The University of Sheffield

Prehistoric Settlement and Agriculture on the Eastern Moors of the Peak District

Anne-Marie Heath

Thesis submitted for the degree of Doctorate of Philosophy

Department of Archaeology and Prehistory

June 2003

1 ACKNOWLEDGEMENTS

First my supervisors, Drs Mark Edmonds and Charles Frederick. It would be facile to even try to describe the help and support I received from them. Suffice it to say that I will never be persuaded that anyone has ever had better guidance and aid. Next, thanks also to Judy Alderson, my best friend without whom I would never have completed the excavation. That also applies to Helen and Alice Ullathorne who came out to dig on the moors in all weather. Then to all the landscape masters students - class of 1999 who also came out and completed the first trench in record time. Willy Kitchen also deserves thanks for lending me all his articles etc. Finally thanks to John Barnatt and Bill Bevan of the PDNPA who gave help and advice whenever it was requested.

1 ABSTRACT

The project is a study of soil erosion within the cairnfields on the Eastern Moors of Derbyshire. A range of Archaeological features and natural sedimentary sequences were excavated in the search for eroded sediments. The erosion evident at these features was dated by means of radiocarbon and optically stimulated luminescence dating. Contrary to previous assumptions as to the scale of erosion in later prehistory, which maintain that this was a severe problem, it is concluded that the evidence indicates a low degree of erosion for the Bronze Age. Erosion is concluded to have increased from the Iron Age with the establishment of extensive pasture land.

1 INTRODUCTION

1.1 CAIRNFIELDS IN THE PEAK DISTRICT

The Peak District in Derbyshire because of its particular circumstances of geology and topography, forms a distinct upland block lying between Sheffield and Manchester in the Southern Pennines (Figure 1). The region has some of the highest densities of archaeological features in Britain (Barnatt, 1987). This is especially true of the moorland in the east of the region, which contains a range of extremely well preserved agricultural and possible settlement remains (ibid). These remains primarily take the form of cairnfields, and it is generally accepted that they date from the Bronze Age although there are contrasting viewpoints which state that their period of use may have extended from the late Neolithic through to the Iron Age or even later (ibid).

The moorland is one of several landscape types in the Peak District, and the distribution of each of these landscapes tends to correspond with the distribution of particular types of bedrock. So, for example, the two major geological zones consist of limestone and coarse sandstone and each of these has a characteristic landscape. The archaeology is similarly zoned, and certain types of feature tend to be closely associated with particular landscape areas. So the moors are associated with the sandstone (or gritstone as it is locally known), and the cairnfields are associated with the moors. Uncertainties over dating and prehistoric land use in the different geologic zones of the Peak District have led to radically different interpretations of the past interrelationships between those zones (eg. Bradley & Hart, 1983, Barnatt, 1996) which in turn has led to uncertainty as to the position of the Eastern Moors evidence with respect to the development of agricultural systems in Britain (eg. Barrett, 1994).

This project has grown out of a larger scale joint project undertaken by the University of Sheffield, Department of Archaeology and Prehistory and the Peak District National Park Authority. This is the Gardoms Edge Project that ran for five years from 1995 to 2000, and combined excavation and environmental analyses in an attempt to gain data that would shed more light on activity within the cairnfields of the Eastern Moors. The primary aim of the research presented here, is to attempt to answer some of the questions raised by the Gardoms Edge project and to resolve some of the uncertainties associated with the gritstone cairnfields by an analysis of the soils and sediments. This will focus particularly on the dating of activity, within and between, the neighbouring cairnfields at Gardoms Edge and Big Moor. The soils and sediments studied will primarily be those that are assumed to have been eroded from prehistoric fields as a result of agriculture. It is hoped to gain from this a better understanding of the long-term developments in the character of prehistoric occupation and agriculture in the Peak.

In this region, various attributes of soils and sediments, but primarily soil fertility, have been used in support of core periphery models, which until recently were a common theme in the literature (eg. Barnatt, 1987, Bradley & Hart, 1983). Soil erosion and deterioration has been cited as a major contributing factor to issues as diverse as the abandonment of the gritstone uplands and the structure of clearance cairns (eg. Long et.al. 1998). However there have been few studies which have investigated soils as a form of environmental evidence in their own right. This is long overdue as soils and sediments comprise the most widespread form of environmental evidence in a region in which other forms are limited to specific areas. An additional aim therefore, is through a study of the soils and sediments of the Eastern moors, to test some of those hypotheses which take as their basis the idea that soil erosion was a direct result of prehistoric agriculture and was implicated in the abandonment of the cairnfields after the Bronze Age.

As the aim is to study developments through prehistory from the 4th to the 1st millennia BC, this study will not be confined to the Bronze Age. The bulk of the evidence does however relate to this period. Similarly, although the project will focus on the Eastern Moors, the initial chapters will also examine the relationships between this area and other parts of the region, as these are a consistent theme running through many current interpretations.

1.2 BACKGROUND - LANDSCAPE

The Peak District is Britain's first National Park and an area of outstanding natural beauty, designated as such because of the quality and variety of the landscapes it contains. The dominant landscape in the central limestone area for example, is gently rolling pasture enclosed by drystone walls, while the surrounding gritstone uplands are mostly moorland. Although these environments are apparently related to the differences in geology across the region, they have come into being not solely because of variations in bedrock, but because the history of occupation and land use has followed different trajectories in each geological area. This has meant that the geological zones have each had different potentials both for the creation and for the survival of archaeological features, and this has resulted in the association of certain types of archaeology with certain areas.

The prehistoric cairnfields, which form the focus of this thesis, are similar in character to those in some other upland areas of Britain, but in this region are found only on the gritstone. Compared to many other areas, which have similar remains, for example Northumberland and southern Scotland (Jobey, 1985, Yates, the number of features that have survived is particularly high. Even today most of the moors which form an almost continuous spread to the east of the river Derwent between Derbyshire and South Yorkshire still contain some cairnfield remains (Figure 2).

The creation and maintenance of the moorland landscape, with its low intensity land use, has ensured the survival of these features. It has also influenced archaeological interpretation and the data collection on which interpretation is based. Implicit in many models relating to the character of prehistoric activity across the region and explicit in some, is the assumption that marginality of environment in the present equates to marginality of either environment or society in the past. For example, Bradley & Hart (1983) argued that the societies who created the cairnfields on the moors would be of lower status than their contemporaries on the limestone, because the land they occupied was less agriculturally valuable. The limestone was therefore the "core" area for settlement, and the gritstone the periphery. As Barnatt (1987) has pointed out however, it is not known whether the present restriction of the cairnfields to the gritstone uplands is a measure of their original extent, or a result of the higher potential for survival of archaeological features on the moors. Barnatt has also argued (1996a) that the different topographical/geological zones of the Peak District would in the past have provided complementary subsistence zones, which may have been exploited in different ways, but were equally important. This argument is centred on a more mobile lifestyle postulated for the Neolithic and earlier Bronze Age, but the basic idea can also be applied to other periods including the present, where farmers have land on the limestone and the grit but use the zones differently.

Although this research does not seek to answer questions relating to the comparative importance of the different areas, interpretations that treat any zone as an isolated entity will be flawed from the outset, as none developed in a social or geographical vacuum. Some consideration of the development of, and differences between the various landscape zones of the Peak District, is vital to an understanding of the form, survival and interpretation of their associated archaeology. This thesis will start, therefore, with a consideration of the various factors that have combined to produce the contrasting landscapes of the region today.

1.3 GEOLOGY

With the exception of sporadic Pleistocene and Holocene sand and gravel deposits and some localised Tertiary sands and gravels, the Peak district is composed of rocks dating to the Carboniferous Period, which ended around 290 million years ago (Wolverson Cope, 1988). These rocks are grouped into two categories, the Lower and Upper Carboniferous. The oldest surface rocks are the Lower Carboniferous (Dinantian) marine limestones, which form the central core of the region. The nature of the Pre-Carboniferous rocks underlying the limestones is known only from three boreholes, at Woo Dale, Eyam and Calden Low (Figure 3) which evidenced respectively, volcanic rocks of at least Devonian age, marine rocks of Ordovician age and red sandstones of probable Devonian age. These paleozoic rocks are believed to have been folded and faulted during the Caledonian Orogeny and then largely peneplained during Devonian times (Wolverson Cope,1999).

1.3.1 The Lower Carboniferous (Dinantian)

The limestones which form the central core of the Peak District (Figure 3) were laid down from Dinantian times as the sea advanced from the south. The faulting of the pre-Carboniferous rocks had allowed movement of faulted blocks, resulting in the sinking of some relative to others and leaving upstanding "highs" (Wolverson Cope, 1999). The central part of the Peak District lies on one of these highs, where shallow waters led to the creation of a marine carbonate platform composed of well-bedded pure limestones, which form most of the present limestone upland. The shallow waters also provided ideal conditions for corals and led to the formation of unstratified carbonate banks, the so-called reef-limestones, which are found at various places around the Peak District, particularly at the margins of the central limestone (Dalton et. al. 1988). Away from the central higher area, there were deeper basins, which received more sedimentation, much of it land-derived. Consequently the limestone in these outer areas is less pure and is often interbedded with mudstones and shales. Today however much of this peripheral limestone is either buried under Upper Carboniferous strata or has been removed by erosion, and so outcrops only sporadically around the edges of the limestone area. Finally, the presence of lavas and tuffs, and of some igneous intrusions shows that volcanic activity was also occurring throughout much of the Lower Carboniferous, mostly in the eastern parts of the limestone area (Dalton et. al. 1988).

1.3.2 The Upper Carboniferous (Namurian Westphalian "Gritstone")

The Upper Carboniferous is marked by the deposition of land – derived sediments (Eden et. al. 1957) which by the end of this period had completely covered the limestone. These sediments, which form the bedrock of the moors, were laid down as river deltas and made inroads into the Carboniferous sea and are divided into two groups of strata, the Millstone Grit, and the Coal Measures. The lower group, which is the Millstone Grit series, comprises coarse sandstones (ie. the grits which give the series its name), argillaceous sediments, shales and mudstones and some thin coal seams. The thickness of the grits and associated strata varies considerably from place to place, reflecting changing depositional environments varying from deep water (shales, mudstones) to more shallow deltaic conditions (grits). The argillaceous sediments are more common in the lower part of the series while grits become more common in the upper part (Wolverson Cope, 1999).

The upper lithological grouping is the Coal Measures. Although this formation contains similar sequences of sandstones shales and mudstones, sands tend to be less coarse than in the Millstone Grits, and shales and mudstones are more frequent. Coal seams are also more common in the Coal Measures, as the name implies, and tend to be much thicker than in the Millstone Grit series (ibid.).

1.3.3 Uplift and Erosion

In addition to the above periods when deposition was the dominant sedimentary process, there have also been several periods of uplift, notably during the mid Carboniferous, the Permo Triassic and the Tertiary (Wolverson Cope, 1999). The uplift had most impact on the west of the region, where folding of the Upper Carboniferous strata occurred (Figure 4). It also had several significant effects on the geology and topography. First, deposition of the Millstone Grit and Coal measures in the west started later than in the east because uplift in the mid-Carboniferous led initially to erosional rather than depositional conditions. Therefore, while the succession of Upper

Carboniferous rocks is fairly complete to the east and north of the limestone, that to the west is more fragmentary because earlier parts of the succession are missing. Second, the periods of uplift caused increased downcutting of the rivers, and the combination of both these factors has resulted in deeply incised valleys and a more dissected topography in the west of the region. Third, the dome-like configuration of the rocks caused by the uplift means that the Peak District as a whole forms a relatively self-contained upland area, rising from lower lying land on either side. Finally, uplift of the rocks resulted in erosion, and the removal of a substantial thickness of the Upper Carboniferous rocks, first during Permo-Triassic times when many of the major landscape features first came into being, and again as further uplift occurred during the Tertiary (Wolverson Cope, 1988).

Erosion also seems to have been the dominant process during parts of the Quaternary, particularly during the most recent glaciation, although the history of this period is not so well understood (Briggs and Burek, 1985). Although it is certain that the area has been glaciated at some point, probably in the middle Pleistocene, most evidence for this has subsequently been removed by erosion. There are now no extensive glacial deposits in the Peak District except in the extreme western fringes. During the last glaciation, the region was close to but beyond the ice sheets and periglacial processes appear to have had the most impact on the landscape. These have tended to produce erosional rather than depositional features for example tors, but solifluction gravel deposits can occasionally be observed at the bottom of steep slopes.

1.3.4 Present Structure

The end result of the various episodes of uplift and erosion is that the geology of the Peak District takes the form of a truncated dome (Figure 4). Consequently, in plan it shows a similar pattern to that of growth rings on a tree. The oldest rocks now outcrop in the centre where the younger rocks have been removed, and the geology gets progressively younger towards the edges (Figure 3).

1.4 TOPOGRAPHY, ENVIRONMENT AND ARCHAEOLOGY

The topography of the Peak District is a product of the structure, uplift and differential weathering of the lithology. In general, the rocks are more highly folded in the west, and the topography more irregular. In other areas the strata dip more gently or have been peneplained and tend to form flat-topped plateau-like structures. General surface elevation increases northwards from around 270m OD at Wirksworth to around 650m OD on Kinder Scout (Figure 2) but local topography shows considerable variation within this. The region is drained by south flowing tributaries of the river Trent, the largest of which is the Derwent, which drains most of the centre, north and east of the Peak and divides the eastern gritstone from the limestone plateau. The rivers Dove and Manifold drain the west and dissect part of the limestone. The region can be divided into three main topographic and environmental zones: the first is the central (Lower Carboniferous) limestone, the second is the surrounding (Upper Carboniferous) gritstone, and the third comprises the river valleys.

1.4.1 The Limestone Plateau

The limestone takes the form of a large anticline, which is fairly flat topped but with some undulations on the surface. The only major dips are seen where the limestone disappears under the overlying Upper Carboniferous rocks so that in the west around Buxton it dips to the west, in the north it dips to the north etc. It is for this reason that the central limestone area is often referred to as a dome or a plateau (Wolverson Cope, 1988).

Within this general outline, the topography of the dome varies between higher, middle and lower altitude areas (Dalton et.al. 1988, Anderson & Shimwell, 1981). The largest part of the plateau surface lies at the mid-altitude range of 250-320m OD. Much of this section consists of the rolling pasture typical of the limestone, which extends upwards into higher ridges, and downwards into numerous valleys. These extend the range of altitudes in this zone, which in turn extends the climatic range and means that the subsistence and agricultural potentials of the limestone varies from place to place.

There are five main ridges, which are typically long, sweeping and whale-backed. At altitudes of 320 to 475mOD, they are the highest parts of the limestone with surface elevations comparable to some of the surrounding gritstone uplands. Climatic conditions are also similar to areas of the same altitude on the gritstone, with higher rainfall, greater wind exposure and a shorter growing season than in lower lying areas (Anderson & Shimwell, 1981).

The most sheltered parts of the limestone and the best conditions for agriculture (in climatic terms), are found on the lower limestone shelves, on the eastern periphery and in the valleys, which can be up to 200m lower than the higher plateau surface. Most of the valleys today are dry or have only seasonal streams, but their form and dendritic pattern indicates that they were originally water-cut features, and although they tend initially to be shallow in the upper reaches they typically deepen as many eventually join the more incised valleys of the major rivers.

A theme common to most models, that place the limestone at the core of Peak District prehistoric activity, is that the limestone has better soils and was therefore more suitable for agriculture than the grit. While this holds true in general terms today, it is important to note that the present landscape of the limestone is a relatively modern construct. It dates largely from the last two centuries, and is the result of the enclosure and improvement of the land in the Post-Medieval period (Barnatt & Smith 1997). Prior to this, the ecosystem over large parts of the limestone was heathland, very similar to the moorland that now covers the grits (ibid). The presence of podzols on the fragments of heath that still remain (Soil Survey Record 4, 1971) indicate that the limestone soils like those on the grit are not immune to deterioration. In the limestone dales and dry valleys, depending on slope, aspect and parent material, soils vary between the widespread rendzinas and the rarer rankers on the upper slopes, to brown earths on the lower and typically many soils on the upper slopes are leached to some extent. On the higher parts of the plateau, most soils are brown earths, the most common, being an acid brown earth belonging to the Nordrach series with a pH of 5.5-6.5 (Anderson & Shimwell, 1981).

Little is known about the prehistoric vegetational environment of the limestone because of a scarcity of contexts suitable for pollen sampling. Some sites have yielded data however, primarily Lismore fields at the edge of the limestone near Buxton and Lathkill Dale near Bakewell. These indicate that forest clearance for agriculture started in these places in the Early Neolithic and continued, though punctuated by episodes of woodland regeneration, through later prehistory. This resulted in an open landscape, by the late

Neolithic at Lathkill Dale and the later Bronze Age at Lismore Fields, where cereal cultivation started in the early Neolithic and continued throughout the later prehistoric period (Taylor et. al. 1994, Wiltshire & Edwards, 1993). Both these sites reflect vegetational changes at a local scale however, and the nature and extent of agricultural activity on the wider limestone plateau is extremely difficult to assess. With the absence of adequate environmental evidence, current understanding of the prehistory of the limestone as a whole, is based largely on the surviving surface archaeology.

1.4.1.1 Limestone Archaeology

Although medieval and post medieval archaeological features are comparatively common on the limestone and comprise both agricultural and industrial remains, survival of prehistoric features has not been as extensive as on the grits, and this period is represented dominantly by monuments and lithics scatters.

Lithics are found across the Peak District, both as occasional finds of lithic artefacts such as axes, and as scatters which can often represent accumulations of material from dates ranging anywhere from the Mesolithic up to the late Bronze Age. In addition to general problems regarding mixed scatters eg. those of secure dating, and of understanding what was being made and in what social context, there are two main problems relating specifically to the Peak District evidence. First, up until recent years there has been a strong bias in recovery towards the limestone, specifically the southeast part of the region where ploughing and subsequent field walking has been far more common than in other areas. The Peak Park Archaeology Service is attempting to redress this bias by instituting a fieldwalking program covering other areas on both the limestone, gritstone and in the shale valleys. Preliminary results from this suggest that a significant bias towards the limestone and away from the shale valleys, only becomes apparent in the Later Neolithic and early Bronze Age, (W Kitchen pers com.). Second, until recently the lithics evidence has not on the whole been analysed in a way that either takes account of biases or is in sufficient detail to provide much information, beyond presence or absence of human activity at any particular place or period. The exceptions to this are the on-going National Park Project, previously mentioned, and two other projects at Mount Pleasant and Roystone Grange, both of which are as yet unpublished. Until these problems are addressed in more detail the contribution that lithics can make to our understanding of the prehistory of the Peak District will be limited.

The earliest monuments are thought to date to the Neolithic and until recently, it was accepted that all the larger Neolithic ritual/ceremonial monuments were found on the limestone. These include two henges, at Arbor Low and the Bull Ring, and various types of Neolithic barrow, ranging from small circular chambered and unchambered, to larger barrows argued to have some similarities with mounds such as Silbury Hill (Barnatt, 1996a). The single possible exception to this is a large embanked enclosure at Gardoms Edge on the Eastern Moors, from which material suitable for carbon dating has recently been obtained. This was originally interpreted as an Iron Age hill fort, but as a result of more detailed observations made in the 1990s, as part of the research project carried out on Gardoms Edge by the Peak District National Park Authority and Sheffield University, it has lately been argued to be closer in form to a causewayed enclosure (Ainsworth et.al. Barnatt, 1998).

It has been postulated (Barnatt, 1996a, b., that the various barrow types on the limestone could represent a progression through time, with the early Neolithic represented by small circular chambered barrows and then long barrows. A range of monuments then developed in the Late Neolithic/ Early Bronze Age, which includes the henges, great barrows, bank barrows and smaller unchambered round barrows (ibid.). Unfortunately there is a lack of dating evidence to support this idea, as no Neolithic monuments have so far yielded carbon dates. At present interpretations continue to be based on typological analyses of form or on distribution.

There are some patterns in the siting of proposed Neolithic monuments. Of the proposed Early Neolithic features, the chambered barrows have no discernible regular distribution pattern in the landscape and are instead found in a variety of locations on both higher and lower parts of the plateau, (Barnatt 1996). Long barrows are all sited at or close to watersheds on the higher limestone. The distribution of the larger proposed Late Neolithic/Early Bronze Age monuments, ie. great barrows, bank barrows and henges, appears to be more regular. The north west of the plateau contains a henge, the north east a great barrow, the south west a bank barrow and a great barrow, the south east two great barrows, and in the centre of the plateau is a henge and two great barrows. Most are again on higher land and at least one in every sector is near to or on, a watershed. It is important to note however, that for various reasons, including intensity of land use, barrows are more likely to survive on higher ground (ibid). The smaller round barrows, of which there are over 500 known examples in the Peak District, are thought for the most part to date to the Late Neolithic and Early Bronze Age (Barnatt, 1999). Round barrows are found in almost all the topographic zones of the region, but their highest concentrations are on the eastern moors and the limestone plateau where they tend to occur either singly or in pairs across the plateau.

Interpretations of the significance of the monument distributions will be discussed in the next chapter, but most models are heavily reliant upon assumptions about agricultural activity and land use for which there is, first, little environmental evidence and second, no evidence in the form of archaeological features relating to agriculture. Therefore any associations that might have existed between monuments and settlement or agricultural areas, are impossible to assess through anything except lithics, the limitations of which have already been outlined.

1.4.2 The River Valleys

As the Peak District is an area of dominantly porous or permeable rocks, surface drainage is often associated with the impermeable shales and mudstones with which both the limestone and the grits are interbedded. On the gritstone this is less problematic because shale beds are more frequent, but in the central, purer limestone areas shales are less frequent, and this coupled with the permeability of the rock causes a general scarcity of surface water. Here, permanent springs are relatively rare, and others are frequently unreliable with a tendency to disappear in dry weather, (Dalton et. al. 1988). This is potentially a problem for livestock, but less so for cultivation as the average rainfall is generally high enough to support crops. With the larger rivers, Dove Manifold and Derwent, the situation is more complex, because with all these rivers, the drainage patterns show signs of having originated in previous geological times, being then superimposed upon the landscapes of the present (ibid). In general terms however, the association of shales with surface water still holds true. The Dove and the Manifold both have their sources outside the limestone area, on the Namurian shales to the north and west. Both also flow over shales for large sections of their courses, and both show significant decreases in discharge when they cross limestone (ibid). In the case of the Derwent and its tributaries, the rivers valleys are dominantly cut into the softer shales around the eastern edges of the limestone dome.

These aspects of the Peak District drainage have various potential implications for prehistoric settlement and subsistence. First, because the drainage is superimposed, the valleys are often larger than would be expected from the present size of the rivers, and more deeply incised. Consequently, they not only increase the amount of sheltered, low altitude land available, and therefore could possibly have provided slightly differing resources to the surrounding uplands, but they also have the added advantage of permanent reliable water. In theory therefore, the valleys are an inviting prospect for agriculturalists. In practice however, the soils developed on the shales tend to be heavy clays, very prone to waterlogging, and this attribute could have reduced their productivity and associated attractiveness, (Anderson & Shimwell 1981).

Barnatt (1996) has argued that the valleys and the lower limestone shelves could have formed a third subsistence zone which provided complementary resources to the higher limestone and grits, but that the valleys were probably more heavily wooded and would therefore be more suitable for home bases. The lower limestone would be better for cereal cultivation and the higher limestone would have made good upland pasture (ibid). With respect to the lower limestone, the Lismore Fields pollen data supports this to some extent, but the river valleys have been intensively settled throughout the historic period, and frustratingly in this zone, there remain very few visible remains that would allow an assessment of prehistoric activity to be made with any precision.

1.4.3 The Gritstone

The highest parts of the gritstone lie to the west and north of the limestone plateau, with the land rising to over 600m O.D around the Kinder Scout/Bleaklow massif (Figure 2). The northern gritstone forms a flat-topped upland covered with thick peat, which drops via steep sided often wooded valleys, to the surrounding lower land. Peat accumulation started here in the Mesolithic and became widespread at an earlier date than on the eastern grit (Tallis & Switsur, 1983). Although tree remains buried by the peat are sometimes associated with charcoal (ibid.) suggesting human interference in the vegetation cover, there are no apparent prehistoric sites here and it seems that this area may always have been beyond the limits of cultivation. Today, the northern Millstone Grit is mostly moorland, its agricultural potential being limited to rough grazing although it has a high amenity value for outdoor pursuits and as grouse moor. The western uplands especially in the north, are similar to the northern but with more irregular topography. The lower shelves mainly towards the south are limited in extent but support modern pasture. Although a higher proportion of the lower shelf land has been improved compared to that on the eastern gritstone, the presence of similar but less extensive cairnfield remains indicate that this land supported prehistoric agriculture.

The eastern gritstone with which this study is concerned, is separated from the limestone by the valley of the river Derwent and rises to a height of between 200 - 450m OD (Dalton et.al.1990). This range of hills generally has a stepped profile, caused by the interbedding of sandstones and shales and of their relative susceptibility to erosion (Figure 5). Typically, rising from the river valley is a (Millstone Grit series) sandstone escarpment, which gives way to a shelf cut back along the softer shales, which in turn gives way to further escarpments (Wolverson Cope 1998). The scarps and backslopes are usually well developed, with the scarps forming prominent "edges" which have often been exaggerated by quarrying. The back slopes are shallow, the strata dipping eastwards at angles of 2^0-3^0 (ibid). The dips stretch for approximately 4km eastwards before the Millstone Grits disappear under the Coal Measures. In traversing the edges, it is possible to see that the exposed sequences conform vertically to a set pattern, which is constantly repeated (Figure 5b), and the vertical sequences are therefore a product of the depositional environments. In contrast, the lateral geological variation is a product of weathering and is far less uniform. Consequently across the landscape the bedrock changes frequently, from shale to sandstone and back again depending upon how complete the removal of any particular layer has been. These lateral changes in bedrock have given rise to a mosaic of ground conditions and habitats. The shales usually form the lower lying land; they have little surface stone, and being less well drained are generally covered with wet loving species such as tussock and cotton grass. The better-drained grits, have much more surface stone and tend to have a vegetation cover of heaths, and increasingly, bracken.

