</td>
<td>0.76</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>8g</td>
<td>Dark grey/ black chert Tertiary</td>
<td>Triangular in shape, cortical inclusions visible on right side. Long, narrow flakes removed from dorsal face.</td>
<td>31</td>
<td>15</td>
<td>6</td>
<td>2.07</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>8d</td>
<td>Cream/brown chert Bladelet</td>
<td>Tertiary flake, bulb and platform slightly damaged.</td>
<td>30</td>
<td>12</td>
<td>5</td>
<td>2.50</td>
<td>Y</td>
</tr>
<tr>
<td>6</td>
<td>9a</td>
<td>Pale grey flint Tertiary</td>
<td>With huge fracture at distal end. Bulb of percussion retained.</td>
<td>24</td>
<td>27</td>
<td>5</td>
<td>0.89</td>
<td>Y</td>
</tr>
<tr>
<td>7</td>
<td>9e</td>
<td>Pale grey/ cream flint Retouched bladelet</td>
<td>Complete bladelet, retouched along lower left edge, distal end and upper right edge. Notched on upper left edge and retouched in notch.</td>
<td>29</td>
<td>10</td>
<td>5</td>
<td>2.9</td>
<td>Y</td>
</tr>
<tr>
<td>8</td>
<td>9e</td>
<td>Cream/brown chert Tertiary</td>
<td>Broken along length of left side.</td>
<td>15</td>
<td>9</td>
<td>3</td>
<td>1.67</td>
<td>Y</td>
</tr>
<tr>
<td>9</td>
<td>9e</td>
<td>Blue/grey flint Tertiary</td>
<td>Broken along length of left side.</td>
<td>18</td>
<td>13</td>
<td>5</td>
<td>1.38</td>
<td>Y</td>
</tr>
<tr>
<td>10</td>
<td>9f</td>
<td>Cream chert Bladelet</td>
<td>Fractured along distal end.</td>
<td>19</td>
<td>9</td>
<td>3</td>
<td>2.11</td>
<td>Y</td>
</tr>
</tbody>
</table>

Single finds
Three isolated finds were found in the field, one was located approximately 140m east of Group A (find no. 11), another 100m west of Group A (find no. 12) and the third 125m north west of Group A.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B Blade evidence</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16c</td>
<td>Pale brown/ grey flint Core</td>
<td>Patina on one surface small blades and flakes have been removed. 21mm x 21mm</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td>?Y</td>
</tr>
<tr>
<td>2</td>
<td>3e</td>
<td>Cream brown/ orange and grey chert Modified pebble</td>
<td>Modified pebble/core fragment. Many granular, cortical inclusions. Blades and flakes removed from surface. 27mm x 26mm</td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td>?Y</td>
</tr>
<tr>
<td>3</td>
<td>3i</td>
<td>Dark and pale grey flint Tertiary</td>
<td>With plain butt and bulb retained. Broken longitudinally on left side and damaged on lower right side.</td>
<td>28</td>
<td>23</td>
<td>4</td>
<td>0.82</td>
<td>Y</td>
</tr>
</tbody>
</table>
TS11 - Temple Sowerby field 11 (NY 619 268).
Location: This field is located 500m north west of Spitals on a north west facing slope, over looking Temple Sowerby Moss.
Conditions: Fieldwalking was carried out in ideal, dry conditions. Field had been ploughed and harrowed prior to field walking.
Finds: A total of four flint pieces were found. Two pieces were found close together and are described as a group, the others are described as single finds.

Group A, which contains two flints, is centred at (NY 61952676) and covers an area 30m x 4m.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10d</td>
<td>Cream/brown chert</td>
<td>Scraper</td>
<td>With cortical butt and pronounced bulb of percussion. Retouched on left hand side to produce a crude scraper. Cortex on approximately two thirds of dorsal surface.</td>
<td>38</td>
<td>27</td>
<td>10</td>
<td>1.41</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10e</td>
<td>Dark grey flint</td>
<td>Secondary</td>
<td>Distal end with very sharp, feather, termination. Part of a secondary flake broken transversely to long axes.</td>
<td>14</td>
<td>24</td>
<td>3</td>
<td>0.58</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