Today some of the lower gritstone, below approximately 250m O.D., is enclosed and under improved pasture. Above this level, although there is some improved pasture, unimproved moorland is the norm and its present agricultural value is limited. The soils here are generally acid and either heavily podsolised or gleyed depending on drainage, which in turn depends on whether the bedrock is sandstone or shale. They range from the Abney Series found mostly on the dipslopes, to the Greatrix Complex on the shales to the Ambergate Complex on the Scarps (Soil Survey record 4). Like on the northern and western gritstone the soils are covered for the most part by a thick mor humus or by peat, which probably started to accumulate in localised badly drained areas during the Mesolithic, (Hicks 1972). This then expanded to become much more widespread after large scale deforestation in the late Iron Age and early Roman periods (Hicks, 1972).

1.4.3.1 Gritstone Archaeology

Good conditions for survival on the less intensively farmed moorland have led to the preservation of a wide range of archaeological features, dating from prehistory up to the 20th century. Most of the post prehistoric remains are actually Post Medieval, and relate to industry, leisure and occasionally ceremonial activities, rather than to agriculture. Industrial use of the moors tends to be related to extraction, dominantly quarrying of stone (but the scars of coal prospecting and extraction are also visible in places), and millstones and quarrying debris litter many of the scarp slopes. The moors are also criss-crossed with quarry tracks and other transport routes such as pack horse trails or modern footpaths, and in an area which otherwise shows notable landscape stability, it is the transport features that show most evidence of erosion. Other less common but nevertheless interesting features comprise monuments such as war memorials and the remains of military training exercises in the Second World War. These consist of bullet holes and mortar bursts on rocks and, occasionally (and slightly alarmingly) the shells that caused them.

The prehistoric remains are as varied but with a different emphasis. The archaeology indicates a fundamentally agricultural rather than industrial use of the gritstone, and dominantly comprises the field systems, house platforms and ceremonial features, known collectively as cairnfields. Of these, house platforms are the least visible. Some can be picked out by the presence of a low semicircular bank of stones surrounding a circular flat area, but if there is no stone bank, the only evidence is a flat circular area. House platforms illustrate the downside of the moorland archaeology. While preservation conditions are very good, visibility with a cover of tall heather is practically non-existent. Even quite large cairns can be difficult to spot among the heather, and the existence of ephemeral, effectively sub-surface features such as house platforms can often only be confirmed by excavation. The possible biases that result from the lack of visibility will be discussed later. The total number in each cairnfield is therefore not known, but for example on Gardoms Edge, there are approximately ten features which it is thought could be dwellings (B. Bevan, pers. Com.).

Ceremonial features in the cairnfields comprise cairns, round barrows and stone circles/ring cairns. Cairns of all shapes and sizes are not surprisingly the most obvious features of the cairnfields. The ones most suggestive of a ceremonial or ritual function tend to be larger and more structured than others and are often associated with artefact concentrations. A sharp distinction in the evidence cannot be made between ritual and mundane forms of activity however, and many cairns show aspects of both.

Barrows are commonly associated with cairnfields, and every cairnfield has at least one barrow in the near vicinity, (Barnatt 1999). Those which are associated with cairnfields tend to be located at the peripheries, those which are not tend to be situated close to but not quite on, topographical boundaries (Barnatt 2000). It has been suggested that such barrows may have been deliberately positioned in order to overlook the land in certain directions rather than to be seen from a distance (ibid).

The final type of ceremonial or ritual monuments in the cairnfields are small stone circles and ringcairns. These form a category of evidence that is exclusive to the gritstone in the Peak District, although they are similar in type to others found across the north and west of England and the south of Scotland (Yates 1984). There are over 40 examples of these features on the eastern moors. They typically comprise a flat central area, which has often been deliberately levelled, surrounded by a low stone bank containing small orthostats on its inner edge. Almost all are found within or near cairnfields, although some survive in isolation in areas where more modern agriculture may well have removed most other traces of prehistoric activity (Barnatt 1986 1987).

The agricultural features consist of groups of clearance cairns and of field boundaries, both of which can vary considerably. Some seemingly simple cairns, show no evidence of phasing and could represent only initial stone clearance. Others show signs of phasing, with for example, larger stones at the base, overlain by smaller and then by more larger stones.

Field boundaries, where present, can be fragmentary or continuous. They usually comprise irregular tumbles of stone, which resemble accumulations of clearance along field edges rather than purpose built walls, and they are generally too low to form effective barriers for stock. It has been postulated therefore that in many cases, fields may have been bounded by hedges or fences that have left no trace other than the stones thrown up against them (Barnatt, 1987). More continuous boundaries are found at a few more complex sites such as Big Moor. These are usually made of earth or earth and stone. These also have been argued to have formed by accumulation this time of sediments, against an obstacle such as a hedge. Alternatively they may represent turf stripped from prehistoric fields prior to cultivation (Barnatt, 2000). Together, the positions of cairns and boundaries suggest that field types varied both within and between cairnfields. Some fields are coaxial and are fairly tightly grouped. Others are less regular in shape and more haphazardly grouped.

There are many possible reasons for the variety of field types. Some, such as change through time, or an association of field type with certain agricultural activity for example, would have more significance for an understanding of the character of the Bronze Age agriculture. Others, such as variations in topography are perhaps less significant in this respect. Either way, the field evidence as it is understood at present is open to a range of interpretations. Some features suggest cultivation, while some are suggestive of stock pounds but on the whole the purpose of the fields cannot be determined with any certainty. Similarly, some features and associations of features hint at chronological depth, but few absolute dates have so far been obtained due to the very limited number of modern excavations that have taken place. Most dates, up to now, have come from individual ceremonial or funerary features in different cairnfields, and these tend to cluster in the early - mid Bronze Age ranging from 1750 + - 150 BC to 1050 + - 150 BC (Lewis 1966, Radley 1966, Riley 1966, Barnatt 1995). The single date obtained so far from a domestic enclosure at Swine Sty on Big Moor, was also early Bronze Age, being 1610 + - 80 BC (Hart, 1981), but artefactual evidence at the site suggests a date range extending into the Iron Age (Barnatt, 1987).

As with other evidence in the various Peak District zones, the survival of the cairnfields has been affected by later agricultural activity although in this instance the picture is more straightforward. Only fragments of cairnfields exist below 250m OD because the land at this level is mostly under modern pasture. The fact that some features still survive here however, suggests that Bronze Age agriculture was practised at this altitude and this also indicates that the number of cairnfields could once have been much higher than it is now. Barnatt (1987), estimates that 90% of land where cairnfields may have existed, has been improved and the evidence destroyed.

Cairnfield size and frequency varies with altitude (Figure 6, Barnatt, 1987). There are 47 existing cairnfields and four more are known from documentary evidence to have existed. The highest density is on the lower shelves, between 250 and 300m OD and almost all the more complex sites are found at this altitude. Above 300m OD there are fewer cairnfields and these tend to be smaller and simpler, with a more restricted range of features, and fewer indications of chronological depth (ibid.). Above 350m OD there are few cairnfields and none with well-developed field boundaries (ibid.). It would seem that perhaps the higher cairnfields were at altitudes approaching the limits for viable agriculture, and the lack of evidence of chronological depth at these sites could indicate that they were occupied for shorter periods of time. This interpretation has to be treated with caution however, as there are other possible explanations for the variation in cairnfield remains. One obvious alternative is that in the higher cairnfields, the farming that took place was of a type that did not leave such visible traces.

There are various factors influencing the visibility of the prehistoric agriculture. First, the amount of surface stone in any given area will influence the number of clearance features that are created. Second, farming practice will influence the amount of clearance. Pastoral fields, for example, would probably only need initial clearance of larger stones, whereas arable fields might generate clearance throughout their lifespan. Finally the amount of erosion and sediment movement will influence visibility, and will in turn be influenced by factors such as farming practice, soil type and topography. It would be expected that arable would produce more sediment movement and consequent build up against obstacles than pasture and so on. The relative simplicity of the higher field systems could therefore, be due to any combination of the above, and before the differences between cairnfields can be understood, the influence of these factors needs to be explored.

The apparent size of the cairnfields may also be a result of the visibility (or lack thereof) of the evidence. The cairnfields, particularly the more complex, tend to be situated on the best available land in any vicinity. This is dependant on the geology and topography and dependant factors such as drainage slope and aspect, which can vary considerably across quite a small area (Barnatt, 1987). Within any given cairnfield the majority of visible field systems tend to be on the better drained gritstone rather than the shale, and the prehistoric farmers seem to have preferred flatter land, often south facing. The cairnfield remains do not necessarily represent the entirety of prehistoric farming activity however. The shale for example, produces far less surface stone than the grit, which could be a reason for the lack of cairns on this bedrock. Alternatively, the worse drained shale may have been more suitable for pasture than cultivation, as may the steeper land and that with a less favourable aspect, and if pasture was not cleared of stone cairns would not be produced. The standing archaeology may not therefore reflect the true extent of prehistoric land use.

1.5 A SUMMARY AND A STARTING POINT

The Peak District is today a region where contrast rules. Differences in geology, topography and land use have created a set of recognisably distinct environments with equally distinct archaeological associations. The differences between these environments inform and pervade archaeological understanding in numerous ways, sometimes subtly sometimes more obviously, but frequently in prehistoric studies with respect to the subsistence potentials of different areas. There are contrasts in potentials arising from topography, specifically from factors such as altitude and associated climate, and slope, aspect and landform. There are very obvious contrasts in geology and soils, and associated with these there are similarly obvious differences in land use, which suggest that the limestone is in general (though not inevitably), more agriculturally productive than the grit. Linked to this there are differences in potentials for the survival and preservation of the archaeological evidence on which our understandings depend. Finally, there is the essential contrast between the potentials of upland areas such as the Peak District, in "the Highland Zone" of the British Isles, and those areas with conditions more amenable for agriculture in the "Lowland Zone".

The problem is that the contrasting landscapes of today, are themselves archaeological features, which are the result of centuries if not millennia of human modification. Consequently, the extent to which the landscapes of the present can be used as direct analogues for the landscapes of the past is questionable, because we simply do not possess sufficient understanding of the original potentials of the land. Despite this, archaeological research has all too often been influenced by perceptions of the agricultural viability of today's landscape zones, and consequently present conditions have too often been projected back into the past. So in the Peak District we have the interesting situation where the Eastern Moors, an area with ample direct evidence for prehistoric agriculture, has been argued to be of secondary importance to the limestone, an area with little or no direct evidence for prehistoric agriculture, on the grounds that the moors were "marginal" land (Hawke-Smith, 1979, Bradley & Hart, 1983, Hicks, 1971).

The perceived marginality of the gritstone closely parallels that of upland areas in general, which have fairly consistently been considered to be poor relations of their lowland cousins for agricultural and settlement purposes, because of poorer climate and soils. For example they have been seen as areas of last resort, to be settled only when the lowlands are full (eg. Burgess, 1985), or only of any use when climatic conditions were milder, having to be abandoned when the climate deteriorated (eg. Lamb, 1981). Until recently therefore, the eastern moors evidence like that of similar remains elsewhere, was viewed as fitting into the general pattern of expansion of settlement into the uplands of Britain during the 2nd millennium BC, and subsequent abandonment of these areas in the 1st millennium BC.

The timing of abandonment and also of establishment of the Eastern Moors cairnfields has increased in importance in Peak District research during recent decades, as the idea has been challenged that marginality can be used to explain in full the establishment and abandonment of cairnfields (Barnatt, 1996a, 1996b, 1999). In these more recent models, Barnatt, in a similar way to Barrett, (1994) has emphasised social change rather than environmental limitations in the interpretation of the Peak District evidence. The focus of debate centres most recently around the shift from mobility to sedentism and from tenure to ownership of land, and this debate has brought to the fore the issues of the character, timing and longevity of activity in the cairnfields, which at present are the best source of evidence for prehistoric agriculture and subsistence.

1.5.1 Thesis Structure

The starting point for this work is therefore, that the Peak District and specifically the cairnfield evidence is open to a number of, often radically different interpretations, the evaluation of which is at present hampered by a lack of certain types of evidence. This particularly applies to dating evidence relating to subsistence activity. In the succeeding chapters these interpretations, and the limitations of the evidence available at present will be first be discussed in more detail. These, and the specific questions which can be answered by this research, the methodology used to find answers, and the conclusions reached, will be addressed in the following order :-

- Chapter 2 – History of Research. This describes the history of research in the Peak District, and reviews the development of the main theories and the main subjects of debate.

- Chapter 3 – Questions and Answers. This chapter will deal with the main current research questions evident in the literature.
- Chapter 4 – Analytical Methods. This chapter describes the methodology used together with the rationale behind the choices of analytical methods.
- Chapter 5 – Results Big Moor and Gardoms Edge - This chapter presents the results of the fieldwork on Big Moor, and Gardoms Edge and describes the stratigraphic characteristics of the archaeology, and the sampling contexts in each trench.
- Chapter 6 – Discussion and Conclusions. This chapter summarises the main findings, discusses the inferences it is possible to make from the data and presents conclusions.

2 RESEARCH

2.1 BARROW OPENERS

The history of research starts in the Peak district, as in so many parts of Britain, with antiquarian excavations aimed primarily at the recovery of artefacts and skeletons. The first detailed written accounts came in the late 1700s, when Rooke and Pegge published the results of their investigations into the "druidical" remains in Derbyshire (Barnatt & Smith, 1991, Rooke 1782, Pegge 1785). By the mid 1800s there were several antiquarians at work in Derbyshire, the best known being Thomas Bateman, whose archive forms the bulk of the published research from that period (Barnatt & Smith, 1991). Between them, Bateman and several of his associates, principally Samuel Carrington and James Ruddock, but also others such as Samuel Mitchell, James Bagshawe and John Lucas, excavated over 400 barrows, with Bateman himself, (or rather his labourers) accounting for at least 200 (Lester, 1973).

To modern eyes, Bateman's accounts of his excavations read like archaeological horror stories. They were usually completed within a day and not infrequently several barrows would be "opened" on the same day, with his record apparently being four, on the 15th May 1845 (Lester, 1973). The usual method was to put a trench through the middle of a barrow in search of skeletal remains and artefacts. If none were found, then anything was likely to happen, as is shown by his account of the excavation of a large mound, Gibb Hill near the Arbor Low henge. After an exceptional six days of digging with no burials found, and the original trench having been widened and deepened several times,

> *"A tunnel was driven from the west side of the trench at right angles, in the hope of finding an interment, but after carrying it three or four yards it was deemed unsafe to continue it; and the supporting timbers being knocked away previous to abandoning the work, the whole superstructure fell in, and much to our surprise, revealed the interment.*
>
> (Bateman, 1861 pp 17-19).

He then adds

> *By the sudden fall of the sides and the adjacent earth, a very pretty vase of small size was crushed to pieces,* (ibid).

Bateman's methods would be unacceptable today, but he can hardly be blamed for working to the standards of the time. In the first half of the nineteenth century, it was standard practice to dig straight through the middle of a monument, because that was where it was thought that artefacts and bodies would most likely be found. It must also be noted that many of the features that were dug at the time were under threat of destruction from numerous sources, such as land improvement and quarrying, not to mention other antiquarians. Bateman's records often provide a valuable account of features that would otherwise have vanished without trace (Lester 1973). In many ways; the records that he kept, the accounts that he published and his subsequent treatment of the artefacts he collected, Bateman was superior to many of his contemporaries. Although his records are by no means comprehensive, omissions tend to be of things that were outside the scope of his investigations, while accounts of matters considered important, were generally clear, reasonably (but inconsistently) detailed and accessible. Therefore descriptions of structure, soils and the location of the features he excavated are often cursory, with few accurate measurements being noted, but his journals and publications document fairly lucidly his methods of recovery, and those artefacts and skeletal remains that he considered to be important (ibid).

In his subsequent treatment of the material he collected Bateman appears to have possessed a similarly enlightened attitude. His books (1848, 1861) reflect a desire to document the investigations carried out both by himself and his colleagues, in order to make the results available to any who had an interest in the subject. They often form the only surviving accounts of work carried out by others. This attitude also extended to the large quantity of material that he collected or bought, which he catalogued in great detail and generally made freely available to other scholars (Lester 1973). Like his excavation methods, Bateman's analyses of the data were in line with the preoccupations of his time and his prime concern was the typological categorisation of objects and the establishment of a relative chronological order. In this respect he was remarkably successful. Bateman's research and the body of material he gathered remained the major source of archaeological data for the Peak District right up until the middle of the next century (Fowler, 1955).

PAGE
MISSING
IN
ORIGINAL

2.2 CULTURE HISTORY

The next significant development in Peak District archaeological research was interpretative and came as the culture history paradigm rose to dominance in British archaeology in the early decades of the 20th century. By this time, ironically, just as the need for better excavation and recording methodologies was being recognised and acted upon, the Peak District entered a long period during which there were few excavations in general, and even fewer which made any notable contributions to the existing body of data.

During this period, the continuing accent upon the acquisition of artefacts and skeletal remains meant that in terms of excavation, the bias towards upstanding monuments persisted. This is illustrated by the work of the Heathcote family. They are among that minority whose work did constitute a significant advance in Peak District archaeological research, by providing the first detailed record of features on the gritstone. During the 1920's and 30's the Heathcotes documented and excavated a series of burial monuments on Stanton Moor, (a gritstone outlier to the west of the main formation). From reading their published accounts however (Heathcote, 1930, 1936, 1939a, 1939b, 1954), it is apparent that although details of structure and stratigraphy etc. were recorded, these were incidental to the main purpose of obtaining artefacts and human remains. In fact, on one occasion, despite having recovered twelve interments, the small number of associated grave goods prompted J.P. Heathcote to comment;

> *"In reviewing the results of the excavations apart from the scientific point of view, it seems to be a matter of opinion whether these are in proportion to the labour expended."*

(Heathcote, 1930).

It was against this background, in which artefacts were of paramount importance, that the first coherent models for the prehistory of the Peak were formulated, (Fowler, 1955, Armstrong, 1956) using data, which by and large, came from the antiquarian collections of the previous century, supplemented by a few more recent excavations and by chance finds.

These models dealt with the waves of immigration which were thought to have taken place from the Neolithic to the Bronze Age, the primary evidence for which was changes in burial practice inferred from artefact and skeletal groupings and from burial monuments. Armstrong's work is an account of the succession of the cultures that supposedly occupied the Peak District from the Palaeolithic to the Bronze Age, while Fowler's is specifically concerned with artefacts as evidence of the transition from the Neolithic to the Bronze Age. Although they write from differing perspectives, both authors agree on the overall sequence of events.

The earliest immigrants were argued to have been pastoralists who arrived at the beginning of the 3rd millennium BC in two different groups; one from the east and one from the west. They settled on the limestone and were thought to have been the builders of the small number of megalithic tombs in the region. The burial rite was communal and the tombs were generally passage graves set in circular cairns (Armstrong, 1956).

As the limestone was thought to have been "shunned" by Mesolithic peoples (Armstrong, 1956: 99) this colonisation of the Peak District by Neolithic farmers appeared to have been largely peaceful, leading, by the mid-Neolithic to racial and cultural fusion between the native hunter gatherers and the immigrant farmers. The evidence for this fusion was the so-called "debased megalithic" burial monuments which were typically rock-cut cists containing single crouched interments or cremations (Armstrong, 1956). Again, according to Armstrong, the economy throughout the Neolithic remained pastoral, with occupation centred on the limestone, while, "*In the Millstone Grit region and the northwest Pennine uplands the Mesolithic hunters remained in possession*" (Armstrong, 1956:104).

The next supposed wave of immigration evidenced by Beaker burials, signals the start of the transition from the Neolithic to the Bronze Age, which Armstrong places at around 1600 B.C. The known Beaker burials were usually single inhumations or cremations, accompanied by grave goods and placed in rock cut cists under circular barrows (Armstrong 1956, Fowler 1955). According to Armstrong (ibid), it is during this period that the first exploitation of the gritstone uplands by farmers took place, as the arrival of the Beaker folk led to increased population pressure on the limestone, causing an expansion of displaced Neolithic farmers and refugees onto the gritstone. The gritstone cairnfields were not attributed to this culture however, and Armstrong's view was that settlement on the grit at this time was small scale, with the limestone remaining the focus of most occupation. Fowler differs on the date of this expansion, placing it in the Middle Bronze Age. The contrast between the two reflects the difficulties of determining the chronological sequence, from a complex and incomplete artefact collection, and without the advantage of absolute dates.

The picture is then complicated by the arrival of Food Vessels, Fowler is vague on whether these represent yet another influx of people into the Peak or simply the adoption of a new style of pottery, but Armstrong takes the view that a new wave of immigrants did arrive, settling again mostly on the limestone.

The final settlers to arrive were the Collared Urn people, supposedly between 1500 and 1400 B.C. The introduction of this pottery type was associated with what Armstrong describes as a marked cultural break, indicated by the disappearance of Food Vessels and the burial of cremated remains in urns, sometimes, but not always, under barrows. The distribution of Collared Urns was also thought to be significantly different to that of other pottery types in that they were dominantly associated with the gritstone rather than the limestone. Although Collared Urns were known from the limestone, the general view was that most represented "secondary" burials, while the gritstone was thought to hold most of the "primary" burials of this culture (Radley, 1966, Armstrong, 1956). In these accounts, the gritstone cairnfields were created by the Collared Urn people, whose "invasion" of the Peak District, supposedly in the Middle Bronze Age, signalled the most significant and archaeologically visible utilisation of the gritstone.

In summary, throughout the first half of the 20th century, the prevailing view of the prehistory of the Peak District held that the region had seen various waves of settlement, colonisation or invasion, from the Neolithic through to the Bronze Age. These ideas were formulated from a fairly narrow range of evidence, which was gathered overwhelmingly from ceremonial and funerary contexts on the limestone and was unsupported by radiocarbon dates.

In terms of providing a broad understanding of the chronology and character of prehistoric occupation of the Peak District culture historical models were a starting point, and as such made a valuable contribution. It is evident now, however, that they were restricted in part by the limitations of the evidence then available.

The most important of these were several chronological problems, which resulted from difficulties in the interpretation and dating of the pottery typology. The Middle Bronze Age in particular was very difficult to pin down in terms of dates or timespan, a fact acknowledged by Radley (1966). This, in turn, meant that the boundaries between neighbouring periods and their associated "cultures" were equally difficult to define. When radiocarbon dates started to be obtained, these added further to the confusion. Many, from so-called Middle Bronze Age ceremonial features on the gritstone, actually pointed to the early second millennium BC, including those from ring cairns and Collared Urn burials. Added to this, when Collared Urns were reassigned to the late third/early second millennia BC, it became apparent that they were largely contemporary with Beakers and Food Vessels. Eventually, it was recognised that the pottery sequence did not break down into clearly defined periods and could not, on its own, provide a detailed chronology. It was also obvious that the simple culture historical model which traced a distinct group of people in each group of forms was also open to question. Pots did not necessarily equal people.

These problems only became apparent in hindsight, after further work was carried out and by the 1950s, the process of obtaining more data had started. It had been realised by this time that the uplands of Britain contained large amounts of archaeological remains about which relatively little was known, and that the Peak District gritstone was no exception to this. The 1948 Council for British Archaeology report, "*A Survey and Policy of Field Research in the Archaeology of Great Britain*" made recommendations which kick-started the next, and arguably the most important phase in the history of Peak District archaeology, namely, field survey (Barnatt & Smith 1991).

2.3 SURVEY

The recommendations of the CBA, were that upland field systems and enclosures, "should be precisely surveyed and measured" and noted that, "only by this means would it be possible....to obtain a realistic picture of the mode of life and social organisation", (CBA, 1948). In the Peak District these recommendations were acted upon by the local (Sheffield) Hunter Archaeological Society, which in 1949, started a *Scheme for Archaeological Research*, focussing on field remains in the area around Sheffield. The practical result of the scheme was the creation of an Archaeological Index, which was effectively a sites and monuments record (Barnatt & Smith, 1991). At the same time, Leslie Butcher, a local mining engineer was also acting upon the CBA recommendations by commencing a survey of earthworks (including those which were earlier than the parliamentary enclosure period, but excluding hillforts, linear earthworks and barrows), in the area outside Sheffield comprising South Yorkshire and North Derbyshire (Beswick & Merrills, 1983). Butcher worked on the principle expressed by the CBA, that "field systems and enclosed areas should be not merely photographed or roughly mapped, but precisely surveyed and measured" (CBA, 1948) and his standards of archaeological recording were extremely high. He produced detailed maps of many previously unrecorded sites, on the gritstone and coal measures as well as on the limestone and his work eventually encompassed remains dating from prehistory through to the Romano-British and Medieval periods. Butcher continued this work for 20 years after starting in the early 1950s and his intention was to publish his findings when finished. Unfortunately he died in 1975, before he was able to do so, but left behind his plans and field notes from which the results of his survey were written up and published (Beswick and Merrills 1983). The importance of the pioneering landscape work carried out by Butcher cannot be too highly stressed. It raised awareness of the nature, extent and complexity of the archaeology across the region, providing a foundation for much subsequent work.

As the project progressed, the information gathered prompted further survey and excavation, for both rescue purposes and for research. From the 1960's onwards, surveys and excavations were carried out across the region, in places such as Big Moor, Ramsley Moor, Beeley Moor and the Mam Tor hillfort

(Riley 1963; Henderson 1960; 1979; Lewis 1966; Richardson & Preston 1969; Machin 1971; Machin & Beswick 1975). In addition to yielding radiocarbon dates, many of these excavations provided information on the character, structure and content of monuments. Where the gritstone remains were concerned, this was a much needed addition to the archaeological database. Most of these projects were, however, small scale; though monuments were starting to be considered in their landscape context, the accent was still largely on the individual site. Questions of how monuments worked, their function within society and their relationships with the broader landscape were dealt with only in exceptional cases.

One very important advance associated with the survey work of 1960's and 1970's was the closer attention given to field remains that were not overtly funerary or ceremonial. Of these, the most obviously neglected were the agricultural remains. These had been touched upon from time to time (Butcher, for example, theorised that certain features were the result of field clearance), but there had been almost nothing in the way of modern recording and interpretation. With the development of more systematic survey, the density, extent and variability of these field remains began to come into focus for the first time.

The continued existence (and our present understanding) of archaeology in the Peak District owes much to the fact that it lies within a National Park (established in 1951). The National Park Authority in conjunction with other bodies such as the Royal Commission for Historical Monuments, have used survey as a conservation tool to great effect across the region. Many of the moorland sites, such as Gardoms Edge and Big Moor have been surveyed in detail by the Royal Commission for Historical Monuments (RCHME) and in consequence, most of the Eastern Moors are now scheduled ancient monuments. The National Park Authority has also acknowledged that in order to manage and conserve the archaeology, it must first be identified and some understanding of it gained. In the early 1980s, therefore, a long-term (and on-going) survey program was instigated with the aim of mapping all the archaeology within the park boundaries.

The contribution that this and the earlier surveys have made to archaeological research in the Peak District has been huge, particularly from the late 70s and early 80s onwards, with the growth of landscape perspectives in archaeology.

Biases have been identified, such as those caused by modern improvements of land, or the effects of ploughing on artefact recovery rates, and there is now a better idea of why there are clusters of evidence in some places and periods, and a relative scarcity in others. Changing ideas on barrow distributions are a prime example of this. In 1988, the Derbyshire Archaeological Advisory Committee instigated a survey of Peak District barrows which gave detailed information on the number of these features and their distribution across the landscapes of the Peak. This made possible a comparison between the survey data and known land-use histories of different areas, and brought to light the fact that there are gaps in the barrow distribution in areas that had seen more extensive cultivation (Barnatt, 1996b).

In summary, the post-war period has seen a general recognition of the need to gain a more detailed and systematic understanding of the nature and spatial distribution of archaeological evidence across the Peak District. To this end, institutions such as the Peak District National Park Authority, and the Royal Commission for Historical Monuments (and more recently, the University of Sheffield) have continued the survey process started by Leslie Butcher. Depending on the nature of the archaeology and of the landscape, a variety of scales have been employed. 1:2500 is generally adequate for farm surveys, which are basically walkover sketch surveys on a farm by farm basis, designed to record the presence of upstanding features. For areas known to contain important archaeological landscapes however, such as the cairnfields, more detailed 1:1000 plots have been used. While much of this work has been for management and conservation purposes, it has also provided invaluable information for archaeological research.

Survey has proved to be a key development in Peak District archaeology. By identifying what exists, it has pinpointed gaps in the evidence and enabled comparisons to be made between different areas of the Peak District and between the Peak and other areas. One important consequence of this has been the documentation of the differential survival of archaeological features in different zones, for example the limestone and the grit. The ongoing survey process has also been instrumental in shifting the focus of archaeological research away from ceremonial monuments, towards the interrelationships of various types of features across the landscape. This in turn has provided a basis for discussing the landscape setting of different classes of archaeology, which has allowed a more comprehensive consideration of the evidence to be made.

In addition to providing answers to some questions, the data generated from the 1960s onwards has led to new questions being asked, and to the realisation that new answers are needed to old questions. Some important issues still remain, foremost among which are, what was the character of occupation in the different zones of the Peak District and what was the chronology and temporality of occupation? During the 70s, 80s, and 90s, a series of research projects designed to address these and other issues have taken place, which have resulted in the formulation of new models for the prehistory of the region.

The first project to take an integrated landscape-oriented approach, was concerned with a previously under-exploited form of evidence, namely environmental data, which from the 1970s has also made a significant contribution to Peak District research.

2.4 ENVIRONMENTAL STUDIES

In the Peak District to date, environmental research has effectively meant pollen analyses. Of these, by far the most influential is that published by Sheila Hicks in the early 1970s (Hicks 1971 & 72). Hicks was the first author to integrate archaeological and environmental evidence and to correlate the two using radiocarbon dates. Her analyses of Eastern Moors pollen cores have had a profound influence on most subsequent studies, not only because she first established the nearest thing to a regional pollen sequence that had been obtained for the Peak, but also because of the coherence of her model, and the fact that it is amply supported by radiocarbon dates.

Hicks obtained her long cores from sites on the upper gritstone shelves, where suitably deep peat bogs exist, namely, Totley Moss, Ringinglow, Leash Fen & Hipper Sick and in addition used cores from two other areas with shallower peat, White Edge and Salter Sitch. Together, these cover the area from Hathersage in the North to well past Baslow in the south. The cores were supported by eleven radiocarbon dates, one from Totley Moss, one from Hipper Sick and nine from the Leash Fen core, with which all the other cores were correlated. The results were also compared to artefactual evidence, which had associated carbon dates. The combined results produced a regional sequence covering a period from the Mesolithic up to the Domesday survey. Hicks zoned her pollen diagrams on the basis of clearance phases, designated as V11a, A1, A2, A3, A4, A5, B1, B2, B3, C:-

V11a.

This zone covers the Mesolithic period. The evidence here indicates that woodland, described as closed mixed - oak forest, covered the area. No interference was identifiable in this forest although Hicks notes that the presence of Mesolithic people is known from artefact finds and she does not discount the possibility that their activities may have affected the vegetation in ways that her analyses had been unable to pick up. Since the publication of Hicks' work, an increasingly convincing case has been made for Mesolithic interference in the vegetation cover of the South Pennines (see Jacobi et. al. 1976, Tallis & Switsur, 1990, Tallis 1991). One of the clearest syntheses on this issue has been provided by Simmons (1996). His overview confirms Hicks' observations, though it still leaves many questions open regarding the scale, duration and purpose of interference.

A1. The first recognisable human impact upon the forest is suggested solely on the basis of pollen evidence, and occurs in the early Neolithic. This is evidenced by an elm decline, and a rise in open land indicators such as Plantago lanceolata. With the exception of some possible, but not certain, cereal pollen at Totley Moss, most of the non-arboreal species were those associated with grassland, (ribwort plantain, nettles, cornflowers). Consequently, Hicks considered the economy to be primarily pastoral and because the impacts were temporary her interpretation was that the lifestyle was essentially mobile; she describes the first farmers as "shifting agriculturalists" (Hicks 1972:15).

A2. Dated on the Leash Fen diagram at around 2120 BC, this phase is the first that she correlates with archaeological evidence in the form of occasional finds of Neolithic polished stone axes. Indications are of temporary small scale clearance followed by regeneration and again, the economy is interpreted as primarily pastoral.

A3. The start of this zone is dated on the Leash Fen core to around 1790 BC, a similar date to that derived from charcoal found in a pit deposit on Harlands Edge in the south of the study area. Although the economy is still considered to be primarily pastoral, the first clearly identified cereal pollen appears at this point on the Hipper Sick diagram, which is also where the clearance phase appears most obvious.

A4. The Leash Fen date for the start of this zone is around 1500 BC, and is the point at which the Bronze Age clearance peaks. It is associated with dates from both Food Vessels and Collared Urns found around the Eastern Moors, and Hicks' interpretation is that by this time the 'collared urn people' were the primary occupants of the gritstone, preferring it to the limestone where settlement pressure was too high. This phase is present on all the pollen diagrams but is most pronounced on that from Leash Fen. Cereal grains are again present in this zone on the Hipper Sick diagram.

A5. The variation between sites is most pronounced in this zone. Continued clearance activity is indicated at Totley Moss, but Leash Fen shows merely the maintenance of existing levels of clearance and other sites show aspects of both. The lower boundary of A5 is not dated on Hicks' cores but she associates this zone with continuing occupation of the gritstone by the collared urn people as indicated by the dates of two Urns found at Brown Edge, one 1020 BC., the other 1250 BC.

Summary of Zone A

Zone A represents a period which spans the Neolithic and Bronze Ages, in which small scale and often temporary clearance of the established woodland was taking place. The scale of the clearance, as reflected on the pollen diagrams, rises in a series of steps throughout this zone, so that although clearance episodes are followed by regeneration, the cumulative effect is of an opening up of the woodland. This is illustrated by the arboreal pollen count, which at the start of the Neolithic comprises around 75-80% of the total pollen but by 1500 BC comprises only 30%. What is also illustrated here is the problem of balancing a long term process, such as the overall woodland decline, with the more short term "back and forth" patterns of clearance, land-use, regeneration etc. which were played out across the landscape by people. This is a problem that becomes particularly acute between 1500 and approximately 500 BC when there seems to be a long period of stasis with no further fall in arboreal pollen but no significant woodland regeneration either. Although pollen can provide an overview of this, details of what was happening on the ground are unavoidably sketchy, and this has led to varying interpretations of the character of prehistoric occupation of the gritstone at the time (see below). Hicks is able to say however that the general trend is for more extensive clearance through time, but that this varies locally in intensity, and that clearance indications on some diagrams are not necessarily reflected in others. The only definite cereal pollen is identified at Hipper Sick, where small amounts appear from the early Bronze Age onwards. Other than these, all the indications are that the economy is mainly pastoral and the lifestyle fairly mobile.

Zone B

This starts at around 340 BC and is characterised by a dramatic increase in clearance indicated by a further fall in the percentage of tree pollen. Zones B1 and B2 show an increase in the importance of cereal pollen, which for the first time is present on all diagrams, but which still forms a relatively minor component of the total pollen count. While the pollen diagrams still show evidence of local differences with, for example, regeneration happening at some sites and not at others, there is less variation between sites, and the same clearance episodes are now more likely to show up on all diagrams. Hicks attributes this effect to the opening up of the landscape caused by the removal of the woodland, and acknowledges that by now the pollen is probably showing a regional rather than purely local picture. She postulates that the population could by now have moved to the lower valleys, and that the uplands were possibly being used for summer pasture, with grazing intensity being the main factor limiting forest regeneration.

B3. This zone starts around 40 AD. The middle is dated to around 420 AD and covers most of the Roman period, but the upper boundary is undated. It is marked by a large peak in the cereal curves, suggesting that cereal cultivation had increased greatly in importance, and that the economy was now more mixed. Hicks points out however that in this zone the apparent increase in cereal pollen could in part be due to the Roman introduction of rye. As it is wind pollinated, pollen from this plant can be carried over large distances, so could be originating in the lower land beyond the moors, and the seeming increase could simply be due to more pollen reaching the catchment area rather than more cereal being grown. Heaths now comprise well over 50% of the total pollen on most diagrams and it seems that it is during this period that the present moorland ecosystem starts to become established. Hicks also argues that the end of zone B and the beginning of zone C sees widespread growth of shallow acidic peat across the moors, due to deforestation and soil deterioration, aided perhaps by a climatic downturn.

Zone C.

This zone is not dated but Hick calculates from peat growth rates that the boundary between B and C falls around the late 10th or early 11th centuries AD. Zone C is characterised by the treeless landscape and moorland habitat that is present today.

Hicks' work established a regional chronology for agricultural activity and vegetation change on and around the Eastern Moors, which is still largely accepted. There are, however, some problems with aspects of this study, primarily, with Hicks' interpretations of the type of activity happening in the Neolithic and early Bronze Age. As she states, because of the filtering effect of forest cover, the pollen catchment was much more localised during these periods. At this time, cereal pollen, or events such as clearance, which show up on one diagram, are not necessarily reflected in others. In contrast, by the later Bronze Age, the diagrams tend to be more consistent, with major changes being represented on most diagrams simultaneously, and by the Roman period the diagrams may be covering a much wider area than in previous periods.

This has important implications for Hicks' interpretations of the earliest agriculture. It has now been shown (Behre & Kucan, 1986), that the likelihood of pollen reaching a suitable preservation site decreases with increasing distance from the pollen source and that distances as small as 30 metres can produce a significant decline in the amount of pollen recorded. It is also known that surrounding woodland can similarly decrease the amount of pollen reaching a catchment (Edwards, 1982). Consequently, the question arises of whether the absence of cereal pollen in the early levels of Hicks' cores can be attributed to the distance between the cairnfields and the sampling sites, compounded by the woodland cover. None of Hicks' pollen cores were taken from sites nearer than 500 metres to any upstanding settlement remains. Moreover, almost all were taken from the upper shelves of the gritstone, whereas the majority of the cairnfields are on the lower shelves. In order to be deposited in the upper moors peat bogs, therefore, pollen from these sites would have to travel uphill, over large distances through woodland. This is an unlikely scenario, given that cereal pollen grains are generally relatively large, heavy and do not travel easily. In addition, wheat and barley, the cereals known to have been cultivated in the Neolithic and Bronze Age are both self-pollinating, and are consequently likely to be under-represented on pollen diagrams.

In light of the above and of the evidence revealed by survey since the 1970s, it is now necessary to question the accuracy of Hicks' conclusions, regarding the nature of Neolithic and early Bronze Age activity on the eastern gritstone, since it can now be argued that her pollen cores were unlikely to contain much evidence from the majority of the settlements on the lower shelves. It may be however, that her interpretation of short-lived, temporary clearance, may be more accurately applied to those smaller and simpler cairnfields on the upper shelves. Because of the survey program that has been carried out since the 1970s, it is now known that these higher cairnfields have fewer indications of chronological depth, and may have been occupied for shorter periods of time (Barnatt 2000).

Long (1994, Long et. al. 1998) has since added more detail to the palynological record from the cairnfields by examining pollen cores obtained from small valley mires on the lower shelves. The sites studied were on Big Moor, Stoke Flat and Salter Sitch, none of which were more than 40 metres away from cairnfield complexes. She then correlated these to a regional pollen sequence constructed using a core from a raised mire at Lucas fen (in the north-west of Big Moor) that was central to the study area but not significantly close to cairnfield remains.

Long used slightly different indicators from Hicks when identifying arable and pastoral activity. In addition to the presence of cereal pollen, she used agricultural weed types as arable indicators and unlike Hicks, placed nettles in this category. For grazing, instead of using solely grassland indicators, Long used the presence of coprophilous fungal spores and, in contrast to Hicks, found most difficulty in identifying pastoral rather than arable activity.

Although Long's regional picture agrees broadly with Hicks' there are important differences in the details. With the exception of the diagram from Salter Sitch, which, although it showed a similar pollen sequence to the others, produced an anomalously late date, cereal pollen formed a significant component of all Long's diagrams from at least the early 1st millennium BC, through to the last few centuries when activity appeared to decline.

The regional sequence she constructed was as follows:

Zone A

The centre of this zone was dated at Lucas Fen to BC 2920-2590. It was characterised by small-scale clearance and opening mixed woodland, with very slight indications that arable activity might have been taking place.

Zone B

This zone was dated at Big Moor to BC 1396-1000 and was correlated to Hicks Zones A2-A5. It was characterised by small scale clearance of woodland, indications of arable activity in the form of cereal pollen, and indications of pastoral activity in the form of coprophilous spores associated with dung. Long concluded that this represented localised arable activity in clearings with some pasture. The end of this zone correlates to zone BMT 4 in the Big Moor core, which saw the decline of arable activity and the commencement of peat growth. At the end of this zone, tree pollen constituted around 70% of the total on Big Moor and the pollen of grass and herbs including cereals constituted around 20%.

Zone C

The base of Zone C was dated at Stoke Flat to BC 380-AD 194. It marks a phase of large scale clearance/tree loss in the Iron Age, which is seen in Hicks' zones B1, B2 and B3. The dramatic woodland loss is also manifested in the Big Moor data (zone BMT5) by a reduction in the percentage of tree pollen to 20-25% of the total, and an increase in the pollen of shrubs and herbs to 75%, much of which is contributed by grasses and moorland species. This is linked to an increase in grazing indicators and Long argues that an increase in grazing activity may have caused the crossing of a regeneration threshold, that was already lowered by the climatic changes of the onset of the Sub Atlantic period.

Zone D

This is undated in Long's cores but she correlated it to Hicks Zone C, which equates to the Roman period and after. It is characterised by ongoing large scale tree loss, with tree pollen falling to less than 10% of the total at the beginning of the zone and less than 5% at the end. In the Big Moor data, the *graminae* total peaks at the base of the zone and then declines and the pollen of heaths rises. By the end of this zone, as in Hicks' Zone C, the moorland has become established.

In summary, Long's work indicated that contrary to Hick's conclusions, the clearance that occurred around the cairnfields through the Bronze Age was linked to arable activity. She noted that this activity declined towards the end of the Bronze Age and, although cereal pollen was still present in the cores, the decline in tree cover meant it could not be reliably linked to local activity. Her conclusions were that activity in the cairnfields had probably ceased by some point in the Early Iron Age and that this decline in arable activity may have been linked to the Sub-Boreal/Sub-Atlantic transition.

Long was unable to date the latter part of her sequence with any precision and there are still certain questions that remain unanswered. Because most of her cores only had one associated radiocarbon date, she was not able to establish a detailed chronology for any cairnfield and dates of establishment are still unknown. In Long's work, as in Hicks', while there are indications that activity in the cairnfields may have ceased at some point in the Iron Age, the local picture is lost in favour of the regional during this period and absolute dates of "abandonment" are also not known.

Taken together, the work of these two authors has created the most detailed profile of prehistoric agricultural activity, that exists for any zone of the Peak District, but some parts of that profile are clearer than others. In summary, the evidence relating to the Bronze Age is clearest. In this part of the sequence, the correlation between progressive loss of tree cover and dates from field remains and artefacts, supports the premise that agriculture, including some arable farming, was taking place throughout most of the Bronze Age. While the indications are that this was small scale and low intensity, our understanding of the character of agricultural practice, its spatial organisation and the temporality of any changes, is poor. At either end of the chronological sequence, ie. in the Neolithic and Iron Age, the picture is hazy. For these periods, there is little artefactual evidence and pollen cores provide the only radiocarbon dates. In consequence, our understanding of the nature of agricultural activity is still severely restricted.

In addition to specific questions as to the nature and timing of agricultural activity, other, possibly related issues, have been addressed through environmental analyses over the last few decades. Foremost among these is the development of the existing Peak District landscapes and the establishment of the moorland habitat, with its associated peats, podsolised soils and generally low agricultural potential and how far this can be related to human impact. While soil deterioration may be part of a progression in interglacials from a mesocratic to an oligocratic phase (Birks 1986) and podsolisation may in many upland parts of Britain be a natural phenomenon (Smith & Taylor 1989), the evidence from the Peak District for the spread of moorland suggests that human activity may be implicated. Tallis and Switsur (1990) have postulated that in the Mesolithic, heaths formed part of a natural mosaic of vegetation that was zoned from lowland to upland forests to scrub in the higher altitude northern part of the Peak District. According to this model, the Mesolithic use of fire may have artificially lowered the tree-line and led to the narrowing of the upland forest belt in favour of moorland. Tallis (1991) argued further that in those areas of Britain, including the Peak District, which have the most prominent evidence for Mesolithic activity, the accumulation of blanket peat started earlier than in other areas at similar altitudes. He also argued that the lowland forests would have been far more stable than those at higher altitudes and the widespread peat and moorland development which occurred at those lower altitudes after 5500BP might only have been made possible by human disturbance.

Certainly Hicks' and Long's work indicates that the beginning of the widespread expansion of heaths and blanket peats is in the Iron Age and *after* large scale tree loss, which they both attribute to agricultural activity. The radiocarbon dates from the pollen cores taken by these authors indicate that peat accumulation started earlier than this and at different times in the valley mires studied. It ranged from the Neolithic at Lucas Fen and Leash Fen to the Middle Bronze Age at Big Moor to the Iron Age at Stoke Flat. The only place where the start of peat formation apparently coincides with a climatic change is at Big Moor, where it is close to the onset of the Sub-Atlantic period (Lamb 1977). Long concludes therefore, that the onset of peat formation in most of the valley mires can more easily be linked to the particular circumstances of topography and drainage, which led to waterlogging in small basins once the tree cover had been removed.

Both authors assume that the podsolisation of the soils started with the development of moorland, rather than with the earlier wooded environment. Given the evidence for soil degradation in other areas where heathland has developed after agricultural use in prehistory, (Dimbleby 1962, Balaam et. al. 1982) the assumption is not unreasonable. This cannot, however, be taken for granted. Dimbleby (1962: 21) notes instances where podsols have apparently formed under forest cover (eg. at Keston Camp in the Tabular Hills) so the assumption that all the soils on the eastern moors would have been brown earths prior to clearance is at present unsupported.

The development of the moors, besides having apparently deleterious effects on the soil, has also had unfortunate influences on archaeological thought. The reverse of the idea that people were forced to abandon the moors, is that they were forced to settle there in the first place. Some theories of this type will now be examined.

2.5 MORE MODELS

Hawke Smith (1979) set out to explore the relationship between population, settlement patterns, economy and the subsistence resource base in later prehistory, in his thesis entitled "Man-Land Relations in Prehistoric Britain", (1979). He took an ecological approach, arguing that there is an "*interactive or reciprocal relationship between population numbers and the economic system that supports them and between the economic system and the food-resources utilised*" (1979: 9). His study area was the land lying between the rivers Dove and Derwent and extending from Kinder Scout in the north to the River Trent in the south. Going against the dominantly pastoral view of the prehistoric economy that prevailed at the time, he chose cereals as the staple crop, on the basis that a mixed economy was more likely to have been in operation in the small scale societies that probably existed in later prehistory. In a mixed economy he argued, cereals were likely to have been used as animal as well as human food and therefore the potential for cereal production was likely to have been a limiting factor in the growth of human populations and in the distribution of settlement. The final strand of his argument was that the viability of cereal production would, in turn, depend upon the combined influence of several other factors, such as climate, topography, geology and most importantly, soils.

The main foci for settlement in this model would be found in areas where conditions for the staple, (ie. cereals), were most favourable. These focal locations would be surrounded by a series of fringe zones, which would be utilised for other purposes, such as pasture, or the gathering of supplementary wild foods for both humans and animals. In this scenario, population would probably rise (if it was not limited by drastic change in either of the other two variables, ie. economic system and food resources), but the system would remain stable while ever there was more prime land available for colonisation. Change in the system would come when all the available land most suited to the growing of the staple was occupied. If this happened, one of the first detectable changes would be that cultivation of the staple would be pushed out into the fringe zones, although other changes could follow. Because these zones were less versatile in terms of how they could be used and/or more fragile and prone to failure where the staple was concerned, they were the places where from an archaeological viewpoint there was more chance of detecting and monitoring change and of isolating the factors that led to it.

Having established the rationale behind his study, Hawke Smith next applied site terrain analysis to present-day soil maps of the area, in order to identify a series of "land facets" across the limestone and the gritstone. The supposed prehistoric agricultural potential of these facets was then used to pinpoint the most likely areas of settlement and farming. He then suggested probable forms of land use for each land facet. These included among others, habitats such as woodland for hunting, woodland for pannage, woodland for grazing, arable, mixed arable and grazing. Finally he compared these to the distribution of surface scatters of pottery and lithics, chance artefact finds, monuments, excavated cave sites other excavated occupation sites, burial sites, and finally, environmental evidence, on the basis that the greatest evidence for settlement should be found in land facets related to agricultural activity, particularly arable.

His conclusions were that during the Neolithic, farmers from the Trent Valley to the south, progressively colonised the limestone of the Peak District and that their use of the area changed from hunting to pasture through to arable cultivation. Once an arable subsistence base was established on the limestone, population increase (by the Early Bronze Age) then pushed cultivation out into the gritstone. Here therefore, both the limestone and gritstone are fringe zones, but the gritstone is more marginal than the limestone, hence it was not settled until later.

In his analysis, Hawke-Smith relies heavily on surface scatters but takes little account of the differences in recovery rates or visibility that arise from land use and vegetation cover. This is a particular problem in the Neolithic period, where much of his chronology for activity and his hypothesis that only the limestone is colonised, are dependant upon the correlation of surface finds with land-facets. The main problem is that two lines of evidence oppose this idea. The first, the five polished axes known from the eastern moors, he simply ignores. The second, Sheila Hicks' findings of clearance throughout the Neolithic starting with the elm decline, he rejects on the basis that elm would not have grown on the nutrient poor soils of the eastern moors, so therefore, the elm pollen in Hick's diagrams must have originated on the limestone! The most important problem with this model however, is that it simply does not work, a fact that becomes clear when the work of Bradley and Hart (1983) is considered.

The starting point for their research, was the hypothesis that the Peak District is one of several core areas for prehistoric settlement in Britain (Bradley 1984) which have been identified as such by the range of monuments and material culture found within them. The aim was to assess socio-political differences within this core area, by comparing the distributions of lithics scatters, artefacts and monuments, on the limestone, gritstone and in the Derwent Valley, to the land facet scheme proposed by Hawke Smith, and in so doing to test his model against the archaeological evidence.

For the Early Neolithic Bradley and Hart proposed, like Hawke Smith, that settlement was concentrated on the limestone, but the predicted association of surface scatters and agricultural land facets did not occur. Early Neolithic lithic scatters, which should have been found in the supposed grazing facet, were mostly found within the supposed woodland facet. To explain this they suggest that either farmers were targeting areas of forest that had already been modified by Mesolithic activity (although the significance of this is hard to discern), or that the woodland was still used for hunting, (the presence of leaf shaped arrowheads was in this case, the main criteria used to date the scatters). The postulated lifestyle was mobile, with the limestone plateau forming part of a seasonal round.

By the Later Neolithic, Hawke-Smith postulated that settlement was established on a more permanent basis, and Bradley and Hart agreed that by this time the distribution of lithic scatters conformed more closely to his agricultural land. Burials at this time tended to avoid Hawk-Smith's arable land, which is a slight problem, but macehead complex artefacts and flint imported from the Yorkshire or Lincolnshire Wolds were almost all found on proposed arable land. There were also high concentrations in the vicinity of the henge at Arbor Low, but it is not possible to tell with any certainty from Hawke-Smith's maps whether this monument is supposed to be in the arable or the woodland facet. Moreover, Bradley and Hart suggested that these concentrations could simply mean that communities living around the henge had better than average access to goods and resources from outside the area and so could not necessarily be used to support Hawke-Smth's hypothesis.

Moving into the Early Bronze Age, Hawke Smith suggests that settlement was at its most complex in this period and that expansion in arable farming, from the limestone onto the gritstone, was taking place at this time. This is based on the premise (for which there is no evidence) that population increased. The implication is that if cultivation was occurring on the gritstone, then the more fertile loess soils on the limestone would certainly also have been cultivated. Again, although there was evidence of cereal cultivation from the gritstone, in the early eighties there was none known from the limestone.

Bradley and Hart agreed with the postulated movement onto the "impoverished" gritstone. Having established the chronology of occupation they then went on to assess the status of the groups colonising the marginal land surrounding the limestone from an analysis of monument and artefact distributions.

Beakers and Food Vessels tended to be found in burials in limestone barrows within Hawke Smith's agricultural land, (thereby supporting his hypothesis), with Beakers being found most often in arable areas. Collared Urns however had a completely different distribution, they were usually associated with grazing land, they were found in higher quantities on the gritstone than the other two artefact types, where they tended to be found in cairns which were smaller than the limestone barrows. When found in association with Food Vessels in limestone barrows, Collared Urns also supposedly tended to occupy a subsidiary position. For Bradley and Hart therefore, these artefacts represented lower status burials, and on the whole the higher status limestone barrows contained more elaborate grave goods than those on the gritstone.