Single finds
Two isolated finds were found in the field, one approximately 70m north west of Group A (single find no.1) and the other 80m west of Group A.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1d</td>
<td>Light grey flint</td>
<td>Core</td>
<td>A number of blades and flakes removed from one side of core but damaged around the other side. Plain butt. 21mm x 27mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>3f</td>
<td>Very pale grey flint</td>
<td>Knife</td>
<td>Made on tertiary flake, with faceted butt, pronounced bulb of percussion and bulbar scar. Retouched around whole of circumference. Unique and good quality flint.</td>
<td>40</td>
<td>28</td>
<td>5</td>
<td>1.43</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

TS12 - Temple Sowerby field 12 (NY 627 255).
Location: This field is located 600m north east of Spitals on a north east facing slope, which forms the south side of Birk Sike valley.
Conditions: Fieldwalking was carried out in ideal, dry conditions. Field had been ploughed for some time and was well weathered.
Finds: A total of fifteen flint pieces were found. Four clusters were identified and have been described as groups, and two isolated finds described as single finds.
Group A, which contains five flints, is centred at (NY 62732648) and covers an area approximately 44m x 60m.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4d</td>
<td>Pale grey flint</td>
<td>Primary</td>
<td>Cortex retained along left side. Upper right hand side broken.</td>
<td>21</td>
<td>8</td>
<td>6</td>
<td>2.63</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5c</td>
<td>translucent dark grey/brown flint</td>
<td>Thumbnail scraper</td>
<td>Complete thumbnail scraper with plain butt, flat bulbar face and convex dorsal face. Retouched around complete circumference and faceted across the whole of the left hand side.</td>
<td>20</td>
<td>18</td>
<td>8</td>
<td>1.11</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>5c</td>
<td>Dark grey chert</td>
<td>Core</td>
<td>Cortical platform and cortex around one side. A number of irregular flakes have been removed from the other side. 24mm x 22mm</td>
<td>78</td>
<td>42</td>
<td>11</td>
<td>1.86</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>6d</td>
<td>translucent dark grey/black flint</td>
<td>Plano-convex knife</td>
<td>Damaged at widest end. Good quality flint. (Comparison: Cherry and Cherry 1987, 3) (?) Beaker period (Edmonds 1995). Irregular facets across both faces</td>
<td>17</td>
<td>18</td>
<td>4</td>
<td>0.94</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>13</td>
<td>Dark grey flint</td>
<td>Secondary</td>
<td>Plain, cortical butt and distal end. Pronounced bulb and bulbar scar Faceted dorsal surface.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Group B, which contains three pieces, is centred at NY 62722640 and covers an area of approximately 20m x 60m

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7a</td>
<td>Dark grey/black chert</td>
<td>Core</td>
<td>Plain striking platform, with long, narrow blade like flakes having been removed from around the complete circumference. 41mm x 23mm</td>
<td>22</td>
<td>5</td>
<td>10</td>
<td>4.40</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>7a</td>
<td>Dark grey/black chert</td>
<td>Secondary</td>
<td>Cortical flake. Huge fracture on one side, faceted on the other. Damaged.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>7b</td>
<td>Grey/brown chert</td>
<td>Scraper</td>
<td>Chert scraper. Very crude, made from a chert pebble with no evidence that the flake has been removed from larger core. Retouched along one side.</td>
<td>29</td>
<td>18</td>
<td>9</td>
<td>1.61</td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>
### Group C
Group C, which contains three pieces, is centred at NY 62812648 and covers an area of approximately 44m x 70m.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9f</td>
<td>Cream/brown chert</td>
<td>Serrated Blade</td>
<td>Complete denticulated blade. Plain butt, produced through hard hammer direct percussion. Denticulated on left edge, retouched along full length of right edge. Denticulations are smooth and rounded.</td>
<td>36</td>
<td>22</td>
<td>9</td>
<td>1.64</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>7e</td>
<td>Black/brown chert</td>
<td>Tertiary</td>
<td>Semi circular in shape, with pronounced bulb and bulbar scar. Broken longitudinally. Possible attempt at retouch around right side, to make button scraper.</td>
<td>17</td>
<td>12</td>
<td>4</td>
<td>1.42</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