There are <u>many</u> problems with this model. The most serious being that Bradley and Hart appear to take all the evidence at face value, seemingly taking no account whatsoever of possible biases. Much of this work is based on the distribution of lithics scatters, and the bias in distributions of this evidence, which have already been discussed, must cast serious doubt on any attempt to reconstruct past settlement patterns where differential recovery rates are not taken into account. Other seeming indications of difference in status between the limestone and the gritstone have since been shown by Barnatt and Smith, (1991) to result from similar biases in recovery. When the relative numbers of excavations in the two areas are taken into account, it is apparent, for example, that the proportions of burials with elaborate grave goods are similar on both the limestone and the grit (Bamatt 1998). The argument that Collared Urns are placed in subsidiary positions in limestone barrows has also been countered by Bamatt, (1996a), who states that the data from burials in barrows is significantly biased by the numbers that were excavated in the past when the tendency was to dig the centre of a barrow and stop once a so-called primary burial was discovered. When data from modern excavations is analysed, there are frequently several inhumations in the centres of the mounds, which are all comparable in terms of associated artefacts, and there is often no one primary burial (ibid). He suggests that the only significant difference in artefact distribution may be the lack of Beakers in burials on the gritstone and even this may be a result of chronological developments, as Beakers tend to be earlier in date than the other two artefact types. Even that can now be challenged in the light of recent excavations which have identified Beakers in cairns on two different parts of the Eastern Moors.

Another problem with this model is its acceptance of Hawke-Smith's land facets, an issue that has also been discussed by Bamatt (1996a). Bradley and Hart accepted Hawke-Smith's land facets as presented in his maps. Difficulties arise from this because some are inaccurate, and most are designed to deal with the landscape at a larger scale and are lacking in detail (ibid.). There is, therefore, considerable ambiguity within the broad zones proposed by Hawke-Smith, with the result that his land facets bear little resemblance to the situation on the ground, other than in very general terms.

Finally, there are two basic assumptions running through both Bradley and Hart's and Hawke-Smith's work. The first is that the gritstone was marginal and the limestone was not (the river valleys are not, on the whole, included in the contrast). This is not supported by the evidence as presented. It is perhaps to be expected that there would be some difference in soil fertility and therefore in productivity, between the limestone and the grit, one having an acid bedrock one having a basic. However, the degree to which the gritstone soils were initially inferior to those on the limestone is unclear and so it is questionable whether the gritstone would have been perceived to be ecologically marginal by prehistoric farmers. It may be the case that the gritstone soils were inherently less fertile and productive than those on the limestone, and it may be true that early farmers were aware of this. In both these models however, this is an assumption based on the present state of the soils rather than a conclusion based on interpretation of the evidence. Both Bradley and Hart's and Hawke-Smith's models are, therefore, flawed, not only by limitations in their examination of the evidence, but also by the projection of their own preconceptions back into the past. More recently some authors have turned aspects of this model on its head to argue that the light sandy soils of the gritstone may have been more attractive to prehistoric farmers practicing hand cultivation than the heavy clay soils of the limestone, (Edmonds & Seaborne, 2001, Barnatt 2000).

The second assumption implicit in both these models is that the patterns of settlement and occupation throughout the whole of later prehistory were essentially sedentary. This is an idea that has been increasingly questioned in recent years, (eg. Barnatt 1995; Barrett 1994; Edmonds 1995; Thomas 1996; Tilley 1994; Whittle 1996) and issues of the form and scale of residence and land use over time are far from resolved.

2.6 RECENT MODELS

More recently, the evidence for prehistoric occupation and farming, and for mobility and sedentism in the Peak District, has been reviewed in some detail by authors such as Barnatt, (2000), Edmonds and Seaborne (2001), and Bevan (2001). Here, far more complex models have been proposed, which do not start from the premise that the Eastern Moors evidence is relevant only to an understanding of the margins of society. In particular the work of Barnatt has been influential in this respect, and this is not just because of the sheer volume of his published research, (see, among others, Barnatt, 1986, 1987, 1990, 1995, 1996a, 1999, 2000). His treatment of the Eastern Moors evidence has a level of detail that is missing from many previous models, and this arises in part from the examination of new data that has come both from survey, and from the data resulting from the Gardoms Edge Project of the late 1990s.

Barnatt takes a holistic view of the archaeology of the Peak District, seeing the landscape in terms of topographic zones which offered different but complementary potentials. To his credit, the ideas he has put forward have changed through time, as more archaeological data has been obtained. Here, his more recent position will be examined.

Like Hawke Smith, Barnatt divides the land into potential land use zones, but his zones are based on a wider range of criteria. In addition to soils, he uses topography, altitude, different climatic conditions resulting from altitude and the effects of geologic variation on factors such as drainage, to assess the suitability of different parts of the landscape for different activities (1996; 1999). The importance of topographic variation across the Peak District for Barnatt, is that it provided a wide range of subsistence opportunities and constraints, within a relatively small area (1996), rather than a core area and margins. By looking in detail at what archaeological evidence is found in the different topographic zones, Barnatt is able to be more sensitive to the human aspects of the landscape, and to better integrate small scale processes like the development of field boundaries, with large scale processes like the development of a settled lifestyle.

Like Barrett, (1980; 1994) Barnatt has examined the change from a mobile to a more settled way of life, but he has done this through a consideration of how people organised themselves and their activities within the landscape, at a local as well as regional scale. He too has argued that changes in the archaeological field evidence reflect both practical developments, as farming of land on a more continued or "sustained" basis developed, and a change in mindset, as tenure changed to ownership. He places the change however in an earlier period than Barrett, at some point in the Late Neolithic to Early Bronze Age, (Barnatt, 1999, 2000).

In the Neolithic, Barnatt postulates that the norm was a mobile lifestyle, involving seasonal movement of people along well established paths, in order to exploit the variety of resources provided by different topographic zones (1996). These ranged from the river valleys and narrow limestone gorges, to the lower limestone and gritstone shelves and the uplands of both the grit and the limestone (see also Edmonds & Seaborne 2001).

The character of the Neolithic lifestyle, and the ways in which it changed through time, is inferred from the changes in the character and distribution of the surviving Neolithic monuments on the limestone. Barnatt sees a development in monuments starting with the earlier chambered tombs, which are associated with a communal burial tradition. There is no apparent pattern to the distribution of these monuments, and he interprets them as reflecting the fluidity of a system in which resources were shared among various groups (Barnatt 1996).

The supposedly later long barrows, in contrast, often appear to be sited in locations peripheral to what Barnatt argues were likely to be the main areas of settlement, (ie. the lower limestone shelves). These are areas such as watersheds on the higher parts of the limestone, which may have been upland pasture to which several groups had traditional access. As such, the rights of access and tenure in these places were perhaps less easy to define and this introduced an added complexity to their use (ibid.). Barnatt's argument though superficially similar to Renfrew's (1973) is not that these are territorial markers *per se* but rather that they are a result of that complexity, and may reflect a variety of concerns both communal and specific to different groups.

The emergence of a mindset which allowed for the idea that land could be more exclusively owned, is signalled by the construction of small unchambered round barrows associated with a single burial tradition. This, according to Barnatt was happening from the Later Neolithic through to the Early Bronze Age, (1996 1999, 2000). The extended period that this encompasses is also the time that saw the building of the two henges, and this synchronicity is indicative of social developments in both a regional and more individual context. The henges are an indication of a social/cultural identity that the disparate groups in the Peak had in common. Barnatt also suggests that the building of the henges was itself an act that would have affected the organisation and social cohesion of the groups involved, and that the construction and subsequent use of these features provided a sphere in which wider social concerns could be addressed and therefore changed (Barnatt 1996).

Local or family concerns were then addressed through the smaller round barrows, which in contrast to the patterned siting of earlier monuments, are scattered more evenly and in greater numbers across the zones of the Peak District, (1999, 2000). Barnatt has deconstructed the argument that burials in round barrows reflect status differentiation (1999) and suggests that they represent local or family monuments whose distribution reflects the holdings of these smaller groups. The emergence of these features in the later Neolithic and Early Bronze Age therefore, reflects a changeover period during which a different perception of the land, developed, and the old system of tenure and communal rights symbolised by the henges, was replaced by a new attitude in which families and/or small groups, identified more closely with specific areas (Barnatt 2000; Edmonds & Seaborne 2001).

This part of Barnatt's model is not without its problems. As he has freely acknowledged (Barnatt 1996), none of the Neolithic monuments are adequately dated, and the supposed progression through time in the type of monuments built, may therefore simply not exist. A further problem is the lack of detail in the archaeological record for the limestone, which is where almost all the Neolithic monuments are situated. As has already been noted, there are no agricultural features here of this period, and a reconstruction of former settlement patterns from monuments and burial features must be speculative. This is especially true because of the biases in evidence which result from the destruction of archaeological remains due to later land use.

The cornerstone of Barnatt's model for the prehistoric occupation of the Peak, is however, the emergence of what he calls *sustained* farming. Although this idea potentially encompasses a multitude of farming strategies, it is essentially the prospect that a group of people identify with, or are closely connected to, a certain area of land. That connection persists through an extended period covering successive generations, and although Barnatt does not explicitly state this, an exclusive sense of ownership is implied. On the limestone, the development of this mindset is manifested by the barrows, but the majority of the evidence comes from the gritstone cairnfields where unlike the limestone, agricultural features are numerous. Barnatt uses several strands of evidence to make his case.

For a comparison of the limestone and the grit, Barnatt uses the unchambered round barrows which are found on both, (1999). He rejects the idea of differences in status between the limestone and the grit, using a detailed examination of these features to support his theory. By examining structure, phasing, the nature of the burial rite as evidenced by treatment of the remains, number of interments in a barrow, gender, age, position of interments, and grave goods, he concludes that although there was considerable variety in most aspects of the burial tradition, there were no discernable differences that could be associated with location in either geological zone (ibid.). Based on the contents of the barrows, he also rejects the idea that this burial rite is indicative of the presence of elites within society. The absence of any signs of social stratification, he proposes, is an indication that the barrows essentially belonged to local family or close kin groups (ibid.).

Barnatt argues from this that the character of occupation was essentially the same across the Peak District zones. The close association of round barrows and cairnfields on the gritstone is a further indication that these monuments were used solely by local groups or families, assumed to be occupying the cairnfields. As no essential difference exists between the gritstone and limestone barrows, it follows that the same is likely to be true of the limestone. In Barnatt's model, therefore, the late Neolithic and early Bronze Age occupation of the Peak District was essentially the same throughout, being based upon small settled family farms practising a mixed economy.

The problem with this idea is that while round barrows exist on the gritstone, so far none have been demonstrated to be of Neolithic date (Barnatt 1999, 2000).

He counters this by arguing that this may be a product of misdiagnosis by the antiquarians who dug most of the barrows on the grit, compounded by the lack of radiocarbon dateable remains and modern excavation in this zone (ibid.). In addition, the round barrows are assumed to relate to the transition period between communal and personal land holdings and in the early part of the transition, the limestone may have been deemed to be the appropriate burial location (ibid.).

The next strand of the argument concerns the ringcairns, small embanked stone circles and agricultural features of the cairnfields. Ringcairns, which appear to have had a ceremonial and funerary role, are found solely on the grit, (Barnatt 1999, 2000) and their close proximity to field system remains, Barnatt sees as again reflecting the local nature of the monuments. He explains their restriction to the gritstone by postulating that by the time it became customary to build these features, there may have been problems of access to the henges for people living further afield.

The notion of sustained use of the land is built upon the cairnfield agricultural and settlement evidence. Barnatt's position is that many of the features appear to be multi-phased, which implies a continued if not continuous use, (2000). In addition, not all the areas with similar soils, bedrock, slope aspect etc. contain cairnfield remains, yet many of those that do, have features overlain by other features. This he takes as further evidence that people chose to stay within the same area (2000). The field boundaries within the cairnfields are variably defined, some with stone or earth banks and some simply with cairns which may be marking the positions of former fields.

Barnatt has analysed these layouts and the range of features within them in some detail and suggests that some features in particular are indicative of an extended use. Prominent among these are the earthen banks that often delimit rectangular fields. He suggests (1999; 2000) that these are the product of accumulation of soil against boundaries such as hedges or fences, which have left no other archaeological trace. They are therefore suggestive of both a fairly permanently settled landscape, and of soil erosion resulting from agriculture.

Finally, Barnatt argues that the pollen evidence supports the idea of an agricultural use of the eastern moors through the second millennium and into the first, (Barnatt 2000, Long et. al 1998, Hicks 1971, 1972). While not necessarily supporting a continued use of any one set of fields the environmental evidence does at least support the idea of a continued use of the eastern moors in general.

The most controversial part of Barnatt's model is his chronology, which is inextricably linked to questions of the longevity of farming activity on the Eastern Moors. The process of change from a mobile to a sustained form of agriculture could, Barnatt argues, have started as early as the late Neolithic with the transition possibly taking around 500 years (Barnatt 2000). Taking into account Long's pollen evidence, of continued activity at some cairnfields into the Iron Age and the arguments recently put forward by Bevan, (2000), this produces a far longer period of occupation than has generally been assumed. Barnatt is on strong ground when he challenges the more traditional view that occupation of many upland areas of Britain was restricted to the second and the first half of the of the first millennium BC (Burgess, 1984, 1985, Higham 1986, Fowler 1978). The problem is that so far, no dates have been obtained from agricultural features in the cairnfields which support the earlier end of this extended chronology (Edmonds & Seaborne 2001). The argument rests to a large extent upon the proximity of early monuments to largely undated cairnfields. A second problem is the lack of comparable agricultural evidence from the limestone, which could elucidate the character of farming in this area.

Finally, although Barnatt's interpretation is based on a detailed and knowledgeable examination of the evidence, there are other possible interpretations. Barrett (1994) interprets cairnfields of the type found on the Eastern Moors, as the remains of long fallow systems. These are systems characterised by temporary cultivation plots where no attempt is made to maintain soil quality, (ibid.) a similar idea to that of the shifting agriculturalists put forward by Hicks (1972). A similar argument is developed by Edmonds and Seaborne (2001). They agree with Barnatt that the proliferation of unchambered round barrows reflects the concern of local kin groups to mark their connections with particular places. They also follow his suggestion, that this may mark the first steps toward a shift of attitude to land. However, they remain unconvinced that this involved sustained farming and persistent occupation from the outset. This took a longer time to develop and may have unfolded differently from one part of the Eastern Moors to another.

More recent interpretations have certainly made the most of the detail now available through survey and excavation. They move us beyond the simple and singular models of earlier decades and in this they are to be welcomed. However, the diversity of the cairnfield evidence, coupled with the lack of detailed dating for agricultural features, makes assessment of both the chronology and character of occupation extremely difficult. Despite the body of data that has now been accumulated, there are still gaps in the evidence, and questions that need to be answered in order to elucidate the character and timing of prehistoric activity.

3 QUESTIONS.

The preceding chapters have reviewed the most important developments in the later prehistoric archaeology of the Peak District, charting how interpretations of the Eastern Moors evidence have changed through time. For a long time, the heather and cotton grass of the moors effectively hid the Bronze Age landscapes from the view of archaeologists, both physically and theoretically. However, as archaeological research has moved beyond the study of artefacts and individual sites, to include the landscapes in which people lived, the perceived significance of the Eastern Moors evidence has grown. The data that have raised the profile of the moors archaeology have come from three main sources:

1. Survey. This is probably the most important development as it has provided the foundation for most subsequent work. It has enabled the spatial extent and the diversity of field remains to be identified. This has prompted the realisation that previous research had mostly ignored a large and potentially valuable source of information on prehistoric activity. It has also provided data on possible biases in the evidence, which can now be taken into account when the latter is analysed and interpreted.

2. Environmental Evidence. This has enabled a better understanding of the prehistoric landscapes and some of the ways in which these were different from those of today. In some places and for some periods it also constitutes the only clue to a human presence although this is indirect and comes in the form of changes to the vegetation cover. Finally it has provided radiocarbon dates, which have allowed the changes in the environment to be compared to the field evidence to obtain a better understanding of how the two might have fitted together.

3. Recent excavations. These have largely grown out of the survey program and have elucidated certain aspects of the field remains, such as construction, which has provided a much better idea of the character of some features. The Gardoms Edge Project in particular has provided data on the character of agricultural features that had seen little systematic investigation prior to that time. This is the largest scale excavation project to take place to date on the Eastern Moors, and it

has provided a much more detailed picture of the activity within and composition of that cairnfield. On other moors however, excavation has been piecemeal rather than systematic and so it is still not known what is typical of the cairnfields in general.

The information from these three sources has demonstrated that many of our older models for prehistoric settlement and land use in the region have been far too simplistic. This has prompted the asking of more detailed questions about the occupation of the area over time. These questions tend to coalesce around two key themes: the chronology and the character of occupation. The data as they currently stand are ambiguous on many points of detail; further clarification can only come from more targeted work in the field.

3.1 THE NEOLITHIC TO THE BRONZE AGE

3.1.1 Chronology

One of the main areas of ambiguity relates to the seeming difference in the chronology of occupation between the limestone and the grit. Several lines of evidence point to the limestone having been occupied at an earlier date than the gritstone. First there are the Neolithic monuments, none of which have been radiocarbon dated. The chronology of these monuments has been constructed largely typologically, by analogy to monuments in other areas (Fowler, 1955). That chronology does however, place most of them in the Neolithic period. Next there are the radiocarbon dates obtained from excavations over the last few decades. These have come from Lismore Fields, a Neolithic settlement site on the edge of the limestone, and from contexts under two barrows on the limestone, at Liffs Low and Carsington. Lismore Fields has produced 4th millennium BC dates from two rectangular buildings (Garton 1991, Barnatt 1995). Liffs Low and the Carsington barrow, similarly produced 4th millennium dates from stakeholes and pits sealed under the barrows, (Barnatt, 1995). While these latter do not date the features, they and the dates from Lismore Fields point to earlier Neolithic occupation on and around the limestone.

In addition there is limited pollen evidence that suggests that some form of agriculture was taking place. A radiocarbon dated pollen sequence from Lismore Fields, indicated that cereal was being cultivated in the vicinity of the site in the 4th and 5th millennia BC (Garton 1991; Wiltshire & Edwards 1993). A further pollen sequence from three valley bottom sites in the White Peak indicated that clearance of the surrounding woodland, probably for pasture, may have started in the late Mesolithic/Early Neolithic and was largely complete by the early 3rd millennium BC. (Taylor et.al. 1994).

The earliest dates from the gritstone are from the pollen cores of Hicks (1971, 72). (The recalibrated versions of Hicks' dates as presented by Barnatt (1995) are used here.) The earliest disturbance to the forest indicated by these dates is in the 4th millennium from Totley Moss, which as Barnatt points out, relates to the elm decline, the cause of which is still not entirely understood. Other than this the earliest dates which are associated by Hicks with clearance episodes, are early 3rd millennium at Hipper Sick, which is also the core that showed the best evidence of cereal cultivation in the Bronze Age, and the 2nd millennium at Leash Fen (Hicks 1971, 72, Barnatt 1995).

On the gritstone, the interpretation of the pollen data as woodland disturbance by people for agriculture has so far not been corroborated by dates from archaeological features. This contrasts with the situation at Lismore Fields, where the periods of cereal cultivation evidenced in the pollen appear to be contemporary with some of the dates from the buildings. There are however other forms of evidence that suggest Neolithic occupation of the gritstone. One is the possible Neolithic enclosure on Gardoms edge (Barnatt 1999, 2000). This has not yet been radiocarbon dated, and like the monuments on the limestone its age has been inferred by analogy to similar features in other areas (Barnatt et. al.1995 1997 unpub.). The other is the rock art that has been found in various places across the gritstone, (Barnatt 1982) but again its date is far from certain. Finally there are the chance finds of Neolithic artefacts such as polished axes and leaf shaped arrowheads that have also been found in scattered locations across the gritstone (Armstrong 1956, 1929). These certainly demonstrate a presence, but it is the character of that presence that is important here.

If the typological dating of features is accepted and the interpretation of clearance from the pollen data is also accepted then there is basically more evidence for settlement on the limestone in the Early Neolithic than on the grit. This raises two questions.

- Is this a true distinction, or has it been produced through biases in the evidence, resulting from differences in preservation?

Where pollen is concerned, Tallis & Switsur (1990) have found evidence of possible human disturbance on the northern gritstone, dating back to the Mesolithic, but they have only been able to do this because the northern peat bogs go back far enough in time. In contrast, much of the eastern moors peat started accumulating much later. Although this in itself may be a sign that human impact only became significant around the 3rd millennium, there is still a possibility that the earlier parts of the sequence of activity are not preserved.

- If there is a real difference in the ages of the features in the two zones, is it chronological, or does it result from differences in the way the two zones were used?

3.1.2 Character of Occupation

Almost all of the presumed Neolithic monuments are on the limestone, yet the evidence discussed above also indicates a Neolithic presence on the grit. There are two possible reasons for this. One is that agriculture and occupation started earlier on the limestone. The other is that the distribution is related to changes in the character of occupation through space and time. As Barnatt (1996a) has pointed out, the two zones may have been used differently but simultaneously and it may be that the siting of monuments on the limestone rather than the grit reflects differences in perceptions of what was appropriate, arising from how the two areas were used.

These questions of the chronology and character of occupation are central to both Edmonds and Seaborne's and Barnatt's models, but Barnatt's in particular rests on the ages ascribed to certain features. If the small round barrows are assumed to be of similar age across the two zones, then Barnatt's hypothesis that they reflect a growing tendency for people to associate themselves with a particular locality, can be accepted. If they are not however, then this case is weakened. Instead of a transition period that is common to all the zones of the Peak District and similar types of occupation, we are left with apparent chronological differences between the two zones which do not allow the assumption that similar processes were occurring in each, to be made.

3.2 BRONZE AGE

3.2.1 Chronology

Moving through into the Bronze Age the amount of settlement and agricultural evidence that is available prompts an increase in the number of questions that can be asked. The first is -

- When does the gritstone first see agriculture and/or settlement?

The pollen data suggests that agriculture may have started on the gritstone in the 3rd millennium. Pollen, as discussed above however, only gives part of the picture and may be heavily biased. As described in Chapter 2, Hicks' pollen cores, which cover the Late Neolithic and Early Bronze Age, may not have contained much evidence of what was happening on the lower shelves, where survey has indicated that the majority of prehistoric activity was probably concentrated. Most of Long's, cores, while they show more clearly that cereal cultivation was being practised on the lower shelves, do not go back sufficiently far in time to indicate when this might have started. Her dates are limited by the age of the peat and most of this in the mires she studied was not older than the 2nd millennium.

There is no indication from the pollen, whether the activity evidenced actually relates to the creation of the features that collectively form the cairnfields. Essentially this is a question of whether the inferred agricultural activity in the earlier part of the pollen sequences involved the creation of the features that now remain, or whether these were a product of the activity seen in the later part of the sequence when cereal cultivation is more in evidence. At present this cannot be clarified satisfactorily, because most of the available dates come from monuments, rather than agricultural features.

Most of the radiocarbon dates from Bronze Age features in the Peak District have come from the Eastern Moors, and almost all of these have yielded dates of between around 2200 BC and 1500BC. These are from the Barbrook II ringcairn on Big Moor, cremations on Eaglestone Flat, immediately to the south of Big Moor, and cremations at Brown Edge on Totley Moor, and Harland Edge on Beeley Moor (Barnatt 1995). There is a strong likelihood that these are all from funerary and ceremonial contexts.

At this point some mention must be made of the context of the dates from Eaglestone Flat. This was a cemetery discovered by chance during the digging of a drain as part of land improvement works. The cemetery comprised cremations in urns which had been placed in pits. As part of the rescue excavation of the site, several cairns and field banks were also dug, and charcoal from beneath some of these was sent for radiocarbon dating. The dates that were obtained therefore, do not necessarily date the agricultural features and most may be associated with the previous funerary activity.

In addition to these, there are only two sites with no overtly funerary or ceremonial function that have yielded radiocarbon dates. One is Swine Sty, in the south of the Big Moor cairnfield, the other is the middle of the Big Moor Central cairnfield, where radiocarbon dates were obtained from within earthen field banks that were presumably related to agriculture (Barnatt 1995). Of these, Swine Sty may be a settlement, but the context of the one radiocarbon date, from charcoal within an enclosure, was not sufficiently secure to allow firm conclusions to be made as to the dating of the main period of occupation (ibid.). The radiocarbon dates from the earthen banks on Big Moor were assayed on bulk charcoal samples taken from within the banks. These all fell into the period from around 1600BC to 1000BC. If the reliability of these dates is accepted therefore, then that places the two agricultural features concerned, into the second half of the Bronze Age, compared to the first half for the ceremonial features. This supports the possibility raised by Edmonds and Seaborne (2001) that many of the visible agricultural features may have been later than the ceremonial monuments. Conversely, it also weakens the case put forward by Barnatt, that the two types of feature were contemporary.

Dates from two earthen banks, on one moor, are however, a totally inadequate basis on which to make assessments of the relative ages of the two types of feature. At present therefore, the dating evidence does not provide sufficient detail to assess where the agricultural features fit, in relation to either the activity evidenced in the pollen record, or to that evidenced by the monuments. Questions arising from this are therefore –

- Are the agricultural features the same age as the monuments?
- Alternately are different phases of activity/types of occupation evidenced by the monuments and the visible agricultural features?

A further problem that arises from the lack of dates from agricultural features is that of assessing how far the dates from the earthen banks on Big Moor can be taken to be representative of the eastern moors as a whole, or in other words –

- Are all the field systems the same age?

This has implications not only for Barnatt's hypothesis that each represents localised sustained agriculture, but also for such factors as the character of the agriculture that was being practised and the size of the population. If the agricultural features across most of the cairnfields proved to be broadly contemporary, this would be suggestive of a more intensively settled landscape. Perhaps in turn, this would fit better with a sustained style of farming. It would also suggest a higher population density than if there proved to be significant chronological differences between cairnfields. If however the reverse were the case, and some cairnfields were later than others, then this would perhaps suggest that interpretations such as the "shifting agriculturalists" of Hicks' model might be closer to reality. The same question can also be applied to areas within cairnfields. In Big Moor for example, there are several cairnfield areas that have been identified by survey (Ainsworth et.al. 1998). These areas have been distinguished by differences in character between the field remains and in particular by the definition of field boundaries in each. In some such as the central area, the fields are clearly delimited by boundary banks. In others the presence of fields is inferred by the spacing of clearance features such as cairns. It is entirely possible that these differences relate to chronology, but without dating evidence this cannot be established.

3.2.2 Character of Occupation

At present, the character of occupation is not clearly understood. Barnatt sees the cairnfields as settlement areas comprised of dispersed farmsteads and survey has picked out possible house platforms, some of which have been confirmed by excavation during the Gardoms Edge Project (Ainsworth et. al. 1998; Barnatt et al 1995; 1996a; 1997; 1998; 2000). These would appear to confirm that people lived in and around the cairnfields. However, this still leaves many questions hanging regarding the character and temporality of occupation (Kitchen 2000; Edmonds and Seaborne 2001).

Edmonds and Seaborne (ibid) suggest that this could have been seasonal, at least in its early stages, the cairnfields part of a cycle of movement which encompassed different zones of the Peak in an economy that was part pastoral and part arable. Kitchen goes one stage further in suggesting that this may have been the case throughout the sequence (2000). Both also point out that gender differences may have been implicated in the occupation of the cairnfields which cannot be identified now from the remains, but for which there are hints. These include the cremated remains from the Eaglestone Flat cemetery which, as far as could be identified, represented mostly women and children. Whether this is a pattern that may be repeated across the Eastern Moors is unknown.

There are other complexities which cannot be resolved except by further excavation. The varying funerary tradition is one. This probably included both cremation and interrment (Barnatt 2000; Edmonds & Seaborne 2001), and cremations are well documented on the grits (Heathcliffe, 1929; Barnatt et.al. 1994). However, unburnt bodies leave little trace because of the acidity of the soil. Nevertheless pits have been found beneath cairns that are suggestive of burial (Barnatt et. al. 1997, Barnatt 2000). The differences in funerary methods may be chronological or it may be related to other matters. Barnatt dismisses the notion of status, but gender and other social divisions may be involved in the choice of burial rite and in the placement of funerary monuments.

Basically the questions that can be posed as to the nature of the occupation of the cairnfields are too numerous to list but environmental analyses can shed some light on certain aspects of farming activity. Pollen has indicated that for certain periods cereals were grown. The evidence for this is strongest in those sequences derived from cores taken close to the cairnfields and in the parts of the sequence that relate to the Middle to Late Bronze Age (Long 1998, 1994). The pollen analyses have also indicated that pasture was present, which suggests a mixed economy. Which was the more important (if any) is difficult to determine and depends on the indicators used in the pollen analyses. Hicks concluded that animal husbandry was the subsistence base; Long found the clear identification of pastoral activity more difficult than that of arable. The fields within the cairnfields vary in size and shape, and these apparent differences may result from changes in the character, scale or intensity of the farming practice through time; they may reflect differences in the use of fields or something else entirely. The main questions that are posed by the ambiguity of both field and environmental evidence would seem to be –

- Was the subsistence base dominantly arable or pastoral?
- Did this change through time?
- What were the methods used?
- How was the agricultural landscape organised?
- How intensively was the land used over time?

There are a huge number of possible subsistence strategies involving both animal husbandry and arable cultivation that could be employed, but interpretations of the Eastern Moors evidence fall generally into two camps, which are in turn related to the degree of mobility of lifestyle. The first of these is represented by the views of Hicks and Barrett, who see the cairnfields as the remains of "shifting agriculture" and "long fallow" systems respectively. These sorts of systems are associated with the cyclical occupation and farming of land on an episodic basis. Beyond abandonment for a time, little else is done to influence, maintain or enhance soil fertility. Barrett sees these conditions as prevailing in the later Neolithic and Early Bronze Ages before ideas of exclusive territorial ownership developed and life became more fully sedentary.

Barnatt's model for the Eastern Moors looks rather different on the surface, but differs mostly in his view on timing. He sees the change to sustained farming, and (by implication) more exclusive senses of ownership, starting in the Late Neolithic and being completed at some point in the early to Middle Bronze Age. One of the most important of the questions relating to the character of occupation of the cairnfields are therefore –

- Was occupation sustained and continuous, or was it more episodic?

The extended chronology apparent in many of the features surveyed and excavated could be easily reconciled with both of these models. Examples of this are the addition of clearance stone to earlier features (see Barnatt et. al. 1995-2000) and the earthen banks in cairnfields such as Big Moor which Barnatt argues have been formed from the accumulation of eroded topsoil against former hedges and fences. What is needed is a greater degree of clarity in our picture of the scale and temporality of any erosion that may have resulted from land use.

3.2.3 The Iron Age

It has long been argued that the uplands of Britain were abandoned in the Iron Age as settlement and agriculture retreated back into the lowlands (eg. Burgess 1985) and until recently this was also the accepted fate of the eastern gritstone, (Hawke-Smith 1979, Hicks 1972). This view is now being challenged, (Bevan 2000, Barnatt 2000 1999, Edmonds & Seaborne 2001). Bevan has pointed out that the lack of any demonstrably Iron Age cairnfield features may be a failure on the part of archaeologists to recognise what is diagnostic of the period rather than a true dearth of evidence (Bevan 2000). The pottery recovered from excavations in the cairnfields illustrates this problem. That recovered from Gardoms Edge particularly from the eastern part of the moor, appears to be Later Bronze Age. Barnatt (1994) has pointed out however that insufficient pottery has been recovered from the eastern moors to construct a reliable chronological sequence for the later second and first millennia BC. It is therefore not known if later Bronze Age pottery can be distinguished from that of the Iron Age. Since the type site for this material is the hillfort of Mam Tor, which has a history that extends into the Iron Age, this is an important concern.

The pollen data is again ambiguous. The Iron Age sees an increase in woodland loss and the persistence of cereal pollen in the cores. But by this period, Long records a decrease in other arable indicators such as weeds associated with cultivation, raising the possibility that the cereal pollen itself was derived from contexts at greater distances, perhaps in the river valleys (Long 1994; Long et al 1998). Both Hicks and Long concluded that the cairnfields were abandoned in this period. However, the picture may not be that simple. What we do not know is whether or not the abandonment that they envisage actually saw the area turned over to more exclusive use for stock.

3.2.4 Summary

Almost all of the current research questions are related in some way to the chronology of the Eastern Moors. At present the chronology is extremely basic, not only because of insufficient absolute dates, but also because of the imprecision of the presently available dating methods. The ages produced by radiocarbon dating are accurate on a scale of centuries rather than decades and therefore present research interests, which focus increasingly on the short-term small-scale processes, are testing the limits of present dating techniques and chronologies. It is only by refining the existing chronologies and adding more detail to the small-scale picture of life in the cairnfields that the larger scale picture will emerge. Until this happens and a better understanding of the chronology and character of occupation is achieved, the position of the cairnfields in relation to settlement and agriculture in the rest of Britain in prehistory will remain unclear.

3.3 SPECIFIC AIMS AND OBJECTIVES

This project is a study of the soils and sediments in the cairnfields on Big Moor and Gardoms Edge, which lie at altitudes of between 200and 350m, on the lower gritstone shelves to the east of the Derwent Valley. These are two of the most extensive cairnfields on the Eastern Moors, each containing a wide range of archaeological features that are both prehistoric and later in date. They were selected as study areas because much of the recent environmental research and modern excavation that has taken place has been focused on these areas, and so the results of this project can be compared directly to other research.

The project will focus specifically on soils which appear to have been eroded from prehistoric fields, on the principle that the erosion is assumed to relate to agricultural activity. It has two primary aims

1. The dating of agricultural activity within the cairnfields. The rationale behind this is that by dating the erosion of sediments, the agricultural activity which is assumed to have caused the erosion will thereby be dated.
2. An elucidation of some aspects of prehistoric agriculture primarily through an assessment of any impacts upon the soil.

Dating

There are several interlinked objectives to the dating of prehistoric agriculture. First is a refinement of the chronology of occupation of the cairnfields. This is simply in the form of adding more chronological detail to the record of agricultural activity, so that how this fits into the overall chronology can be better understood. The dating of agricultural activity can potentially, depending upon the dates obtained, elucidate the earlier and later parts of the sequence of activity in the cairnfields, which at present form a major area of ambiguity in current models.

Second, is the aim of comparing any dates obtained from the two cairnfields to establish if there are reasonable grounds for believing that they were closely contemporary. This has implications for the scale of settlement on the gritstone uplands and for several aspects of current models. The idea is to examine whether, if the two cairnfields can be shown to be contemporary, the inference can be made that these represent any sort of norm for activity on the eastern moors. Similarly, the potential exists for the dating of activity in different parts of the same cairnfield. This could help to elucidate the duration of activity within that area, and again assess whether there is a basis for believing that the cairnfields represent similar types of activity, at similar periods.

Third, a more specific objective is to obtain dates, which would allow for a comparison of the ages of ceremonial and agricultural features. This in turn, would aid in the assessment of the validity of certain aspects of current models, in particular the differing views of Barnatt and Edmonds, as to the significance of the spatial association of ceremonial and agricultural features.

3.4 CHARACTER OF OCCUPATION

There are limits to the inferences that can be made about the character of occupation of the cairnfields from a geomorphological study, and many of the questions central to current research cannot be addressed through this medium. For example, questions as to whether the occupation of the cairnfields was on a seasonal or more permanent basis, cannot be tested, because the dating methods do not provide sufficient resolution. Similarly the nature of the prehistoric agriculture cannot be firmly established using the methods chosen here, as grazing, arable and woodland clearance can all lead to erosion, and the end result in terms of sediments deposited would be similar for all three processes. Arable farming would be expected to cause more erosion than pasture however, as it leaves the ground surface free of vegetation in certain seasons, so some association between the degree of erosion and land use may be assumed, but on a very tentative basis.

Whether the agriculture was on a continuous or more episodic basis can potentially be investigated to some extent, by an assessment of the scale and intensity of the sedimentation. This rests on three basic assumptions –

- That erosion resulting from prehistoric agriculture can be clearly identified.
- That the degree of erosion is linked to the scale, intensity and duration of the land use.
- That any intervals between episodes can be both identified and dated.

It is the intention here therefore, to make some assessment of the scale and intensity of land use through an examination of the degree and duration of erosion within the cairnfields. This would potentially allow for a consideration of what kind of land use model the degree of erosion best fits.

Linked to this is the testing of certain specific hypotheses regarding the character and duration of prehistoric land use on the Eastern Moors. The first is that the agricultural practices of the Bronze Age led to a major and dramatic phase of soil erosion (Barnatt 1999; 2000). If this were the case, it should be possible to identify the consequences in the depth and character of (dated) sediment.

The second hypothesis, also put forward by Barnatt, (1999, 2000) is that certain earthen banks were not built at all, but were formed by the accumulation of eroded soils against former field boundaries such as hedges and fences. This again has implications for the intensity of prehistoric agriculture and also for questions relating to the formality of land divisions.

The specific methods used to carry out these objectives will be described in Chapter 4.

4 METHODS

This chapter will describe the methods used in this study. It will first focus on Big Moor and Gardoms Edge, from which the data was obtained, and will describe for each area, the location, geology, topography and the archaeology it contains. It will then describe the methodological strategy employed in selecting contexts for study. Finally, it will describe the specific methods employed, and the rationale behind the use of those techniques.

Geographically, the two areas of moorland are almost adjacent to each other on the gritstone escarpments immediately to the east of the Derwent Valley. Figure 7 shows their topographic positions and their location in relation to the main present-day settlements in the Derwent Valley.

4.1 BIG MOOR

4.1.1 Location

Big Moor is the larger area both in terms of acreage and spread of field system remains. It lies to the north and slightly east of Gardoms Edge, and is centered at SK 270760 (Figure 7). The cairnfeld remains are situated at a somewhat higher altitude than those of Gardoms Edge, with the majority being located between approximately 310 to 330m O.D. (whereas those on Gardoms Edge extend from around 200m O.D. to approximately 280m). The present day boundaries of the moor are a mixture of topographical and man-made features. It extends from the B6054 in the north, to just beyond Swine Sty (262737) in the south, and from the scarp of White edge in the west (262767), to the A621 in the east. Big Moor comprises the area of unimproved moorland encompassed by these boundaries, lying immediately to the east of White Edge, and is now managed as a sanctuary area for flora and fauna by the Peak District National Park.

4.1.2 Topography and Geology

Geologically, this part of the Eastern Moors is composed of the interbedded sandstones and shales of both the Millstone Grit series and the Lower Coal Measures, overlain in places by drift deposits of Pleistocene age (Figure 8). The horizontally bedded but slightly dipping character of the solid geology, has produced a stepped topography. This consists of small escarpments backed by dip slopes which extend into broad, fairly shallow shelves. Topographically Big Moor is located on the east facing dip slope of the White Edge escarpment, which is one of these shelves. Geologically White Edge is composed of the Crawshaw sandstone, which marks the base of the Lower Coal Measures in the immediate area (Figure 8). The edge itself faces west and is the highest part of the moor, lying at between 320 to 365m O.D. To the east, the dip slope falls steeply at first, then more shallowly to become a distinct shelf which, continuing east, is then bisected by Bar Brook which has cut a steep valley running north-south. Swine Sty (Figure 7, 272750) marks the southern limit of the sandstone outcrop and here, although it is lower in altitude than White Edge the sandstone shelf still rises prominently from the lower land to the south via a short but steep slope. From Swine Sty the edge of the shelf runs north east until it meets the Bar Brook valley where it turns to run south east, becoming shallower and eventually petering out to the south of Ramsley Moor.

Although the sandstone is the dominant bedrock over much of the shelf, there are areas of drift deposits and of shales, which have important effects upon the drainage and vegetation where they occur. In the centre of the moor are patches of glacial "head" gravels, which are generally only seen at the base of slopes where drainage channels have cut through the overlying soils. Their topographic positions suggest that they are probably solifluction deposits, generally assumed to be of periglacial origin. Working on that assumption, they are useful for archaeological purposes for providing a rough chronological baseline for Holocene sedimentary sequences. Other than this, their significance is minimal and they appear to have little impact on vegetation and drainage. Of greater importance are the shales, which are more widespread, particularly over the centre, north west and south east of the moor. Although these never form prominent surface exposures, their impermeability exerts a significant influence over the drainage, leading to waterlogged conditions. On the ground, there is little observable difference in either soils or vegetation between areas where the bedrock is dominated or influenced by shales, and areas of supposed alluvium or drift as shown on geological maps of the area (Figure 8) most of which are variably detailed. On this basis it appears there is a possibility that some of the latter areas may be mis-categorised and are in fact shales. Whether shales or alluvium however, both give rise to gleyed very heavy clay soils which are usually waterlogged even in dry weather. However both tend to be covered by blanket bog, making them extremely useful for the purposes of obtaining pollen samples. One of the cores used by Long (1994 Long et. al. 1998) were obtained from the small patch marked as alluvium at 274757 on Figure 8, where a small mire occurs close to cairnfield remains. Those used by Hicks (1970, 1971) were taken from the larger area whose centre lies at 267770. The soil maps for Big Moor are less detailed than the geologic maps, but they designate most soils of the eastern gritstone dip slopes as part of the Cockey Complex, (Soil Survey Record 4 1971). These range from surface water gleys to incipient peaty gleyed podzols through to brown earths. In reality the soils vary tremendously according to local conditions but most on the gritstone areas of the shelf, appear to be stagno-humic podzols.

The final topographic feature relevant to this study, is the valley of Bar Brook which has cut a deep valley through the shelf slightly east of the centre. This valley is narrow and steep sided in the north, becoming wider to the south as the stream exits the outcrop and flows out onto the shales. The steepest parts, seem to have been avoided for agricultural purposes in prehistory, as they contain no visible archaeology today. The stream valley is an important topographical feature however, as it is a natural landscape division separating the east and western parts of the moor. The valley is also the major drainage channel. Bar Brook is a third order drainage and its small tributaries are first and second order streams. The system therefore provides an ideal opportunity for geomorphological study, as the moor is the sole source of the sediment load of both Bar Brook and its tributaries. Many of the small tributary streams drain areas of the moor with archaeological remains, and their alluvial deposits are ideal contexts in which to search for evidence of anthropogenically induced erosion.

4.1.3 Archaeology

As elsewhere on the eastern moors, the surface archaeology is strongly associated with the grits, which on Big Moor are Crawshaw sandstones, with most being concentrated in the south, although there are scatters of features right across the moor. The edges of the plateau, around the valley of Bar Brook, contain the highest density of features, with substantial spreads occurring both to east and west of the drainage. Further east the cairnfield remains eventually peter out on neighbouring Ramsley Moor. The RCHME survey (Ainsworth et. al. 1998) noted that spatially, the cairnfields are divided into three main areas, Big Moor West, Big Moor Central and Big Moor East, shown as areas 1, 2 and 3 in Figure 9.

All three main areas, along with the smaller outliers, are composed of a mixture of features, suggestive of agricultural, settlement and ritual/ceremonial activity (Ainsworth et. al (1998). Ceremonial features include three small embanked ringcairns/stone circles, between four and thirteen burial cairns, one kerb cairn, two or three cists, four or five burial cairns with associated platforms, and cup and ring marked rocks, some of which are still *in situ* while others are now in Sheffield City Museum (ibid). While there is therefore a wide range of monument types found across Big Moor, there is little difference between the three main areas in the density of such features, which are similar in each.

It is thought that most prehistoric buildings were wooden, leaving therefore only sub-surface traces such as postholes (Ainsworth et.al.1998). Consequently settlement sites are the most difficult feature to identify with certainty by survey. In the absence of excavation, they are recognised by the presence of small flattened platforms, some rectangular but most circular. In addition some of these platforms are partly defined by cairns or banks which meander needlessly, and appear to be the result of clearance stone deposition around a pre-existing structure. There are up to 37 such structures scattered across the moor and as in the case of ritual ceremonial features, the density is similar in all of the three main cairnfield areas (ibid.).

The main difference between the East, West and Central areas is in the agricultural features, and more specifically in the layout of fields and whether field boundaries are well or poorly defined. The agricultural features which comprise the majority of the remains, consist of banks, both stone and earthen, linear clearance heaps and clearance cairns. The RCHME survey also lists lynchets, cultivation edges and patches of clearance stone. Finally there are other features which can be less certainly identified and which the RCHME survey listed as "possibles", and these include gates, tracks and animal pens. The density of clearance features appears to be related primarily to the natural stoniness of the ground, but the possible fields they mark out vary significantly. Big Moor east (area 3, Figure 9) lacks well defined field boundaries. Big Moor Central (area 2) has the most complex spread of remains comprising a palimpsest of well defined fields mixed with numerous small cairns. In Big Moor West, (area 1) the different layouts are more spatially separate, with the north and south parts having poor to moderate boundary definition and the central area having well-defined fields.

In addition to the prehistoric archaeology, there are numerous features of Medieval and post Medieval date (Ainsworth et.al. 1998). Some reflect a more industrial use of the moor and these include evidence of mining activity such as bell pits, small quarries on White Edge and "dayworking" scars comprising pits and waste heaps, reflecting small scale local digging of stone for items such as troughs. There are also numerous transport features such as hollow-ways, paved paths, guide stones and bridges. Hollow ways, which represent the courses of pre-turnpike packhorse routes, comprise the majority of transport features and the earliest were in use from at least the medieval period although their precise chronological origins are unknown (ibid). The major routes tend north east-south west across the moor and their use may have intensified in the post medieval period when they are known to have been used for the transport of commodities such as salt from the Cheshire Plain and manufactured items from the newly forming industrial regions to the east (ibid).

Finally, the most recent classes of evidence are two small reservoirs built in the late 1800s, grouse-shooting butts, and World War II military features such as slit trenches and foxholes, all of which add considerably to the range and complexity of surface remains.

All three of the main cairnfield areas were examined for features that had the potential to provide dating and sedimentary evidence of soil loss, but these were only found on Big Moor Central, therefore all the features excavated were on the main shelf. The criteria used in the selection of features, the features selected and the methodology applied will be described in section 4.3

4.2 GARDOMS EDGE

4.2.1 Location

The Gardoms Edge cairnfield lies between two escarpments, Gardoms Edge, (Figure 10, 272734) which forms its western boundary and after which it is named, and Birchen Edge, which forms its eastern approximate eastern boundary (Figure 10 280725). To the north and south it is bounded by the A621 and the A619 respectively. In size it is considerably smaller than Big Moor. This is partly because the dip slope it occupies is smaller, but it is also because part of the land has been enclosed and is now improved pasture. The improved land effectively splits the moor into two, (Figure 11). The bulk of the cairnfield remains are located in the larger area of moorland to the east of the Gardoms Edge scarp in the north. There is also a smaller area of cairnfield remains on a stretch of unimproved moorland to the south. In some of the improved fields in between, the line of a large semicircular enclosure that is thought to be prehistoric, can still be traced because the stone has not been completely removed. There is a strong probability therefore, that the cairnfield remains originally formed a continuous spread which extended down into the Derwent Valley.

4.2.2 Topography and Geology

The geology of Gardoms Edge consists of grits and shales. The cliffs or edges run north to south and the lateral exposures east to west, so the rocks get progressively younger eastwards (Figure 12). The boundary between the Millstone Grit Series and the Lower Coal Measures lies at Birchen Edge. The whole of Gardoms Edge is therefore on the Millstone Grit Series. The major gritstone beds are the Chatsworth grits and the Rivelin Grits, both of which are slightly coarser than the Crawshaw sandstone of Big Moor, but otherwise very similar. As with Big Moor the relative resistance to weathering of the grits compared to the shales has led to the formation of a stepped series of escarpments. These start in the west with the Gardoms Edge scarp which faces west and rises to an altitude of approximately 280m OD (Figure 12). Eastwards of the edge the altitude increases steadily via alternating exposures of grit and shales with the grits forming west-facing scarps and the shales overlying the dip slopes. The strata dip gently eastwards and to the south, the land becomes a broad shelf that extends down to the River Derwent. The effects of the geological differences are the same as on Big Moor. The grits form the lower lying ground at the base of each dip slope, are covered with heavy clay soils of the Cocky Complex and are poorly drained.

4.2.3 Archaeology

Although smaller in size than Big Moor, the Gardoms Edge cairnfield has an equally high density of field remains, and these have been surveyed at a scale of 1:1000 by (RCHME, 1993, unpub.). and about 2000 archaeological features have been identified. Like on Big Moor the results of the survey showed that there is a strong association between the lighter sandy soils of the grits and the upstanding archaeology and most of the surface remains are found in bands following the gritstone exposures. Although the remains stretch right across the moor, the majority are situated on the main shelf between the Gardoms Edge and Rivelin Grit scarps and suggest two distinct phases of prehistoric activity. The early phase is represented by two cup and ring marked stones, a standing stone, and a large stone built enclosure. This is located on the highest part of the Gardoms Edge escarpment, (centred at approximately 272730 Figure 10) and forms an arc that starts and finishes at the scarp edge, (Figure 13). The structure consists of a rubble bank, 5 to 10 metres wide and 1.5 metres high, and runs for over 600m, enclosing a semi-circular area that is heavily boulder strewn. A short distance outside it to the east is a large earthfast boulder with cup and ring marks and a standing stone. It was originally interpreted as a hill fort, (Hart 1981) but the character of the bank mitigates against this idea. It is generally too low to have any sort of defensive function and the survey revealed a number of gaps that resembled entrances. In addition, there are cairns thought to be Bronze Age, (RCHME 1996) on top of the stone bank towards the south of the northern canfield area, so if the postulated age of these features is correct then the enclosure cannot be later than the Bronze Age. It has now been argued that the feature is closer in form to a causewayed enclosure, (Barnatt 2000, Barnatt et al 2000) and could therefore be Neolithic in date. At present the enclosure is undated, but radiocarbon samples have been obtained from a secure context under the bank and hopefully when processed these will resolve the uncertainty.

The later phase of prehistoric activity is represented by the field system evidence scattered across the moor. This comprises the same sort of remains as exist on Big Moor, house sites (at least 10 possibles), probable fields defined by clearance features such as cairns and linear clearance banks, these last two forming the bulk of the evidence, and ceremonial monuments including a large burial cairn and a ring cairn. In addition there are two linear features, which cross the centre of the main shelf to the east of the Gardoms Edge scarp (E & F, Figure 13). These run parallel to each other in an east west direction and their function is uncertain. One is a low stone bank that could be a boundary, the other is a pit alignment whose purpose is unclear.

There are patterns within the evidence, which can only be satisfactorily investigated through excavation. Across the cairnfield, the character of the remains varies in different areas shown as 1, 2and 3 in Figure 13. In area 1 for example, the distribution of the cairns is suggestive of smaller and more irregularly shaped fields. In area 2 boundary definition is better and the fields are more regular in shape. In area 3, which is bounded on three sides by stone banks, the cairns are larger and seemingly more regularly spaced rather than small and scattered. Whether these differences are chronological, indicating changes through time, or represent differences in usage, indicating different functions for different areas is unclear.

The excavations of the Gardoms Edge Project have overturned some existing ideas and led to new interpretations (Barnatt et. al 2000 unpub). For example the rectangular shape of area 3 plus the size and regular shaping of its cairns, hinted at a later use of this apparent field. Essentially this area looked as if it could have been used for plough agriculture whereas the size and shape of the fields elsewhere more resemble small hand tilled plots. Excavation of one of the cairns in the 2000 season, however, revealed that this was a ceremonial feature, probably a burial mound on to which clearance stone had been added later. Moreover the artefactual evidence, which included a leaf shaped arrowhead and fragments of beaker pottery, indicated an early rather than later date. Similar indications of chronological depth are apparent across the cairnfield, for example the possible Neolithic enclosure is overlain by later clearance heaps, and the possible boundary bank previously mentioned, (E, Figure 13) overlays and bisects an earlier subrectangular enclosure. In all, the cairnfield remains are a complex palimpsest of features of apparently different ages and function, and the results of the Gardoms Edge project have shown that in the absence of excavation their appearance and distribution can frequently be misleading. The archaeological features excavated for the purposes of this project are shown as T5 and T9 in Figure 13 and were located in area three. A pit sampled to obtain material for radiocarbon dating is shown as T2. The work was carried out during the 1999 excavation season of the Gardoms Edge excavations.