### Group D
Group D, which contains three pieces is centred at NY 62782654 and covers an area of approximately 44m x 30m.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5g</td>
<td>Black flint</td>
<td>Retouched bladelet</td>
<td>Black flint with brown cortical inclusions along left and right sides. A notched, bladelet flake with plain butt, diffuse bulb and hinge fracture at distal end. Two notches on right side. (?) Notch retouched. Possibly Mesolithic/Neolithic.</td>
<td>38</td>
<td>14</td>
<td>5</td>
<td>2.71</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>7g</td>
<td>Black chert</td>
<td>Core frag.</td>
<td>? Plain/cortical striking platform a number of irregular flakes removed but none show clear concentric lines bulbs of percussion. No flake scars complete. 25mm x 14mm</td>
<td>17</td>
<td>12</td>
<td>4</td>
<td>1.42</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>7g</td>
<td>Pale and dark grey chert</td>
<td>Retouched tertiary</td>
<td>Rectangular in shape, retouched around three edges, thermally damaged, fractured transversely.</td>
<td>18</td>
<td>35</td>
<td>8</td>
<td>0.15</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>

### Single Finds
Two isolated finds were found in the field, one was located approximately 60m east of Group B (find no. 1), the other 80m east of Group A (find no. 2).

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Tool/flake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11a</td>
<td>Pale grey flint</td>
<td>Retouched tertiary</td>
<td>Bulbar end missing but retouched along the broken edge. Retouch also visible in two other areas</td>
<td>29</td>
<td>34</td>
<td>3</td>
<td>0.85</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>11d</td>
<td>Dark and light grey flint</td>
<td>Blade</td>
<td>Distal end of flint blade, snapped transversely to long edge with hinge fracture evident on bulbar face of distal end. Retouch all round.</td>
<td>18</td>
<td>14</td>
<td>5</td>
<td>1.29</td>
<td>Y</td>
<td></td>
</tr>
</tbody>
</table>
TS14 - Temple Sowerby field 14 (NY 629263).

Location: This field is located 700m east of Spitals on a fairly level terrace although dips slightly to the north east.

Conditions: Fieldwalking was carried out in ideal, dry conditions. Field had been ploughed for some time and was well weathered.

Finds: Only one piece of flint was found.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Trav/s tint</th>
<th>Raw material</th>
<th>Toolflake type</th>
<th>Characteristics</th>
<th>L</th>
<th>B</th>
<th>T</th>
<th>L:B</th>
<th>Blade evidence</th>
<th>Late Neo/BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4d</td>
<td>Cream and black chert</td>
<td>Secondary Bulbar end with plain butt, no retouch but broken transversely to long axes.</td>
<td>23</td>
<td>26</td>
<td>8</td>
<td>0.88</td>
<td>Y</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 5

GREAT RUNDALE FINDS

Group A was located on the north side of the stream at NY 72582777.

<table>
<thead>
<tr>
<th>Flake/chip type</th>
<th>Raw material</th>
<th>no. of pieces</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclassified flakes/chips</td>
<td>Grey and cream chert</td>
<td>47</td>
<td>Very angular chips with no distinguishing characteristics.</td>
</tr>
<tr>
<td>Secondary</td>
<td>Cream and grey chert</td>
<td>8</td>
<td>Irregular, angular flakes with white, chalky cortex. Three show signs of flake removal. One with hinge fracture. Largest 6mm x 5mm.</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Grey flint and cream and grey chert</td>
<td>36</td>
<td>27 pieces are irregular, angular flakes and all show some signs of flaking on their surface. Five pieces retain evidence of either a bulb of percussion or the inverse scar of a bulb. Four pieces are very fine flakes up to 1mm in thickness. Largest is 9mm x 6mm.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group A bladelet flakes</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Find no.</td>
<td>Blade Flake Materia l</td>
<td>Length</td>
<td>Breadth</td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------------------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>1  Y</td>
<td>Light grey flint</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>2  Y</td>
<td>Light grey flint</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>3  Y</td>
<td>Cream chert</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>4  Y</td>
<td>Light grey flint</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>5  Y</td>
<td>Mottled grey chert</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>6  Y</td>
<td>Light grey flint</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>
Group B was located on the south side of the stream at NY 72592775.