4.3 STRATEGY – SELECTION OF CONTEXTS FOR STUDY

The primary aim of this project was the dating and characterisation of prehistoric agricultural activity, as evidenced by sedimentary deposits eroded from prehistoric fields. The field research was designed to work at two distinct scales, and the selection of study contexts for both was achieved by prospecting for features, either natural or man made, which had the potential to provide useful data.

4.3.1 Large Scale

This was based upon an examination of stream deposits in the Bar Brook catchment on Big Moor (Figure 14). Bar Brook is a low order drainage system, where sediment inputs are limited to the adjacent slopes and thus in part to the prehistoric fields that cover them. Preliminary field visits identified naturally occurring sedimentary sequences exposed along stream channels, consisting of interbedded peats and sandy alluvial sediments. These sequences had the potential to provide material for both C14 and OSL (Optically Stimulated Luminescence) dates, from which a long term chronology of sediment deposition could be constructed. It was hoped that this would encompass, but not be limited to, the period of use of the surrounding cairnfields. The chronology, complemented by a close examination of the sedimentary sequences, would provide the basis for the identification of any changes in the depositional regime that could be linked to prehistoric farming or other land use. Such sequences would provide an overview of processes at work within the catchment rather than specific information on any particular part of the cairnfield, but could be used in theory to assess the relative effects of human activity on the catchment at any given period covered by the chronology.

There were two natural sediment sequences sampled for the purpose of constructing a long term chronology. Both were on Big Moor as no suitable deposits exist on Gardoms Edge. One was an alluvial fan, deposited by a small, un-named first order tributary stream at its confluence with Bar Brook. The other was a sequence of stream deposits laid down by the same tributary. The latter were exposed at a nick point where the tributary exited the main gritstone shelf (Crawshaw Sandstone) to the west of Bar Brook. The alluvial fan and the nick point sections are situated within 30m of each other at the northern end of the Big Moor Central cairnfield (Figure 15).

4.3.2 Small Scale

In order to complement the large-scale studies, a separate series of excavations were undertaken within the Big Moor Central cairnfield. This work concentrated upon the identification and dating of activity and change at a more local scale within the field systems themselves. The fieldwork here focused upon individual archaeological features and specifically on sediments accumulated against them and on buried soil profiles beneath. The features examined were selected so that the accumulated sediments had a strong probability of being the result of erosion of soils in prehistoric fields. The primary objective here was to corroborate this, by obtaining material for OSL dating which in theory dates the deposition of such sediments. Radiocarbon dating would also have been used if any suitable material had been recovered from the excavations but it was not. The use of both OSL and C14 dating is discussed in more detail in section 4.4.5 below. The examination of buried soils was intended primarily to provide a baseline for comparison with the accumulated sediments, in order to better identify them.

Features selected for these purposes were those which were aligned parallel to contour and so constituted slope obstacles against which sediment could accumulate, and those which were asymmetrical in shape, suggesting a build-up of sediments on the upslope side of the features. In all seven structures of this type were excavated and sampled, five on Big Moor and two on Gardoms Edge.

On Big Moor, these comprised:-

1. Trench 2. A stone and earth bank.
2. Trench 3. A cairn
3. Trench 4. A stone bank
4. Trench 5. A stone and earth bank.
5. Trench 6. An earthen bank.

On Gardoms Edge, these were:-

1. Trench 5. An earthen bank

2. Trench 9. A cairn overlying an apparent earthen bank or possible lynchet.

The position of the Features excavated on Big Moor is shown in Figure 14. The position of the trenches excavated on Gardoms Edge is shown in Figure 13.

In addition, radiocarbon dating samples were obtained from a pit fill and a palaeosol under an associated spoil heap, which were excavated as part of the Gardoms Edge Project, (Trench 2 1999, Barnatt et. al. 2000 unpub, T2 Figure 13).

4.4 EXCAVATION AND RECORDING PROCEDURES

4.4.1 Big Moor

The archaeologically significant parts of Big Moor now have scheduled ancient monument status, and it was not feasible to excavate any features in their entirety. Nor was this desirable as the sedimentary stratigraphy can be understood better in section. All archaeological features were therefore sectioned. This was done by the digging of a trench through the width of the feature, which also extended out at least 2m to include the ground surface on either side. The sections always ran cross-contour and were therefore usually at right angles to the length of the feature. In this way, any sediments accumulating behind the features would show up in section. The trench was always excavated from the ground surface down to the C horizon so as to ensure that the full soil profile was also seen in section. The only exceptions to this were when the C horizon was at a depth exceeding the permitted health and safety limits for excavation and this occurred in two instances, on Features 5 and 6. On these occasions the trench was only dug to the safe depth.

The archaeological material in each trench was excavated by context following standard archaeological practice, and in the archaeological levels both sediments and stone were given context numbers. Single context recording was used throughout, except on those occasions where interpretation was aided by multiple context records. Each context was planned at a scale of 1:20, photographed and levels taken, and the recording protocols followed were those used by the Peak National Park Archaeology Service (PNPAS), which in turn follow those used by the English Heritage Central Archaeology Service. The protocols are described in the PNPAS site recording manual, a copy of which, along with all the original excavation drawings and records, is stored at the University of Sheffield, Department of Archaeology and Prehistory. Any finds or samples taken during the course of excavation were recorded on plans, and finds and sample sheets. The texture, stone content etc. of sedimentary contexts was assessed by hand in the field and recorded on the relevant context sheets. Once excavation was complete, sections were photographed and drawn at a scale of 1:10, and samples were taken from sections and recorded on section drawing and sample sheets. Sediments below the depth of archaeological material were also recorded on section drawings.

4.4.2 Gardoms Edge

The excavation, of the two features on Gardoms Edge differed from that of Big Moor these were oriented cross-contour. They were therefore sectioned parallel to contour. Sampling and recording procedures were the same as those described above for Big Moor. In addition on Gardoms Edge, extra samples were taken from trench 2 (Gardoms) that was excavated as part of the Gardoms Edge project. These samples were recorded in the same way as those from Big Moor, by being noted on the relevant drawings and sample sheets.

4.4.3 Analytical Techniques - Sampling and Methods

A standard set of samples comprising those for granulometry, loss on ignition and magnetic susceptibility, was taken from each feature excavated. The purpose of analysing these samples was to test the interpretations that were based upon the field observations made during excavation. For these purposes one small bag or a 2.5 cm cube sample provided sufficient material for all three analyses. The samples were taken from the excavated sections ideally at approximately 5cm intervals or on either side of stratigraphic boundaries, (whichever was the smaller) from the surface to the base of the section. In practice the stone content of the sediment, particularly within features such as cairns frequently made the intervals more irregular than this. The number of bag or cube columns taken varied according to the feature, but three was usually the norm with one being taken outside and upslope of the feature, one through the centre of the feature and one outside and downslope. The uses to which these samples were put are described below.

4.4.3.1 Granulometry

Granulometry was used to supplement the field observations of sediment texture, to clarify the general textural characteristics of the sediments and to pinpoint any changes in either depositional regimes or pedological processes down the profile. In practice, as the sediments examined were dominantly sandy, this meant identifying changes in the proportions mainly of sand and silt down the soil profiles and between different parts of the sections. These were used to corroborate the field observations of the presence of material that had been sorted by transport. Of particular interest in this respect were differences between the textural profiles of buried soils, and sediment interpreted in the field as having accumulated against a feature.

The granulometric analysis was performed on a Cilas 940 Laser Diffraction Particle Sizer. All samples were first heated in a solution of 30% (100 volume) hydrogen peroxide to remove any organic material and were then subjected to detailed granulometric analysis of the < 2mm fraction. The use of this instrument has certain pros and cons. Its major advantage is the speed of the analysis as, once the samples are prepared, this takes about 7 minutes. Consequently it allows for sampling at a higher resolution than traditional methods, which take days to complete. The main disadvantage is that while this method provides accurate measurements of the sand, silt and coarse clay fractions, laser diffraction tends to underestimate the fine clay content, (Beuselinck et al.,1998, Konert & Vandenberghe, 1997) Clay rich samples are therefore best processed by traditional sieve hydrometer analysis. For the purposes of this work however, a) all features sampled were on sandy substrates which contained very little clay and b) absolute proportions of any size fraction were less important than relative proportions, as it was changes across and down the soil profile that were of interest. The measurements of clay content presented below should therefore be treated with some caution, but it was felt that the level of inaccuracy was in this case acceptable.

The results of the granulometric analyses are presented and discussed in Chapter 5 in the sections relating to each individual feature.

4.4.3.2 Magnetic Susceptibilty

The main purpose in subjecting the samples to magnetic susceptibility analysis was to confirm the identification of buried palaeosols, which were not necessarily clearly visible in the field. Normally, palaeosols can be distinguished from overlying sediments by colour and textural differences, but this was not necessarily the case in the soils under examination. Here, the textural differences were in many instances too subtle to be completely assessed in the field, and colour was the least reliable indicator of pedologic characteristics because it tended to be a product of the podsolisation process.

It therefore reflected the state of oxidation of soil minerals rather than the presence of original soil horizons. Indeed buried soil epipedons (A horizons) typically appeared to be a pale lavender colour, although this impression was never confirmed by the Munsell colour characterisation.

Magnetic susceptibility works on the principle that magnetic minerals become more strongly magnetised in the presence of a weak magnetic field, and the susceptibility is the extent to which the magnetism of the minerals increases, when such a field is applied (Clarke 1990). This is recorded in SI units (System Internacionale – meter-kilogram – second), as the ratio of the increase in magnetism, proportional to the strength of the applied field. While magnetic susceptibility is a product of the mineralogy, concentration of magnetic minerals and the grain size and shape of the minerals, certain processes are known to increase it. Magnetotactic bacteria, for example, which are involved in the decay of organic material, fix and create magnetic minerals such as magnetite, and burning can also cause the formation of magnetic minerals such as magnetite or maghaemite (ibid). Either or both of these processes can be relevant to soil A horizons, which can therefore be expected to possess higher magnetic susceptibility than other layers, and can consequently be distinguished by this method. Magnetic susceptibility measurements were carried out on a Bartington MS2 meter, following Gale and Hoare, (1991). The reversible low frequency mass susceptibility (Xlf) of the samples was measured twice and an average of the two readings was used. As with the granulometry, results are presented in the discussion relevant to each feature in Chapter 4.

4.4.3.3 Loss on Ignition

Loss on Ignition supplemented the magnetic susceptibility analyses, and was used for the same reason, namely to identify buried soils, the rationale being, that relic A horizons could in theory be expected to contain more organic material than the surrounding sediment. The samples were first dried at low temperature then weighed before and after organic matter was burnt off, following Briggs (1977).

4.4.4 Pollen

A skeletal pollen diagram was prepared for the nick point section by Mr R Craigie of the University of Sheffield, Department of Archaeology and

Prehistory as part of a proposal submitted to NERC for funding for radiocarbon dating. Samples for this were extracted from the nick point soil monoliths at 5 cm intervals or on either side of lithological boundaries, and were processed following Faegri & Iverson (1989).

4.4.5 Dating

In addition to the above samples, any material that was suitable for dating purposes was also sampled and the dating methods used were radiocarbon and optically stimulated luminescence (OSL).

4.4.5.1 C14 Dating

At the outset it was envisaged that C14 could be used in two ways:-

1. To date organic material sealed within or below features in the cairnfields and so date the features by association. However, datable material from within features proved to be almost non-existent, and only the Gardoms Edge pit alignment yielded suitable material. In this case dates were obtained from a peat at the base of a pit fill, and a buried turf line under a mound of material, which appeared to be the upcast (or spoil), from the initial digging of the pit (see T2 Gardoms Edge, Chapter 5).

2. To date organic layers within sedimentary deposits. The rationale in this case was that in depositional contexts, such as at the nick point on Big Moor, peat or organic-rich sediments were likely to represent *in situ* accumulation during periods of landscape stability (incipient soils in essence), whereas sandier layers would represent pulses of erosion or landscape instability. It was hoped, therefore, to bracket such mineral layers with carbon dates from organic-rich strata, and so determine when the major pulses of erosion and deposition were occurring. Most of the carbon dates obtained were used for this purpose and came from the nick point on Big Moor.

With these layers, it was important to establish that the organic matter from which the samples were obtained was actually *in situ* rather than re-deposited (Brown, 1997, pp.49-500). To this end, three basic criteria were used to assess the organic-rich layers: 1) the presence of a horizontal fabric, 2) the degree of humification of the organic-rich sediment, and 3) the loss on ignition value. The presence of a strong horizontal fabric within the sediment matrix was considered to be the most important indicator of *in situ* material as this was assumed to be unlikely to be present in reworked peat. The degree of humification and the loss on ignition values were less important, as peat development *in situ* can be accompanied by both mineral inwash and drying out which will start the decay process. These were still useful, however, as corroborative factors.

In addition to the above criteria, the samples were examined microscopically for the presence of roots, a possible source of contamination. Samples were assessed subjectively and those that were considered to contain too many roots (i.e. too many to be removed, or fragments too small to be removed) were rejected. Ultimately six samples were obtained from the nick point and one from the fan (see Chapter 5).

The samples were processed at the NSF Arizona AMS Facility at The University of Arizona, and were calibrated to 2 sigma using the Oxcal Program available from The Oxford Radiocarbon Accelerator Unit following the protocol outlined by Bronk Ramsey, 2000.

4.4.5.2 OSL Dating

This technique works on a similar principle to that of thermoluminescence, but it measures the last exposure to light of quartz or feldspar grains within sediments. The amounts of ionised electrons trapped within such mineral grains are proportional to the amount of background radiation, from thorium, potassium-40 and uranium in the background sediments, that they have received since burial. The time elapsed since the grains were last exposed to light is calculated by dividing the paleodose, which is the amount of radiation they have received, by the dose rate, which is the strength of the ground radiation flux. The paleodose is assessed by measuring the burst of luminescence emitted by the trapped electrons when the mineral grains are exposed to set doses of radiation in a laboratory, causing them to be released from the traps. The dose rate is calculated either by direct measurement of ground radiation with a gamma spectrometer, or by laboratory measurement of the sediment.

Material for OSL dating was obtained from both archaeological features and natural depositional contexts, with the same rationale as was applied to radiocarbon samples. In the case of archaeological features and the more naturally occurring sedimentary deposits, the OSL dates are assumed to date the time of sediment deposition. With archaeological features, OSL samples were taken from a) deposits assumed to have been transported on the slope and deposited behind the cultural features (usually banks oriented parallel to contour), or b) from deposits that would have been on the surface prior to burial by large stones associated with clearance cairns. In most cases owing to a lack of other datable remains, the OSL samples were the only form of geochronology available from the features and their associated sedimentary deposits. With the naturally occurring deposits, specifically the fan and the nick point, the OSL samples complemented the carbon dates. Theoretically, the OSL dates should pinpoint the time of sediment transport and therefore periods of landscape instability, whereas the radiocarbon dates from organic-rich sediments which were inferred to be incipient soils, should date the periods of landscape stability between phases of sedimentation. In reality, the latter assumption is potentially complicated by redeposition of organic material from upstream.

There were certain advantages to the use of OSL compared to radiocarbon, not least among which was that with OSL there is a direct link between the activity being dated and the age obtained, because the resetting of the OSL signal within the sand grains occurs when the sediment is exposed to sunlight during transportation. With radiocarbon, the link between activity and dating is often by association and therefore less direct (Taylor 1987).

In addition, at the start of the project, it was envisaged that material suitable for OSL dating would be more abundant than for radiocarbon dating. Personal experience with the five year Gardom's Edge Project had already shown that apart from bulk charcoal, datable organic material from secure contexts tended to be confined to ceremonial or domestic structures, and was largely absent from agricultural features. Charcoal flecks and burnt roots are fairly common, but in an environment which has been regularly burnt for centuries, such items were considered to be too risky to date on a tight budget. In contrast, most agricultural features have proved to be composed of a mixture of stone and sediment and so were potentially datable by OSL. However, just because there was abundant sand did not mean that the samples would yield archaeologically meaningful dates. Factors which influenced the application of luminescence dating were not the abundance of material *per se*, but rather 1) the depth below surface, 2) the method of sediment transport, and 3) pedoturbation, all of which may influence the accuracy of the dates produced.

With reference to the first of these factors, with samples that are obtained from less than 30cm below the surface there is a soft component of the cosmic dose that cannot be calculated. (With samples taken at depths in excess of 30cm below the surface, this is not a problem because the hard dose can be calculated with a simple algorithm (Presscott & Hutton 1994)). Therefore the total cosmic dose is under-estimated causing the calculated ages to be slight over-estimates. This only makes a difference of around 10% to the calculation (M Bateman pers. com.) and in the case of the Big Moor samples, the cosmic dose was only around 10% of the total palaeodose. The calculated ages therefore should only have varied by about 1%.

The method also assumes rapid burial and in theory if this did not happen, the calculated ages would under-estimate the date of deposition, but would still reflect the date of burial. As agricultural activity can be inferred from both deposition and burial of sediment, this is not a problem.

As a result of these limitations, where sediment was very close to the surface, such as at trenches 4 and 5 on Big Moor they were considered to be unsuitable for dating and so were not sampled for OSL purposes.

The second limiting factor is the method of transport of the sediment. This affects the number of quartz grains that are exposed to sunlight and are bleached or reset and in which the luminescence signal is reduced to zero. Aeolian transportation provides the best conditions for bleaching (Aitken 1998). The resetting of water transported sediment depends on the clarity of the water, as the clearer the water, the more grains will be exposed to sunlight. As water transport appears to have been the dominant process on both Big Moor and Gardoms Edge, the most obvious drawback to the use of OSL was the potential for inadequately bleached or partially bleached sediment. In an initial attempt to counter this problem, only sandy rather than clay-rich sediment was sampled, on the assumption that clayier deposits would muddy the water (in both literal and dating terms). The assumption that the sandy deposits were associated with clear water discharge is unsupported and potentially erroneous, although in the case of short distance, dominantly sheet erosion deposits, as is assumed to have been the case with the sediment eroded from prehistoric fields, the bleaching potential is much more certain.

A further means of countering the problems of inadequate bleaching of sediment was to run numerous replicates of the samples, in order to obtain sufficient data for statistical analysis of the paleodose (d_e.) distributions. The paleodose measurement for each sample, which was carried out on 28 aliquots, was therefore repeated at least three times. The distributions were then examined and any d_e. values which were more than three times the value of the standard deviation were excluded from the age calculation.

A further potential cause of inaccuracy is pedoturbation, which could in theory mix sediment of different ages producing an average that does not relate to the event of interest, namely the time of transportation. In order to assess the reliability of the dates produced, the method employed was that advocated by Bateman et al (2003), which was the use of paleodose probability plots. Only the d_e data, which fell within a normal distribution centred on the modal probability was used to calculate age, (see Chapter 5).

Twelve samples were obtained for OSL dating, all from Big Moor. Four were from the nick point, four from a field bank (trench 2) and three from a cairn (trench 3). Wherever possible multiple samples were taken in a vertical column from the same area of section. The reasoning here was that this would allow changes through time to be investigated. It would also provide some means of assessing the reliability of the dates produced as the ages should increase with depth from surface. In practice this was only possible at the nick point, but samples from features in the cairnfields were taken as close to each other as was feasible so stratigraphical control was still possible.

As it important that the sediments were not exposed to light, they were collected in opaque plastic tubes approximately 5cm in diameter and 10-15cm long. These were hammered horizontally into the sediments exposed in section until the tube was tightly packed to ensure that no mixing of sediment occurred inside. The tubes were removed from the section, and the ends were capped with opaque plastic lids and sealed with tape. They were then labelled and double bagged again in black plastic. 100g moisture samples were obtained from the holes left after removal of the tubes, and these were also double bagged and used later to determine the moisture content of the sediment, an important factor in the age calculation. The hole was then enlarged using a dutch auger and a gamma spectrometer was inserted, in order to measure the ambient radioactivity of the sediment. The readings from this were used in the palaeodose calculations. The gamma spectrometer was later found not to have worked on some occasions. By the time this was realised, the foot and mouth disease outbreak had made the moors inaccessible and it was too late to obtain further readings.

Consequently, all samples sent for inductively coupled plasma (ICP) spectrometry analysis to determine the uranium, potassium and thorium content from which the dose rate could be calculated. In theory, this method could produce less accurate results as the laboratory analyses are based upon sediment samples, and therefore take no account of the influence of stones, rocks or different sediment near to the sampling site.

The measurement of radioactivity by both ICP and the gamma spectrometer is based upon the abundance of radioactive isotopes of the above elements present in the sediment or in rocks. These produce alpha, beta and gamma radiation, which have pathways of different lengths. Alpha and beta radiation have much shorter pathways than gamma radiation. The influence of alpha radiation will extend outwards from the emitting mineral particle up to a radius of approximately 0.025mm. That of beta radiation, is approximately 3mm but that of gamma radiation is up to 300mm, (Aitken 1998). What this means in theory, is that ICP analysis of sediment will therefore detect alpha, beta and gamma radiation from particles *in the sample*. The sample, while still in situ however, could well have been receiving additional contributions of gamma radiation from particles in rocks etc (or other sediment layers) up to 30cm away. Once the sample is removed from its original position, the additional contribution that the surroundings are making to the gamma radiation component can no longer be measured. The gamma radiation may therefore be under-estimated by ICP, while a gamma spectrometer because it is inserted into the sampling site, will measure all the gamma radiation reaching that site and will consequently be more accurate. Conversely, however ICP provides more accurate measurements of beta radiation, and so where both sets of measurements were available the gamma spectrometer results were used for the gamma radiation, and the ICP results were used for the beta component. This is actually the most accurate method possible of measuring all the radiation. A subsequent comparison of the gamma spec readings that were available for some samples and the ICP results for the same samples revealed no appreciable differences in ambient radiation measurements and any potential inaccuracies or advantages appeared to be minimal.

The samples were processed and ages calculated at the Sheffield Centre of International Drylands Research Luminescence laboratory at the Department of Geography, University of Sheffield. The methods used in the laboratory processing of samples follow Bateman and Catt 1996. The equipment used is described in, Murray & Wintle 2000, and the OSL measurement procedure followed that of Bateman et. al. 2003. D_e values were measured following the single aliquot regenerative dose protocol (Murray & Wintle 2000) with a preheat ascertained experimentally by preheat plateau tests of 160° C.

The data used in the age calculation is shown in Table 1. All the dates obtained by radiocarbon and OSL are shown in Table 2. The individual dates are discussed in the results section relating to the features from which they were obtained, as are any issues arising from the particular circumstances of context, sampling etc.

Table 1 - OSL Age Calculation - Data

Sample No.	Lab. Code	D_e	Diameter	Dose Rate	U.	K.	Th.	Water
BMK1	Shfd 01009	0.51 ± 0.03	231± 19	1173 ± 128	0.96	.073	3.48	16 ± 5%
BMK2	Shfd 01010	0.60 ± 0.05	231 ± 19	1204 ± 128	0.97	0.92	3.92	25 ± 5%
BMK3	Shfd 01011	0.51 ± 0.09	215 ± 35	1183 ± 127	1.20	0.90	3.97	28 ± 5%
BMK4	Shfd 01012	1.59 ± 0.10	231 ± 19	1231 ± 130	1.27	0.89	4.89	27 ± 5%
204	Shfd 01043	5.41 ± 0.08	165 ± 15	1532 ± 76	0.80	0.77	3.30	09 ± 5%
206	Shfd 01044	3.64 ± 0.70	168 ± 43	1237 ± 64	0.70	0.66	2.80	16 ± 5%
208	Shfd 01045	3.85 ± 0.07	181 ± 31	1317 ± 86	0.80	0.66	3.30	15 ± 5%
210	Shfd 01046	8.41 ± 0.11	135 ± 42	1319 ± 86	1.00	0.73	4.00	11 ± 5%
303	Shfd 01047	9.38 ± 0.11	215 ± 35	1191 ± 62	0.90	0.63	3.60	19 ± 5%
305	Shfd 01048	9.08 ± 0.15	168 ± 43.5	1377 ± 71	0.80	0.78	4.00	14 ± 5%
307	Shfd 01049	2.65 ± 0.05	200 ± 50	1018 ± 60	0.90	0.44	3.50	09 ± 5%

Table 2 - Radiocarbon & OSL Dates

Feature	Context No	Depth from surface	Type	Lab. No.	Age	C14 Calibrated (Oxcal) (95% prob)	Calendar Age (OSL)
BIG MOOR							
Nick Point		35	C14	AA-43258	438 ± 38	AD 1410-1520	
		50	OSL	Shfd01009	442 ± 56		AD 1504-1616
		77	OSL	Shfd01010	498 ± 65		AD 1479-1569
		98	OSL	Shfd01011	1501 ± 235		AD 266-736
		107	C14	AA-43259	513 ± 82	AD 1290-1530	
		122	C14	AA-43260	475 ± 42	AD 1390-1490	
		148	C14	AA-43261	713 ± 69	AD 1180- 1410	
		185	C14	AA-43262	552 ± 74	AD 1280-1480	
		205	OSL	Shfd01012	1294 ± 158		AD 550-866
		225	C14	AA-43263	1712 ± 41	AD 240-420	
Fan		77	C14	AA-43267	1640 ± 210	100BC-900AD	
		77	C14	AA-43266	>9500		
Bank - (Trench 2)	2014	60	OSL	Shfd01043	3531 ± 182		BC1711-1347
	2004	30	OSL	Shfd01044	2943 ± 162		BC 1103-779
	2004	35	OSL	Shfd01045	4171 ± 232		BC2401-1937
	2004	45	OSL	Shfd01046	6377 ± 423		BC4798-3952
Cairn - (Trench 3)	3022	70	OSL	Shfd01047	7879 ± 420		BC6797-5457
	3009	35	OSL	Shfd01048	6593 ± 356		BC4947-4235
	3009	35	OSL	Shfd01048	8030 ± 467		BC6495-5561
	3002	20	OSL	Shfd01049	2602 ± 160		BC760-440
GARDOMS							
Palaeosol	2018	39	C14	AA-43264	2105 ± 43	210 BC-10 AD	
Pit peat fill	2052	25	C14	AA-43265	2097 ± 44	210 BC-10 AD	

5 RESULTS

This chapter will describe results of the excavations and laboratory analysis on a trench by trench basis, starting with Big Moor and moving on to Gardoms Edge. National Grid References for the location of the trenches are given alongside the heading at the beginning of each trench section.