<table>
<thead>
<tr>
<th>Flake/chip type</th>
<th>Raw material</th>
<th>no. of pieces</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclassified flakes</td>
<td>Cream and grey chert</td>
<td>39</td>
<td>Irregular, angular flakes/chips with no distinguishing features.</td>
</tr>
<tr>
<td>Secondary</td>
<td>Cream and grey chert, grey flint</td>
<td>12</td>
<td>Irregular, angular flint flakes with white chalky cortex. Most show signs of having been struck. Largest flake is 8mm x 4.5mm.</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Cream chert, grey and beige flint</td>
<td>24</td>
<td>Irregular and flakes of which most are very thin &lt;2mm. Some show signs of facets on their surface. Largest is 8mm x 5mm.</td>
</tr>
</tbody>
</table>

**Group B bladelets.**

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Blade</th>
<th>Material</th>
<th>Length</th>
<th>Breadth</th>
<th>L:B ratio</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y</td>
<td>Cream chert</td>
<td>10</td>
<td>3</td>
<td>3.3</td>
<td>Triangular in latitudinal profile, snapped transversely at both ends.</td>
</tr>
<tr>
<td>2</td>
<td>Y</td>
<td>Cream chert</td>
<td>7</td>
<td>3.5</td>
<td>2</td>
<td>Tiny blade like flake with a central ridge on its dorsal face. Slight damage on its bulbar end.</td>
</tr>
<tr>
<td>3</td>
<td>Y</td>
<td>Cream chert</td>
<td>12</td>
<td>4</td>
<td>3</td>
<td>Triangular in latitudinal profile with slight damage to the bulbar end. Central ridge on dorsal face but snapped along the length on right side.</td>
</tr>
<tr>
<td>4</td>
<td>Y</td>
<td>Dark grey flint</td>
<td>7</td>
<td>4</td>
<td>1.75</td>
<td>Irregular, angular flake with a L:B ratio of less than 2:1 but narrow flake removal evident on one surface.</td>
</tr>
<tr>
<td>5</td>
<td>Y</td>
<td>Dark grey flint</td>
<td>9</td>
<td>4</td>
<td>2.25</td>
<td>Tiny leaf shaped flake with a central ridge on dorsal face. Both ends slightly damaged. Some flaking evident on one end</td>
</tr>
</tbody>
</table>

Group C was located on the south side of the stream at NY 72562773

<table>
<thead>
<tr>
<th>Flake/chip type</th>
<th>Raw material</th>
<th>no. of pieces</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chips</td>
<td>Cream chert</td>
<td>6</td>
<td>Irregular, angular flakes with no diagnostic features</td>
</tr>
<tr>
<td>Secondary</td>
<td>Beige flint</td>
<td>1</td>
<td>A single irregular, angular flake with a chalky, white cortex. Measures 9mm x 5mm.</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Grey and cream chert</td>
<td>7</td>
<td>Irregular, angular flakes with no clear diagnostic features. Largest measures 7mm x 6mm</td>
</tr>
</tbody>
</table>
### Group C bladelet type flakes

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Blade Flake</th>
<th>Material</th>
<th>Length</th>
<th>Breadth</th>
<th>L:B ratio</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y</td>
<td>Light grey chert</td>
<td>11</td>
<td>3</td>
<td>3.66</td>
<td>Triangular in shape and longitudinal profile. Very crude bladelet type flake.</td>
</tr>
<tr>
<td>2</td>
<td>Y</td>
<td>Cream chert</td>
<td>7</td>
<td>3</td>
<td>2.33</td>
<td>Very crude, tiny bladelet type flake broken across bulbar end.</td>
</tr>
</tbody>
</table>

### Group D was located on the north side of the stream at NY72552776

<table>
<thead>
<tr>
<th>Flake/chip type</th>
<th>Raw material</th>
<th>no. of pieces</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chips</td>
<td>Cream chert</td>
<td>5</td>
<td>Three angular chert flakes and a single quartz chip. No diagnostic features.</td>
</tr>
<tr>
<td>Secondary</td>
<td>Cream chert and beige flint</td>
<td>3</td>
<td>Three irregular, angular flakes, one of flint, two of chert. Pitted white cortex on all three. Largest is 8mm x 5mm.</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Cream chert and grey flint</td>
<td>4</td>
<td>Four irregular, angular flint flakes. All show signs of flake removal, one has distinct facets on both faces.</td>
</tr>
</tbody>
</table>