5.1 NICK POINT (SK427460 375810)

The nick point was located along the course of a small tributary of Bar Brook, approximately 30m upstream of the confluence between the two. The tributary drains the small mire (seen at top left in Figure 14) and has been through at least two periods of downcutting and one of deposition. It first carved out the small gully through which it runs. This was then filled with deposited sediment and the stream is presently entrenching again, cutting through the sediments that are now exposed along the channel sides. The edge of the Big Moor Central cairnfield is approximately 60m to the south on the higher ground above the nick point and the slope to the north also has cairnfield remains. Two holloways marking the courses of packhorse routes cross the stream a short distance to the west. Both run northeast / southwest, and from the stream continue up onto the main shelf and across the cairnfields. Both the fan and the nick point are ideally placed to catch sediment coming down the slope from both the packhorse routes and the prehistoric fields.

As the sedimentary sequence at the nick point was a natural exposure, it was simply cut back and cleaned to remove vegetation and expose fresh sediment. Once cleaned, the exposed section could be seen to be composed of interbedded sands, peats and peaty sediment, with sand dominating the top of the exposure and silty, more organic-rich layers prevailing at the base. The basal peaty silts were resting upon gravels that appeared to be glacial head deposits.

After cleaning back, a series of monoliths were removed from the exposed section using plastic guttering. These extended from the ground surface at the top of the exposure to the basal peaty silts - a depth of 2.35m, and once extracted they were labelled with the major stratigraphic boundaries and the points of overlap. The stratigraphic sequence was then drawn in the laboratory from the column samples at a scale of 1:5 and preliminary descriptions were added.

5.1.1 Sedimentary Sequence

The sedimentary sequence drawn from the monoliths and the dating samples taken are shown in Figure 16. The section was 2.3m tall and contained numerous beds or layers. The texture of these strata varied from coarse to fine (mean phi (Mphi) 2- Mphi 6), the organic content from 2% to > 30%, and the thickness from 1cm to >20cm. All the sediment was sand size or below and the only gravels that occurred were the head deposits at the base. Because the nick point is very high in the catchment near to the source of the stream, these different strata almost certainly represent changes in the magnitude of rainfall run-off events from the surrounding slopes. The stratigraphic sequence is described below.

Table 3 - Nick Point Sequence - Descriptions

Depth	Description
0-9	This area comprises 3 layers. A basal sand (Mphi 2.6). The present H horizon and the present turfline. It fines upwards to 4 Mphi in the H horizon and loss on ignition values increase from 6% in the sand to 31% in the turfline
9-13	This comprises two layers, a coarse basal sand (phi 2.8) which fines upwards to a sandy black organic layer (phi 4.1) suggestive of a turfline.
13-15	A 5cm layer of dark coarse sand. Mphi 2.8. LOI 3%.
15-19	A 4cm layer of lighter coarse sand. Mphi 2.8. LOI 2%
19-23	A 4cm layer of darker coarse sand. Mphi 2.5. Loss on ignition 2%.
23-28	A laminated layer comprising alternating bands of sand and organics. Mphi 2.86. Loss on ignition 2%.
28-31	A layer of lighter sand. Mphi 2.7
31-41	Peat, (loss on ignition – 72%) changing from unhumified at base to well humified at top. 10cm thick. Mixed throughout with sand
41-45	A layer of loose sand Mphi 2.4. loss on ignition 2%
45-55	A couplet fining upwards from Mphi 2.4 to 4.1. It contains significantly more organics in the top layer, which has a loss on ignition value of 11% compared to 2% in the basal sand. The top layer may be indicative of

Depth	Description
	some soil development, but there is no well developed turfline.
55-60	A couplet composed of a basal sand layer topped by an organic-rich sand. Mphi increases upwards from 2.3 at base to 3.8 in upper layer. Loss on ignition increases from 1% at base to 26% at top. The top layer may be indicative of some soil development, but there is no well-developed turfline .
60-61	Black organic layer. Possible turfline. Mphi 2.6. loss on ignition 4%.
61-66	Coarse sand with organic lenses at base. Mphi 2.22. Loss on ignition 2%.
66-72	A couplet composed of a coarser basal sand and a finer upper sand containing more organics. Mphi increases from 2.4 to 3.5 and loss on ignition increases from 2% to 3%
72-79	A couplet comprising a coarser basal oxidised sand topped by a finer organic-rich layer. Mphi increases from 2.7 at the base to 4.3 at the top. Loss on ignition increases from 1% at the base to 7% at the top.
79-90	A couplet composed of a coarser oxidised basal sand 4cm thick, topped by a thicker (7cm) more silty, and organic-rich layer containing sand lenses. Mphi increases from 2.5 at the base to 4.8 at the top. Loss on ignition increases from 1% at the base to 9% at the top.
90-97	Organic-rich silt. Mphi 6.1. Loss on ignition 26%.
97-102	Oxidised sand with some organics . Mphi 3.5. Loss on ignition 6.1
102-110	Organic-rich silt with fine laminae. 8cm thick. Mphi 6.02. Loss on ignition 18%
110-113	Oxidised sand layer 3cm thick. Mphi 3.02. Loss on ignition 2%.
113-115	Black organic layer with fine sand bands. Possible turfline. Mphi 4. Loss on ignition 7%.
115-120	A 5cm thick sand layer. Mphi 2.15. Loss on ignition 1%
120-140	A 16cm thick layer of organic-rich silts. Mphi ranges from 4.48-6.26. Loss on ignition from 7% to 32%.
140-142	A 2cm thick black organic layer. Possible turfline. Mphi 4.89. Loss on ignition 17%
142-144	Organic-rich silt. Mphi 5.78. Loss on ignition 22%
144-145	A 1cm thick sand layer. Mphi 4.25. Loss on ignition 8%.

Depth	**Description**
144-155	Organic-rich silt layer, 10cm thick. Mphi 4.06-5.38. Loss on ignition 11%-13%
155-161	A 6cm thick coarser sand layer. Mphi 2.62. Loss on ignition 2%
161-164	Thin layer of sand overlain by thin black organic layer. A sand pulse overlain by a possible turfline. These two were sampled together. Mphi 3.48 Loss on ignition 3%.
164-173	A 9cm thick layer of organic-rich silt. Mphi 6.22-6.27. Loss on ignition 24%-28%
173-174	A 1cm thick sand layer. Mphi 4.28. Loss on ignition 9%.
174-180	A 6cm thick layer of organic silt. Mphi 6.36. Loss on ignition 29%.
180-181	A 1cm thick sand layer. Mphi 3.95. Loss on ignition 10%.
181-186	A 5cm thick layer of organic silt. Mphi 4.66. Loss on ignition 14%
186-191	A 5cm thick layer of organic-rich sand and silt. Mphi 4.42. Loss on ignition 12%.
191-200	Interlayered sands and organic-rich silts. Sand layers 1cm thick. Silty layers 2-3cm thick. Mphi 3.6-4.17 Loss on ignition 6-14%.
200-203	A 3cm thick layer of coarse sand. Mphi 1.91. Loss on ignition 3%
203-212	A 9cm thick layer of organic-rich sand and silt. Mphi 3.66-4.37. Loss on ignition 6-15%.
212-213	A 1cm thick layer of sand. Mphi 2.54. Loss on ignition 4%.
213-217	A 4cm thick layer of organic-rich silt. Mphi 4.72. Loss on ignition 13%.
217-220	Thin layers of alternate sands and silts. Mphi 3.98. Loss on ignition 6%.
220-230	10cm thick layer of organic silts. Mphi 4. Loss on ignition 8%.

The different layers shown above, fall into five basic types:-.

- Discrete sand layers.
- Couplets, which graded upwards from coarser material at the base to finer at the top.
- Organic-rich silty sediment.
- Black well-humified organic layers. Possible turflines.

- Peat.

Sand Layers and Couplets

Discrete sand layers occurred throughout the section. When the laboratory data was analysed they typically proved to have mean phi values of between 2 and 4. In the upper part of the sequence they tended to be low in organic content, with loss on ignition values often being <5%. In some of the thinner sand layers which occurred in the bottom half of the sequence and were interbedded with organic-rich strata, the loss on ignition values could be higher, at slightly above or below 10%. In the upper part of the sequence the sand layers tended to be thicker at around 5cm than in the lower part, where they were frequently only 1 or 2cm in thickness.

Couplets were found mostly in the upper part of the sequence. The coarser basal layers had similar phi and loss on ignition values to the discrete sand layers described above. The upper parts of the couplets were finer and tended to contain more organic material, although this varied more widely. The couplets tended to be between 5 and 10cm thick.

Both the individual sand layers and the couplets appear to represent runoff that was of sufficient magnitude to deposit clearly identifiable sand beds, and these strata were therefore interpreted as signs of landscape instability.

Organic-Rich Sediment.

This was characterised by finer material, with phi values in excess of 4 and loss on ignition values of between 10% and 30%. Above approximately 100cm, when they were present, they were of similar thickness to the sands at around 5cm. Below this the organic-rich layers were much thicker with most being more than 5cm thick and four being >10cms.

The organic-rich layers appear to represent times when the rate of sedimentation was lower. Peaty deposits were forming *in situ* and runoff was depositing trickles rather than swathes of material, which was being incorporated into the existing sediment. The differing thickness of the organic-rich layers in the upper and lower part of the section is suggestive of shorter periods of low sedimentation in the upper part and more prolonged periods of low sedimentation in the lower part.

Peat

There was only one true peat in the exposure, at 31-41cm below the surface. This had a loss on ignition value of 72% and Mphi values of around 6. The base was unhumified but the top was darker in colour and better humified. This appears to represent a relative hiatus, when the rate of sedimentation was extremely low compared to the rest of the upper part of the sequence.

Turflines

These were characterised primarily by their very dark colour and the degree of humification of the organic material. Their loss on ignition and mean phi values varied, but when the laboratory samples were analysed they showed that many had loss on ignition values of slightly less than 10% and the phi values were generally similar to those of the underlying sediments.

5.1.2 Samples and Laboratory Analysis

Four samples were taken for OSL dating from sands exposed in the section at depths of 50, 77, 98 and 205 cm from the surface.

Six samples for radiocarbon dating were taken. One was from peat at 35cm and the others were from organic-rich silts at 107cm, 122cm, 148cm, 185cm, and 225cm.

Sub samples for particle size, loss on ignition and magnetic susceptibility were extracted from the monoliths in 2.5cm cubes at approximately 5cm intervals, and pollen samples were also taken at approximately 5 cm intervals or on either side of major stratigraphic boundaries. The positions of all the dating samples are shown in Figure 16. The results of the laboratory analyses are shown in Table 4 and Table 5. The results of the dating assays are shown in Table 6.

Table 4 - Nick Point - Laboratory Data

Sample	Depth CM	% Sand	% Silt	% Clay	Mean Particle Size (Mphi)	Xlf	LOI %
1	0	72.6	25.7	1.6	3.68	12.6	31
2	5	65.9	32.1	2.0	4.08	7.6	17
3	6	86.3	12.9	0.8	2.67	12.0	6
4	10	57.4	40.4	2.2	4.13	0.6	18
5	13	82.9	16.2	0.9	2.8	0.0	3
6	15	83.4	15.7	0.9	2.84	-0.3	2

Sample	Depth CM	% Sand	% Silt	% Clay	Mean Particle Size (Mphi)	Xlf	LOI %
7	19	87.1	12.2	0.7	2.49	-0.4	2
8	23	83.9	15.3	0.8	2.86	-0.4	2
9	28	83.7	15.4	0.9	2.72	-0.4	2
10	31	62.8	35.4	1.9	4.02	-0.2	12
11	33	9.2	85.5	5.2	6.1	-0.5	62
12	36	12.2	82.9	4.9	5.95	-0.7	72
13	41	88.1	11.4	0.6	2.4	-0.5	2
14	45	62.3	35.7	2.0	4.16	-0.7	11
15	50	84.2	14.9	0.9	2.74	-0.5	2
16	55	70.9	27.5	1.6	3.86	-0.3	26
17	58	90.3	9.1	0.6	2.32	-0.5	1
18	60	85.3	13.8	1.0	2.61	-0.4	4
19	61	91.3	8.1	0.6	2.22	-0.6	2
20	66	75.3	23.1	1.6	3.46	-0.2	3
21	69	87.6	11.6	0.8	2.42	-0.6	2
22	72	53.3	44.1	2.6	4.3	0.0	7
23	76	84.0	15.0	1.1	2.69	-0.4	1
24	79	42.1	55.0	3.0	4.86	0.5	7
25	83	41.1	55.8	3.1	4.81	0.4	9
26	88	88.3	11.0	0.7	2.47	-0.3	1
27	94	8.40	86.24	5.36	6.18	-0.4	26
28	101	75.6	22.9	1.5	3.5	-0.1	4
29	105	12.2	82.2	5.5	6.02	0.3	18
30	110	80.0	18.7	1.3	3.02	0.0	2
31	113	80.0	18.7	1.3	4	-0.1	7
32	116	87.4	11.8	0.8	2.15	-0.5	1
33	121	41.2	54.8	4.0	4.61	-0.2	33
34	123	49.7	46.9	3.4	4.48	0.5	7
35	127	29.5	66.4	4.1	5.26	0.2	16
36	132	34.1	61.9	4.0	5.19	0.4	11
37	136	6.02	88.28	5.70	6.26	0.0	32
38	140	39.2	55.7	5.1	4.89	0.3	17
39	142	20.1	73.9	5.9	5.78	0.2	22
40	145	61.2	35.1	3.7	4.25	0.0	8
41	148	62.7	34.5	2.8	4.06	0.2	11
42	153	25.5	69.9	4.6	5.38	0.4	13
43	157	83.7	15.2	1.2	2.62	-0.5	2
44	160	74.1	24.5	1.4	3.48	0.7	3
45	164	8.3	85.6	6.1	6.22	0.3	24
46	168	9.4	83.9	6.7	6.27	0.2	28
47	172	54.6	42.0	3.4	4.28	0.1	9
48	175	5.0	89.0	6.0	6.36	0.2	29
49	180	68.6	29.2	2.2	3.95	0.0	10
50	182	37.0	59.0	4.0	4.66	0.2	14
51	184	45.6	50.7	3.7	4.36	0.3	10

Sample	Depth CM	% Sand	% Silt	% Clay	Mean Particle Size (Mphi)	Xlf	LOI %
52	187	48.5	48.0	3.5	4.42	0.3	12
53	190	67.4	30.5	2.1	3.84	0.1	6
54	194	59.7	37.9	2.4	4.17	-0.5	10
55	197	68.3	29.8	1.9	3.6	0.1	14
60	200	91.3	8.2	0.6	1.91	0.3	3
61	203	72.1	26.2	1.7	3.66	-0.1	8
62	205	56.0	41.2	2.8	4.37	0.4	15
63	210	66.9	31.1	2.0	4	0.5	6
64	212	85.0	14.0	1.0	2.54	0.3	4
65	215	45.0	51.8	3.2	4.72	-0.3	13
66	217	69.5	28.5	2.0	3.98	0.0	6
67	223	68.1	29.5	2.3	4	0.3	8

Table 5 - Sand -Silt - Clay - 3 Point Averages.

Sample No	Depth	% Sand 3 Point Average	% Silt 3 Point Average	% Clay 3 Point Average	Mphi 3 Point Average
1	0	74.9	62.2	1.5	3.48
2	5	69.9	58.5	1.7	3.63
3	6	75.5	58.7	1.3	3.20
4	10	74.5	61.9	1.3	3.26
5	13	84.5	36.0	0.8	2.71
6	15	84.8	33.0	0.8	2.73
7	19	84.9	32.6	0.8	2.69
8	23	76.8	42.5	1.2	3.20
9	28	51.9	79.3	2.7	4.28
10	31	28.1	148.5	4.0	5.36
11	33	36.5	172.3	3.6	4.82
12	36	54.2	106.2	2.5	4.17
13	41	78.2	52.0	1.2	3.10
14	45	72.5	59.7	1.5	3.59
15	50	81.8	45.4	1.0	2.97
16	55	82.2	41.2	1.1	2.93
17	58	89.0	25.5	0.7	2.38
18	60	84.0	29.6	1.0	2.76
19	61	84.7	35.1	1.0	2.70
20	66	72.1	49.4	1.7	3.39
21	69	75.0	60.6	1.5	3.14
22	72	59.8	77.4	2.2	3.95
23	76	55.7	88.5	2.4	4.12
24	79	57.1	114.4	2.3	4.05
25	83	45.9	95.5	3.1	4.49
26	88	57.4	104.9	2.5	4.05
27	94	32.1	136.6	4.1	5.23
28	101	55.9	111.4	2.8	4.18
29	105	57.4	107.1	2.7	4.35

Sample No	Depth	% Sand 3 Point Average	% Silt 3 Point Average	% Clay 3 Point Average	Mphi 3 Point Average
30	110	82.5	41.3	1.1	3.06
31	113	69.5	48.7	2.0	3.59
32	116	59.5	82.2	2.7	3.75
33	121	40.2	123.8	3.8	4.78
34	123	37.8	133.9	3.8	4.98
35	127	23.2	157.7	4.6	5.57
36	132	26.5	168.7	4.9	5.45
37	136	21.8	168.6	5.6	5.64
38	140	40.2	141.3	4.9	4.97
39	142	48.0	120.5	4.1	4.70
40	145	49.8	93.0	3.7	4.56
41	148	57.3	109.5	2.8	4.02
42	153	61.1	93.3	2.4	3.83
43	157	55.4	68.2	2.9	4.11
44	160	30.6	138.1	4.7	5.32
45	164	24.1	183.5	5.4	5.59
46	168	23.0	155.5	5.4	5.64
47	172	42.8	140.7	3.9	4.86
48	175	36.9	137.8	4.1	4.99
49	180	50.4	105.1	3.3	4.32
50	182	43.7	125.8	3.7	4.48
51	184	53.8	109.0	3.1	4.21
52	187	58.5	91.2	2.7	4.14
53	190	65.1	78.3	2.1	3.87
54	194	73.1	70.4	1.6	3.23
55	197	77.2	46.6	1.4	3.06
60	200	73.1	48.1	1.7	3.31
61	203	65.0	77.8	2.2	4.01
62	205	69.3	77.0	1.9	3.64
63	210	65.6	62.4	2.1	3.75
64	212	66.5	75.3	2.1	3.75
65	215	60.9	90.1	2.5	4.23
66	217	45.9	58.0	1.4	2.66
67	223	22.7	29.5	0.8	1.33

Table 6 – Nick Point Dates

Depth from surface	Lab Code	Type	Age	C14 Calibrated (Oxcal) (95% prob)	Calendar Age (OSL)
35	AA-43258	C14	438 ± 38	AD 1410-1520	
50	Shfd01009	OSL	442 ± 56		AD 1504-1616
77	Shfd01010	OSL	498 ± 65		AD 1439-1569
98	Shfd01011	OSL	1501 ± 235		AD 266-736*
107	AA-43259	C14	513 ± 82	AD 1290-1530	
122	AA-43260	C14	475 ± 42	AD 1390-1490	
148	AA-43261	C14	713 ± 69	AD 1180- 1410	
182	AA-43262	C14	552 ± 74	AD 1280-1480	
205	Shfd01012	OSL	1294 ± 158		AD 550-866
225	AA-43263	C14	1712 ± 41	AD 240-420	

*** A more likely age for this sample is 1479-1655. (435 +/- 88) see below.**

The overall trend of more sand layers in the upper part of the section and more organic-rich layers in the lower part was evident in the field. The laboratory analyses revealed that there was also a cyclicity to the sedimentation, which was obscured to some extent by the lithological variation, and the dates obtained gave an indication of the time periods associated with the sedimentary cycles.

Before the relationship between the sedimentation and chronology of the nick point can be discussed however, comment must be made on certain dates obtained. On the whole the radiocarbon and OSL dates agree with each other quite well. Taking into account the errors, most of the radiocarbon dates overlap and there are none that are out of sequence. The same is true of three of the four OSL dates, which again overlap both with the radiocarbon dates and with each other. The exception is the third OSL date of AD 266-736 (1501 ± 235 – Shfd01011) for the sediment at 98cm. This is completely out of sequence, being seemingly far older than the sediment below it. The probability plots of the paleodose data for this sample however show that the data are not normally distributed, indicating that the sample is mixed and contains sediment of differing ages.

Figure 17 is a frequency diagram of the paleodose (in Grays) values yielded by this sample (Shfd 01011) and the previous OSL sample above (Shfd 01010). It shows that Shfd 01011 clearly exhibits three distinct modes (the modes are shown in blue, the data points are shown in black and the modal value is indicated by the red marker point.) Well-reset and bleached samples should exhibit a single mode as in the plot below (Shfd 01010 taken from 77cm). The presence of multiple modes in the probability plot of sample Shfd01011 indicates that the sand comprising the sample has multiple ages.

Two possible scenarios can cause this attribute. The first is that bleaching of the sediment during transportation was incomplete, meaning that complete resetting of some sediment has not occurred. If this were the case only the youngest mode on Table 7 (below) represents the age of deposition, while the rest are either associated with previous periods of transportation or reflect the OSL signal of the parent material. The second possibility is that post-depositional bioturbation has occurred, mixing older and younger sediments together. If this were the case then the youngest mode most likely represents bleaching caused by pedotubation, and the other modes may represent the period of deposition, or the OSL signal associated with different age deposits that were mixed together by this process.

The third possibility is that both of the above processes might apply, ie. incomplete bleaching was then followed by post-depositional mixing. The latter could have happened either by bioturbation or at the time of sampling. If the sediment layers behind/inside the exposed section rose up steeply, then a tube inserted into the section horizontally would catch younger sediment at the front and older sediment at the back.

The particle size data for the sediment, while informative, cannot resolve the uncertainty completely, although the sorting values indicate that the sample may be mixed. The standard deviation of the particle size distribution is a measure of the sorting of the sediment. Thus, a lower standard deviation means better sorted sediment. The standard deviations for the other OSL samples are all below 1.6. That of the third OSL sample is considerably higher at 2.11. This difference in sorting values may be evidence of the mixing together of more than one sedimentary unit, or it may simply be attributable to subtle variations in deposition. Taking all the above factors into account there is a likelihood that in this case sediment transported earlier has been mixed in with some that has been transported later, giving a date that reflects the range of ages in the sample rather than the most recent time of deposition.

If this is the case then the various modes in the palaeodose distribution data should reflect the times of transportation of the different fractions of the sample. On splitting down the palaeodose data into the three modes it was evident that statistically there was a fraction of the sediment involved that seemed to have been transported considerably later than the rest of the sample. This fraction gives a date of 435 +/- 88 (AD 1479-1655) for the time of transportation, as opposed to > 1000 years ago for the rest of the sample. The dates obtained for the different modes on the palaeodose plot are shown below.

Table 7 - Paleodose Probability Plot. Sample Shfd 01011. Modes

Mode	Date	Error	Age
1	435	88	AD 1479 -1655
2	1305	335	AD 362 - 1032
3	2141	335	BC 388 – AD110

This youngest date (Mode 1) is consistent with the dates from sediment above and below, and on balance, it would seem that the most likely possibility is that sand inwash occurred, but that the sediment was incompletely bleached.

Figure 18 shows the simplified lithology plus the dates obtained, and the results of the laboratory analyses in graphic form. The first aspect of interest is that none of the dates obtained are prehistoric. The earliest date of AD 240-420 places the lowest organic sediments in the Roman period, and as these immediately overlie glacial head deposits there is no evidence from the sequence that sedimentary deposition was occurring in the Bronze Age.

The particle size data indicate that there is a very subtle increase in sediment coarseness from the lower to the upper part of the profile. This is manifested by the mean particle size curve, which shows that while there is coarser sediment with phi values of between 2 and 3 throughout the section, most of the higher values of 5 and 6 are found from 100cm down. The only exception to this is the peak in the curve at around 30cm, which relates to the peat at that depth. All the other peaks of between 5 and 6 phi relate to the organic-rich sediment strata in the lower part of the sequence.

The peaks in the loss on ignition data show 4 major phases of the build-up of organic-rich sediments, which follow the curves on the mean particle size graph, equating to those periods where phi values indicate that relatively fine-grained sediment was being deposited. This correlation between the deposition of fine grained sediment and the build up of organic-rich material, is suggestive of periods when organic material was accumulating *in situ*, accompanied by low levels of sedimentation which was incorporated into the ground surface. These phases occur at approximately ;-

- 30-40cm
- 90-100cm
- 120-140cm
- 165-175cm

In contrast, the sand percentages peak where the loss on ignition falls, indicating that between periods of relative landscape stability there were six phases of sand inwash when the rate of sedimentation was higher. These occur at approximately:–

- 0-30cm
- 40-90cm
- 100-120cm
- 140-160cm
- 175-200
- 200-230 cm

Although the phases can be seen on the raw data plots, they are difficult to distinguish because the numerous sand layers in the section obscure (to some extent) the overall trend. The plots were therefore smoothed by conversion to 3-point running averages (Figure 19), and this shows the sand inwash phases more clearly. The bottom phase however, whose upper limit is around 200cm, is smoothed out on the averaged graph and only shows on the raw data plot in Figure 18.

Phase 1. 235-175cm

There is one radiocarbon date and one OSL date associated with this phase. The radiocarbon date (Beta- AA-43263) was from peaty silts at the base of the section at 225cm and gave an age of AD 240-420. The OSL date (Shfd01012) was from a thin sand layer at 205cm and gave an age of AD 550-886.

This phase is evidenced by the sand peaks that occur at the base of Figure 18 below around 200cm, which according to the radiocarbon date equates to the Roman period. The sand layers in the section at this point are thin and do not suggest large scale or high intensity landscape instability, especially when compared to the upper part of the exposure. The majority of the sediment is fine grained. Although the particle size analysis indicates that there was some soil erosion and associated sedimentation, the peaty silt layers which were deposited at this time are comparatively thick (15-20cms) and fine grained, suggesting that this was of relatively low intensity. The inclusion of organic matter within these deposits supports this idea. The OSL date indicates that this phase ends at some point prior to the Norman Conquest, towards the end of the first millennium AD.

Phase II. 200-175cm

The OSL date from the previous phase suggests that the earliest that Phase II started is sometime prior to the Norman Conquest. The middle of this phase is dated by the next radiocarbon sample (Beta-AA-43262) from the top of a sandy peat layer at 185cm. This gave an age of 1280-1480 AD, placing it in the Medieval period. The next radiocarbon sample (associated with Phase III) from organic silts 34cm higher in the section, gave a date of AD 1180 - 1410, so taken together the dates suggest that Phase II is probably closer to the early than the late Medieval period.