### Group E was located on the south side of Great Rundale Tarn

<table>
<thead>
<tr>
<th>Flake/chip type</th>
<th>Raw material</th>
<th>no. of pieces</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chips/flakes</td>
<td>Cream and grey chert</td>
<td>29</td>
<td>Irregular, angular chips with no distinguishing features.</td>
</tr>
<tr>
<td>Secondary</td>
<td>Cream and grey chert grey, beige and honey flint</td>
<td>15</td>
<td>Irregular, angular flakes with a white chalky cortex. Largest flake measures 8mm x 6mm</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Cream and grey chert beige flint</td>
<td>11</td>
<td>Irregular, angular flakes with various levels of flaking on their surface. Largest flake measures 10mm x 6mm. Three have slight blade like tendencies but are not clearly of this typological category.</td>
</tr>
</tbody>
</table>
### Group E Bladelets

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Blade Flake</th>
<th>Material</th>
<th>Length</th>
<th>Breadth</th>
<th>L:B ratio</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N</td>
<td>Dark grey flint</td>
<td>7</td>
<td>6</td>
<td>1.16</td>
<td>Sub-rectangular in shape with hinge fracture at distal end and suggestion of retouch along edge of fracture. Broken transversely at bulbar end.</td>
</tr>
<tr>
<td>2</td>
<td>N</td>
<td>Cream chert</td>
<td>7</td>
<td>5</td>
<td>1.4</td>
<td>Very thin (1.5mm) flake with bulb and bulbar scar retained and evidence of flaking on dorsal face.</td>
</tr>
<tr>
<td>3</td>
<td>?Y</td>
<td>Cream chert</td>
<td>9</td>
<td>6</td>
<td>1.5</td>
<td>Flake with central ridge and plain butt. Hinge fracture at distal end.</td>
</tr>
<tr>
<td>4</td>
<td>Y</td>
<td>Cream chert</td>
<td>9</td>
<td>4</td>
<td>2.25</td>
<td>Triangular shaped flake, rectangular in latitudinal profile. Broken along the length of one side. Sharp point.</td>
</tr>
<tr>
<td>5</td>
<td>Y</td>
<td>Cream chert</td>
<td>12</td>
<td>3</td>
<td>4</td>
<td>Very thin (&lt;1mm) flake tapering to oblique points at both ends. Concoidal lines suggest this is the distal end of a larger flake.</td>
</tr>
<tr>
<td>6</td>
<td>Y</td>
<td>Cream chert</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>Tiny bladelet type flake, triangular in profile with a central ridge on dorsal face tapering to a point at distal end.</td>
</tr>
</tbody>
</table>

**Group F** was located on the north side of a stream to the east of Great Rundale Tarn at NY 73462844.

<table>
<thead>
<tr>
<th>Flake/chip type</th>
<th>Raw material</th>
<th>no. of pieces</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unclassified chips</td>
<td>Cream and grey chert, grey and beige flint</td>
<td>1085</td>
<td>Irregular, angular chips with no diagnostic features. Some are &lt;1.5mm thick but most have similar measurements for length, breadth and thickness. Largest flake is 11mm x 5mm.</td>
</tr>
<tr>
<td>Secondary</td>
<td>Cream and grey chert grey and beige flint</td>
<td>94</td>
<td>Irregular and angular flakes with pitted, grey/cream cortex. One flake has a white chalky cortex. Majority are of grey flint as opposed to chert, generally thinner than the unclassified chips described above. Facets evident on the surface of some flakes. Largest measures 8mm x 5mm.</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Cream and grey chert grey, beige and honey flint</td>
<td>430</td>
<td>Irregular and angular flakes. A variety of shapes are represented and many are very thin flakes. Many also show signs of flake removal from their surface. The largest measures 11mm x 5mm.</td>
</tr>
</tbody>
</table>
Group F bladelet type flakes. Asterix marks (?) deliberately shaped pieces.

<table>
<thead>
<tr>
<th>Find no.</th>
<th>Blade Flake</th>
<th>Material</th>
<th>Length</th>
<th>Breadth</th>
<th>L:B ratio</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y</td>
<td>Cream chert</td>
<td>12</td>
<td>4</td>
<td>3</td>
<td>Crude bladelet flake with central ridge. Hinge fracture at bulbar end and very end of tip broken.</td>
</tr>
<tr>
<td>2</td>
<td>Y</td>
<td>Grey chert</td>
<td>8</td>
<td>2</td>
<td>4</td>
<td>Triangular both in latitudinal profile and in overall shape. Very sharp point at both ends.</td>
</tr>
<tr>
<td>3</td>
<td>Y</td>
<td>Beige flint</td>
<td>9</td>
<td>4</td>
<td>2.2</td>
<td>Grey flint flake with white chalky cortical inclusions. Ridge along the length of the dorsal face. Some faceting on both faces.</td>
</tr>
<tr>
<td>4</td>
<td>Y</td>
<td>Dark grey flint</td>
<td>11</td>
<td>4</td>
<td>2.75</td>
<td>Triangular shaped flake with a rounded bulbar face and two very straight, flat facets on dorsal face. Sharp point.</td>
</tr>
<tr>
<td>5</td>
<td>Y</td>
<td>Cream chert</td>
<td>12</td>
<td>6</td>
<td>2</td>
<td>Sub-triangular in shape with a central ridge on dorsal face. Hinge fracture at distal end.</td>
</tr>
<tr>
<td>6*</td>
<td>Y</td>
<td>Cream chert</td>
<td>12</td>
<td>4</td>
<td>3</td>
<td>Thin (1mm) obliquely blunted chert flake. Two central ridges on dorsal face. Hinge fracture at bulbar end. Edges sharp.</td>
</tr>
<tr>
<td>7*</td>
<td>Y</td>
<td>Beige flint</td>
<td>10</td>
<td>4</td>
<td>2.5</td>
<td>Thin (1.5mm) flint flake with two ridges along the length of dorsal face. Widens towards distal end with a sharp left hand edge.</td>
</tr>
<tr>
<td>8</td>
<td>Y</td>
<td>Cream chert</td>
<td>6</td>
<td>2.5</td>
<td>2.4</td>
<td>Tiny chert flake with central ridge along dorsal face. Triangular in latitudinal profile.</td>
</tr>
<tr>
<td>9</td>
<td>Y</td>
<td>Grey chert</td>
<td>10</td>
<td>4</td>
<td>2.5</td>
<td>Triangular in latitudinal profile. Central ridge along dorsal face snapped obliquely across one end.</td>
</tr>
<tr>
<td>10*</td>
<td>Y</td>
<td>Cream chert</td>
<td>10</td>
<td>4</td>
<td>2.5</td>
<td>Flake with three longitudinal facets along the length of dorsal face which suggest bi-polar knapping technique. Notched on lower left side with possible retouched along the length of this side. Tapers to a sharp point at distal end but is slightly oblique with suggestion of serrations along right side of point.</td>
</tr>
<tr>
<td>11</td>
<td>Y</td>
<td>Beige flint</td>
<td>14</td>
<td>4</td>
<td>3.5</td>
<td>Triangular shaped flake which is also roughly triangular in latitudinal profile. Evidence of flakes having been removed from each surface.</td>
</tr>
<tr>
<td>12</td>
<td>Y</td>
<td>Light grey chert</td>
<td>12</td>
<td>4</td>
<td>3</td>
<td>Lozenge shaped flake with sharp point at each end. Triangular in latitudinal profile with a central ridge along the length of dorsal face.</td>
</tr>
<tr>
<td>13</td>
<td>Y</td>
<td>Grey chert</td>
<td>10</td>
<td>4</td>
<td>2.5</td>
<td>Long narrow flake with diffuse bulb of percussion and plain butt. Ridge along dorsal face and slight notch half way along left side.</td>
</tr>
<tr>
<td>14</td>
<td>Y</td>
<td>Cream chert</td>
<td>9</td>
<td>4</td>
<td>2.25</td>
<td>Chert flake with bulb and bulbar scar retained. Central ridge along dorsal face Broken along left edge and across distal end.</td>
</tr>
<tr>
<td>15*</td>
<td>Y</td>
<td>Pale grey flint</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>Small leaf shaped flake with central ridge on dorsal face. Hinge fracture on bulbar face.</td>
</tr>
<tr>
<td>16</td>
<td>Y</td>
<td>Beige flint</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>Flint flake with plain butt and bulb of percussion retained. Two ridges along dorsal face. Flake has sharp edges but tip broken.</td>
</tr>
<tr>
<td>17</td>
<td>Y</td>
<td>Grey chert</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>Small sub-oval flake with central ridge along both faces. Both ends rounded.</td>
</tr>
<tr>
<td>18</td>
<td>Y</td>
<td>Beige flint</td>
<td>9</td>
<td>5</td>
<td>1.80</td>
<td>Mottled flint flake with a plain butt and damaged bulb. Sharp edges but tip broken. Tiny chips removed from upper right side</td>
</tr>
<tr>
<td>ID</td>
<td>Color</td>
<td>Material</td>
<td>Length</td>
<td>Width</td>
<td>Thickness</td>
<td>Description</td>
</tr>
<tr>
<td>----</td>
<td>-------</td>
<td>----------</td>
<td>--------</td>
<td>-------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>19</td>
<td>Y</td>
<td>Pale grey chert</td>
<td>7</td>
<td>3</td>
<td>2.33</td>
<td>Mottled chert flake. Triangular in latitudinal profile. Diffuse bulb of percussion and broken tip.</td>
</tr>
<tr>
<td>20</td>
<td>Y</td>
<td>Beige flint</td>
<td>8</td>
<td>2</td>
<td>4</td>
<td>Very similar in form to find no. 2 although slightly smaller.</td>
</tr>
<tr>
<td>21</td>
<td>Y</td>
<td>Cream chert</td>
<td>8</td>
<td>3</td>
<td>2.66</td>
<td>Tiny flake with plain butt and bulb of percussion retained. Central ridge on dorsal face, parallel sides and broken tip.</td>
</tr>
<tr>
<td>22</td>
<td>Y</td>
<td>Beige flint</td>
<td>11</td>
<td>3</td>
<td>3.66</td>
<td>Fine, 's' shaped flake. Ridge along each face one formed by hinge fracture. Parallel sided until the tips when each end curves in opposite directions.</td>
</tr>
<tr>
<td>23</td>
<td>Y</td>
<td>Beige flint</td>
<td>8</td>
<td>3</td>
<td>2.66</td>
<td>Tiny parallel sided flake with square ends, although one end is slightly oblique.</td>
</tr>
<tr>
<td>24</td>
<td>Y</td>
<td>Cream chert</td>
<td>10</td>
<td>2.5</td>
<td>4</td>
<td>Very narrow, parallel sided flake, tapering towards one end. Plain butt tip broken.</td>
</tr>
<tr>
<td>25</td>
<td>Y</td>
<td>Beige flint</td>
<td>10</td>
<td>2</td>
<td>5</td>
<td>Long and narrow flake with tiny cortical inclusions. One square end and one pointed.</td>
</tr>
<tr>
<td>26</td>
<td>Y</td>
<td>Beige flint</td>
<td>8</td>
<td>3</td>
<td>2.66</td>
<td>Rectangular in section tapering to a flat point. One square end one oblique point but tip broken.</td>
</tr>
<tr>
<td>27</td>
<td>Y</td>
<td>Light grey flint</td>
<td>6</td>
<td>4.5</td>
<td>1.33</td>
<td>Secondary flake with cortical butt and fine facets removed from the bulbar face. Central ridge on dorsal face.</td>
</tr>
<tr>
<td>28</td>
<td>Y</td>
<td>Beige flint</td>
<td>7</td>
<td>2.5</td>
<td>2.8</td>
<td>Secondary flake with cortex along the length of the right side. Central ridge on dorsal face.</td>
</tr>
<tr>
<td>29</td>
<td>Y</td>
<td>Beige flint</td>
<td>8</td>
<td>3</td>
<td>2.66</td>
<td>Secondary flake with cortical inclusions along full length on two sides. Third side caused by a hinge fracture.</td>
</tr>
<tr>
<td>30</td>
<td>Y</td>
<td>Light grey flint</td>
<td>7</td>
<td>3.5</td>
<td>2</td>
<td>Flake with small cortical inclusion at distal end. Very shaped edge and some faceting on dorsal face. Small cortical inclusions on the plain butt.</td>
</tr>
<tr>
<td>31</td>
<td>Y</td>
<td>Light grey flint</td>
<td>10</td>
<td>3</td>
<td>3.33</td>
<td>Secondary flake, triangular in latitudinal profile with cortex along the full length of the left side. Some faceting on other two sides.</td>
</tr>
<tr>
<td>32</td>
<td>Y</td>
<td>Light grey flint</td>
<td>7</td>
<td>3</td>
<td>2.33</td>
<td>Small secondary flake with a cortical butt. Very tip of distal end broken and broken along the length of the right side. Some notching on the bulbar end of the dorsal face.</td>
</tr>
</tbody>
</table>
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Abbreviations

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