At this point in the section, between 175 and 200cm, there is a slight but noticeable change in sedimentation. The organic-rich silts are thinner, with only one being thicker than 5cm. The sand layers are also thin at around 1-2cm but are more numerous, there are 6 discrete sand layers in this phase, compared to 3 in the phase before. The overall thinness of the organic layers, plus the way in which they are interspersed by the sand layers, suggests that the return period between major episodes of sedimentation is getting shorter.

Phase III. 140 -160cm.

This period of erosion and sedimentation is dated by a radiocarbon sample (Beta-AA-43261) taken from organic silts, which lay between sand layers, at 148cm. It gave an age of AD 1180-1410, which places the phase squarely in the medieval period. Statistically however, this and the preceding radiocarbon date from Phase II are very close, covering almost the same period and this is an indication that sedimentation has gained in intensity. This period of landscape instability declines by the Middle to Late Medieval period, as indicated by a radiocarbon date of AD 1390-1490 (Beta-AA-43260) from a sample taken at 122cm. This was from the top of a thick layer of peaty silt, which represents a period of relative stasis.

Phase IV. 100 -120cm

The fourth phase of erosion/sedimentation is dated by a radiocarbon date of AD 1290-1530 (Beta-AA43259) taken at 107cm from a layer of humified peaty silt. This age places it in the late Medieval to early Post-Medieval period. The OSL date of 1479-1655 at 98cm (Shfd01011) generally supports this interpretation. It is at this mid area of the section that the silt layers are becoming thinner and the sand layers are becoming thicker. The mean particle size indicates that more coarse material is being deposited here than was deposited lower in the section. The signs of instability are therefore becoming more pronounced.

Phase V. 40 – 90cm.

The fifth phase of sand inwash is the most pronounced and rapid in the sequence. The three dates associated with this phase are an OSL date of AD 1437-1567 at 77cm, (Shfd01010) an OSL date of AD 1504 -1616, (Shfd01009) at 50 cm, and a radiocarbon date of AD 1410-1520 (Beta-AA43258) at 35cm. The latter is from a peat at the top of this phase that denotes a period of relative stasis between the fifth and sixth depositional phases. The two OSL dates are apparently younger than the overlying radiocarbon age, and therefore one or more appear out of sequence, but statistically all three dates are very close. If the errors are included they cover the period between 1439 and 1616, and the closeness of the ages indicates that sedimentation at this time was progressing more rapidly then previously. This becomes particularly evident when the top radiocarbon date (AA 432568) is considered. Its position in the section is higher than those of the OSL samples, but the peat from which it was obtained, represents a period of stasis and presumably it relates to a time after the fourth sand phase ended. According to this date the latest this could be is the early 1500s. The bottom OSL date (Shfd 01010) has a large error, but suggests that the earliest date for the commencement of this phase was the early 1400s. The OSL date, which is stratigaphically between the two at 50cm, (Shfd 01009) also has a large error but overlaps with the radiocarbon date and the bottom OSL date, so its true age is probably around the early 1500s. Using the bottom OSL date to indicate the start of the phase and the radiocarbon date to indicate the end, the overlap of the dates effectively spans the 15th century from 1439 to 1520, a period of less than 100 years.

By this phase the change in sedimentation in the sequence is obvious; the sand layers are thicker and more numerous than the silt layers, and the mean particle sizes are coarser than in the bottom half of the section.

Phase VI. 30cm -Surface

The final phase occurs after AD 1410-1520 and the relevant sediments continue up to the present ground surface. This is represented almost entirely by sand, with little organic material that would indicate any prolonged period of stasis except in the top layers immediately below the ground surface. From the surface down to a depth of 12cm, loss on ignition values are between 6 to 31% compared to the layers immediately below where they are less than 5%. This suggests that soil formation is occurring and either root penetration or other biotic activity is transferring material down the profile. Other than that, the evidence for this phase is very similar in character to that of the Phase V and suggests an equally pronounced degree of landscape instability.

There is no date to suggest when the final phase ended, but at some time after AD 1410-1520 the stream began downcutting and entrenchment of the channel has effectively fossilised the sequence to promote the formation of the proto topsoil described above.

5.1.3 Summary and Discussion

Together, the dates, field observations and results of the laboratory analyses suggest that deposition of the sedimentary sequence at the nick point did not start until the post-prehistoric period. When it did start, at some point probably in the Roman period, it appears to have progressed relatively slowly and the landscape instability that it reflects appears to have been low in intensity. Most sediment in the first phase is fine-grained and organic-rich and appears to have accumulated slowly. Figure 20 shows the relative timespans for the different phases as indicated by the various dates including errors. Taking into account the errors on the radiocarbon and OSL dates, Phase I could in theory have covered almost 700 years, and in this phase around 28cm of sediment accumulated.

In contrast, the longest Phase II appears to have lasted is around 400 years, yet the same depth of sediment was deposited as in Phase I. This suggests that there was some change in the process or activity that had been causing soil erosion, serving to accentuate it. This change becomes more pronounced in the upper part of the profile where an increasing degree of landscape instability is seen with height.

In general terms and considering the whole of the nick point sequence, if the changes in sedimentation were purely climatological, due for example to periods of increased wetness leading to higher intensity or more frequent runoff events, then the sedimentation would be expected to show successive increases and declines as the weather worsened and ameliorated through time. To some extent it does this, as there are periods of relatively low sedimentation evidenced by the build-up of organic-rich material. The overall rate of sedimentation however, increases continuously up the profile so that by the top of the sequence it is happening at a much faster rate than at the bottom. Figure 21 shows the increase in the rate of sedimentation through time. It has been created by plotting the midpoints of the ages obtained. With the radiocarbon dates these are the midpoints of the calibrated ages. With the OSL they are the midpoints of the calendar ages. The plot indicates that the rate of sedimentation increases almost exponentially through time. The steadily increasing rate of sedimentation suggests that climate alone cannot be responsible for the changes, and it may be that human activity is implicated.

Figure 21 suggests that the increase in the rate of sedimentation starts in Phase II, probably in the Early Medieval period, but Figure 20 also illustrates that the dates from Phases II and III are statistically very close and cover almost the same period. In this case if the sediments in Phases II and III are taken to represent the Medieval period, then the amount of sediment deposited is around 80cm (from 200cm to 120cm in the section). Both these figures illustrate that the rate of sedimentation continues to increase so that by the early Post-Medieval period, a further 80 cm had been deposited, this time in a period of 100 years.

There is both documentary and environmental evidence to suggest that various types of activity were occurring on Big Moor throughout the timespan indicated by the dates. One of these was probably grazing; the other was transport along the packhorse routes that cross the moor. The packhorse route nearest to the nick point crosses the stream approximately 30m upslope and sediment eroded from this route had to pass through the nick point if it was carried more than 30m by any runoff event. There is a strong probability therefore that this communication route is the origin of some of the sediment at the nick point. This idea and its implications will be explored further in Chapter 6.

5.2 TRENCH 1 – ALLUVIAL FAN. (SK427465 375790)

This was a natural feature, deposited at its confluence with Bar Brook by the same stream that created the nick point sequence (Figure 14). Like the nick point it was composed of inter-bedded sands and organic-rich silts, with the silts being more abundant towards the base and the sands being more abundant at the top. In section it could be seen that the sediment at the base of the fan was composed of gravels, assumed to be glacial head deposits.

The fan was discovered before the nick point sequence, and it was originally intended to try to extract the long-term chronology for the site from this feature. Once the nick point sequence was discovered however, it was decided to sample both for radiocarbon and OSL dating, because it was felt that by correlating the two sequences a more detailed picture of geomorphological change could be obtained.

5.2.1 Excavation and Samples

A trench measuring 7m long x 1.5m wide and 1m deep was excavated through the sediment immediately to the west of Bar Brook. A photo-mosaic of the whole section was then compiled and a complete record of the section stratigraphy was drawn from the photomosaic (Figure 22). Two overlapping sediment monoliths were taken from the most representative part of the section at 2.2m north, from the surface down to the sand overlying the glacial head. These were for particle size, loss on ignition and magnetic susceptibility purposes. The profile of the combined monoliths was drawn at a scale of 1:5, and is shown in Figure 23. A sample for radiocarbon dating was obtained from peaty silt at 77cm near the base of the monolith. The position of the sample is also shown in Figure 23. This was divided into two sub-samples, one composed of the organic component of the silt matrix, and the other was a beetle elytrum. These were separated because the organic material was heavily decomposed and there was a possibility that it could contain redeposited material of differing ages, whereas the elytrum was assayed for insurance as it was known to be an individual rather than a possible amalgam.

In the event, the organic material could not be dated with any precision and the assay returned a date of >9,500 years (Beta - AA43266). The beetle elytrum returned a date of 1640±210, which gave a calibrated age of BC100-AD900 (Beta - AA43267).

5.2.2 Stratigraphic sequence

The stratigraphic sequence at the fan was less than half as tall as that of the nick point, being 95cm thick as opposed to 2.3m. It did not contain as many individual beds, and in most of the section the strata were not as thick, although the thickness of the individual strata increased with depth.

There was also not such a clear division into upper and lower sections as there was in the nick point sequence, although below around 44cm there were more organic-rich beds than there were above this depth. The sediments were generally finer than at the nick point, with only 5 beds being composed of sand with phi values less than 3, and the remainder of the section being composed of fine sand or silt-sized material.

Depth cm	Description
0-1	Turf
1-4	H horizon
4-6	A discrete sand layer containing few organics. Relatively coarse.
6-7	A fine sand layer containing some organic lenses.
7-9	A dark well humifed organic layer. Possible turfline
9-12	Sand
12-14	Sandy organic layer. Possible turfline
15-25	A 5cm thick layer of sand, organic free in the upper part, organic lenses in the lower.
25-31	A 5cm thick layer of fine organic-rich sand

Depth cm	Description
31-32	A discrete coarser sand layer, low in organics
31-34	A sandy dark organic layer. Possible turfline
34-37	A coarser sandy layer, low in organics
37-40	A silty layer. Organic-rich
40-44	A coarser sand layer
44-53	A finer sandy silty layer organic-rich
50-55	A coarser sand layer
55-57	A silty sandy layer organic-rich
57-66	A 9cm thick fine sand layer comparatively low in organics but with organic lenses
66-67	A silty organic-rich layer
67-69	A coarser sandy layer low in organics
69-85	A silty layer. Organic-rich
85-95	A fine sand and silt layer. Some organics.

Unlike the nick point sequence, were are no couplets and most of the thinner sand layers were laid down as discrete beds. There was also no true peat in the profile despite the fact that more of the beds were organic-rich. Other than these differences, the types of strata were similar to those of the nick point but composed of finer material. This was not surprising as the fan is further away from the source of the sediment, and as it has formed on the Bar Brook valley floor the gradient is less steep. Most of the strata contained some organics. The laboratory analysis showed that other than 6 beds, all contained more than 5%, but the loss on ignition percentages for individual beds were actually higher at the top of the section than at the base.

5.2.3 Results of Laboratory Analyses

Table 8 - Alluvial Fan - Analytical Data

Sample	Depth CM	% Sand	% Silt	% Clay	Mean Particle Size (Mphi)	Xlf	LOI %
1	0	62	37	2	3.80	1.6	56
2	3	73	26	1	3.97	2.0	61
3	5	84	15	1	2.69	1.1	4
4	9	0	100	0	4.75	5.0	10
5	11	86	13	1	2.60	9.9	25
6	13	69	29	2	3.69	0.9	8
7	16	84	15	1	2.77	10.8	11
8	19	85	14	1	2.67	4.6	5
9	22	76	22	2	3.40	3.5	6
10	26	71	27	2	3.69	8.0	14
11	28	73	25	2	3.63	8.4	13
12	31	82	17	1	2.86	5.1	14
13	32	73	25	2	3.74	-0.2	5
14	34	82	16	1	2.80	1.0	22
15	37	29	66	5	5.25	-0.4	5
16	41	86	13	1	2.63	0.4	28
17	44	54	43	3	4.39	-0.4	1
18	49	54	42	4	4.47	0.0	5
19	52	46	50	4	4.58	0.2	9
20	56	64	33	2	4.09	-0.3	6
21	59	82	17	1	3.05	0.1	3
22	64	63	34	2	4.12	-0.3	2
23	66	79	20	2	3.14	-0.2	5
24	68	49	47	4	4.48	-0.2	2
25	71	50	45	4	4.42	-0.4	7
26	77	44	52	4	4.59	0.1	7
27	83	69	29	2	3.70	0.3	13
28	87	48	48	4	4.21	0.1	4
29	92	82	17	1	2.81	0.2	5

Table 9 - Alluvial Fan - Radiocarbon dates

Feature	Depth from surface	Type	Lab. No.	Age	C14 Calibrated (Oxcal) (95% prob)
Fan	77	C14	AA-43267	1640 ± 210	100BC-900AD
	77	C14	AA-43266	>9500	

5.2.4 Analysis

Despite the large error on the radiocarbon date (Beta- AA43267) from peaty silts at 77cm near the base of the section, the calibrated age places this deposit into a similar timespan as the basal part of the nick point section. Other than this one radiocarbon date there is no way to correlate the deposits in the two profiles. The fan represents a completely different depositional environment than the nick point and the lower number of beds in the fan means that much of that sequence is missing from this feature. The analytical data do show some similar phases of sedimentation however. Figure 23 shows a sand pulse between approximately 72 and 95cm, which according to the radiocarbon date, probably correlates with the first phase of sand inwash to the nick point. After this there are four more sand inwash phases –

- 68-52cm
- 45-37cm
- 31-12cm
- 5-0cm

These may be indicative of some of the same periods of landscape instability as were seen at the nick point, but without any dating evidence there is no way to be sure. Interestingly, the loss on ignition curve does not necessarily peak in the opposite way to that of the sand percentage. This is because more of the fan beds contain significant amounts of organics. In turn this is probably because the fan represents a depositional environment that is lower in energy than that of the nick point.

Most of the fan deposits, whether these form discrete sandy, or peaty silty layers, are similar to the organic-rich silts in the lower part of the nick point sequence both in terms of particle size and loss on ignition. Most of the sediments have phi values between 3.5 and 5. Few of the sedimentary strata have loss on ignition values of less than 5%, and many have over 10%. Like the nick point silts the organic rich layers probably represent periods when sediment was being added in slow increments that did not fossilise the existing ground surface, but were instead incorporated into it. The fan sediments however, unlike the silts at the nick point, probably only represent periods when runoff was more extreme. In essence, because the fan is lower in the catchment, only the higher magnitude runoff events are likely to have carried sediment far enough to be deposited in it.

In summary, the sedimentation at the fan appears to have started at some point between the end of the Iron Age and the beginning of the medieval period. Most of the sediments in the fan are suggestive of a low rate of sedimentation. These sediments are, however, likely to reflect the periods of higher intensity runoff, manifested at the nick point by the deposition of coarser material in discrete layers. Evidence of lower intensity runoff events is likely to be missing from the fan sequence because the depositional environment is lower in energy. Although the sedimentation at the fan displays a similar cyclicity to that of the nick point, and possibly represents some of the same periods of landscape instability, there is no way to establish this for certain as there are insufficient dates to allow correlation of the two sequences.

5.3 TRENCH 2 – SK427465 SK375790.

5.3.1 Location and Description.

Trench 2 was a section through a stone and earth bank located on a break of slope at the northern edge of the Big Moor Central cairnfield. The slope below the bank to the north is steeper than that above to the south and at the base of the slope to the north is the nick point section (Figure 14, Figure 15).

The length of the bank is 19.5m. Its width and height vary along its length, but its maximum height is approximately 70cm and its maximum width is approximately 4m. It is oriented roughly east-west following the edge of the gritstone shelf, and is parallel to contour. There are no visible prehistoric features downslope, but upslope at a distance of approximately 47m are other cairns and banks identified as prehistoric by the RCHME survey (Ainsworth et. al. 1998), and a packhorse route guidestone.

It was selected for excavation for four reasons

1. It was oriented parallel to contour, making it a slope obstacle with the potential to trap sediment on its upslope side.
2. It was asymmetrical in cross-contour section and so there was a probability that sediment had accumulated on the upslope side.
3. The slope on which it was situated was the steepest on the part of the shelf containing cairnfield remains (approximately 1:10), which means it had the highest potential for soil loss.
4. The distance from the bank to the nearest upslope obstacles was 47m, which presumably comprises the "fields" from which sediment was eroding. Given that the length of slope is also a contributing factor to erosion, this also increased the potential for soil loss from the area above the bank.

5.3.2 Excavation Results

A trench 2m wide by 8m long and orientated at right angles to the bank (ie. north – south) was dug down to the C horizon of the soil in order to section the feature at one of its highest and widest points. This was roughly 3m from its eastern edge where the bank terminated in what could have been a small cairn or alternatively just a thickened end section. At this end of the bank its asymmetry was the most pronounced, with the northern (downslope) side being significantly steeper than the southern (upslope) side.

The excavation revealed that the bank could be divided into an inner core, and an outer area and it appeared that it might have formed or been constructed in several phases (Figure 24, Figure 25).

Phase I. Sediment Accumulation or Earthen Bank. (Context 2014, Figure 24)

The earliest earthen part of the bank was a low mound 5-10cm high, of pale sandy sediment (context 2014). This was no different in texture to sediment higher in the section but differed instead in the amount and type of coarse fragments it contained. Whereas the sediment immediately above it was relatively stone-free, this material contained 15-20% coarse fragments ranging from 5cm across or smaller (sub angular) up to 20 cm across, angular, thin and flat.

During excavation it was felt that there were three possible interpretations for this feature

1. The mound might be the remains of an earthen bank that pre-dated the stone structure.
2. The mound is a fraction of the original ground surface sealed under the stone bank and so not altered to the same degree as the land to either side.
3. The mound is sediment eroded from upslope, which accumulated against the first phase of stones (below).

It was not possible to clarify this question during excavation due to the similarity of the sediment that both lay under the first phase of the stone bank and also partly covered it. However the stone content mitigated against slopewash as the sole explanation for the formation of the mound, particularly as it contrasted so clearly with the relatively stone free sediment above.

Phase II - 1st Phase of Stones, (Context 2015, Figure 25, Figure 27)

This was situated running east-west between 5.4 and 6m north, (view A Figure 25). It comprised a linear arrangement of stones laid in layers. They were relatively small in size, ranging from 10cm up to 40cm across, mostly sub angular, and many were relatively thin and flat. These had been piled on top of each other to form what resembled a low irregular revetment approximately 20-40cm high. The centre of the excavated part of this context appeared to have tumbled out of place. This feature appeared to be sitting in part on context 2014 (above), but some of the latter sediment appeared to be backed up against it.

Phase III - 2nd Phase of Stones (context 2016, Figure 25, Figure 27).

This was a line of very large stones, which had been placed immediately to the south (upslope) of context 2014, and were leaning against the stones of 2015 and the sediment of 2014 (View B Figure 27). The excavated part of this phase comprised 4 stones, all being at least 40cm long and 30cm wide. Three were angular and one was round.

The interpretation of this context depends on whether context 2014 (described above) was a pre-existing earthen bank, or was sediment accumulated against the first phase of the stone bank. If 2014 was an earthen bank; both the revetment and this line of large stones could have been placed at the same time and could be a single phase. If, however, context 2014 represents build up of sediment against the first phase of the bank, then these large stones are a true second phase placed on top of that build up.

Phase IV - 3rd Phase of Stones (contexts 2012 & 2013, & Figure 25)

In contrast to the inner stones of the bank described above, most of the outer stones show little in the way of patterning, either in size or placement. The potential third phase of stones comprises stones that vary in size from 15 to 60cm across and in shape, from rounded to angular. The stones of context 2013, starting at 5m north, were placed seemingly in no kind of order on the top and the north side of what was by then the bank, spilling over on to the ground surface on the north. They covered the postulated first phase of stones, but did not completely cover the second phase. Whether these contexts were added to the bank at the same time as the inner stones, or whether they are in fact a later phase could not be established. All the outer stones of the bank are surrounded by, and appear to sit within, the sediment of context 2004, but it was not possible to establish during excavation whether this context separated the inner stones from the outer. However see section on black humic soil (context 2010 below)

Phase V - Sediment (context 2004, Figure 25)

This was a fine-grained deposit of sediment that appeared to have first accumulated against, and then covered the bank, filling the interstices between the stones. In texture it was a very homogenous, fine sandy loam, which contained almost no coarse fragments. The greatest depth of this material was found, as could be expected, against the southern side of the bank, where it reached a depth of over 50cm and completely obscured the inner stones.

Black Mineral Soil (context 2010, Figure 24)

This layer is discontinuous and could not be identified through the middle of the bank due to the large amounts of interstitial organic material present. It appears both to the south and the north of the bank and almost certainly forms a continuous layer. It is a fine-grained sandy loam, very similar in texture to 2004 (above), but very dark; almost black in colour suggesting that it may contain more organic material. For the most part it lies directly below the present day soil humus and during excavation was assumed to be the top part of 2004 which had been coloured black by material washing down out of the peat. When seen in section however, an alternative possibility suggested itself as it was realised that this material also lies under several of the upper stones of the bank, and in places lenses of 2004-type material separate it from the peat. This therefore could be an old turf line representing a period when deposition of sediment stopped or slowed. If this is indeed a turf line, it separates the outer from the inner stones of the bank, suggesting that the outer stones are a later phase. Unfortunately, this layer can only be seen under stones on the north and south edges of the bank from 0-4.8m north and from 5.8-7m north. Within the bulk of the bank from 4.8m north to 5.8m north, if it does exist, it is obscured by lenses of interstitial organic material.

Summary of Bank Construction

At least two slightly different sequences for the development of the bank can be proposed.

Sequence 1. An earthen bank (context 2014) is the first feature in place. Contexts 2015 and 2016 are then placed on top of 2014. 2016, a line of large blocky stones is placed so as to form the southern side of the bank. 2015, a revetment-like arrangement is placed to form the northern side. These two contexts together form the inner core of the bank.

This inner structure is then covered by the outer stones. These stones have a much greater range of sizes and shapes than do the stones of the inner bank. None of them are as large as those of context 2016. It was not clear during excavation whether these outer stones were added as the bank was built or whether they were a later phase, added some time after the original construction of the inner bank.

The bank is then covered by sediment (context 2004) originating upslope, to the south. This sediment first backs up against the southern side of the bank (2016), fills the spaces between the stones, and eventually covers the south side of the bank, spilling partly over onto the northern side.

There is a possibility that sediment accumulation went on as the bank was constructed. The inner core of the bank may therefore have been covered with sediment prior to the addition of the outer stones, which may then in turn have been covered.

The presence of 2010 (the black mineral soil) may indicate that there was cessation of sediment deposition and the development of a turf line in between the construction of the inner bank and the addition of the outer stones.

Sequence 2 - Context 2015 (revetment) is constructed first as a low stone bank.

Context 2014 is sediment eroding downslope from the south and accumulating against 2015.

Eventually this sediment starts to cover 2015, 2016 (larger inner stones) is then added to the south of 2015 on top of 2014.

From then on the sequence is the same as sequence 1

5.3.3 Samples

Five samples were taken from the west-facing section of the bank (Figure 24).

1. Sample 212 was a column of 2.5 cm cubes taken at 3.10m N. This was for the standard laboratory analyses of particle size, magnetic susceptibility and loss on ignition.

2. Sample 204 (lab. code, Shfd01043) was an Osl sample taken at 3.3m N from the inner core sediment (context 2014) in order to date this earliest phase of the bank.
3. Sample 206 was an OSL sample (Shfd01044) taken at 2.35m N from context 2004, in order to date this later phase of sedimentation.
4. Sample 208 (Shfd01045) was an OSL sample taken at 1.75m N, also from context 2002. This was to see if there were any significant differences in the dates from the accumulated sediment that would indicate the period over which accumulation had occurred. It was also for the purpose of providing a check on the accuracy of sample 206.
5. Sample 210 (Shfd01046) was an OSL sample taken at 1.52m N from context 2002 and from slightly lower in the section than sample 208. Its purpose was the same as that of 208.

5.3.4 Results .

Table 10 - Results of Laboratory Analyses

Context	Description	Depth	xlf	LOI	% sand	% silt	% clay	mean (Mphi)
2002	H Horizon	6	0	31.9	71.3	26.6	2.1	3.8
2004	Accumulated Sediment	10	0.2	7.9	57.5	39.2	3.3	4.2
2010	Organic-rich Layer	15	0.3	6.6	68.9	28.5	2.6	3.9
2004	Accumulated Sediment	17	0.4	13.3	72.3	25.5	2.2	3.8
2004	Accumulated Sediment	28	0.4	15.5	66.4	30.8	2.8	4.0
2004	Accumulated Sediment	35	0.3	12.4	70.5	26.9	2.5	3.9
2004	Accumulated Sediment	38	0.4	7.2	65.5	31.6	2.9	4.1
2004	Accumulated Sediment	42	0.2	3.5	70.7	27.0	2.3	3.8
2004	Accumulated Sediment	50	0.1	4.4	69.5	28.2	2.3	3.9
2014	Inner core	53	0.1	2.1	70.6	27.1	2.3	3.9
2014	Inner core	59	0	1.8	59.8	37.0	3.2	4.2
2014	Inner core	65	0.1	1.5	53.1	42.8	4.1	4.4
	Natural	72	0.4	7.4	53.1	43.8	3.1	4.2
	Natural	75	0.7	19.9	51.1	45.6	3.3	4.2
	Natural	78	0.6	19.5	61.4	35.1	3.5	4.1
	Natural	83	0.6	17.8	57.9	39.1	3.0	4.0
	Natural	87	0.5	6.7	57.3	40.2	2.6	4.0
	Natural	91	0.5	8.2	55.8	41.3	2.9	4.1
	Natural	97	0.5	4.6	55.8	41.3	2.9	

5.3.5 Analysis

Figure 26 shows the lithology in the centre of the bank from which the soil column sample was taken, and the results of the laboratory analyses. These indicate quite clearly that sediment accumulated against the bank.

Starting with the lowest sediment, the area below approximately 80cm is the former (and present) B horizon of the soil. This is evidenced by the increasing stoniness, which occurs down the profile, and the tailing off of values for loss on ignition, and magnetic susceptibility, indicative of reductions in the amounts of organic material present at depth.

The area from approximately 70-80cm is the former A horizon of the old ground surface. This is clearly indicated by the peaks in loss on ignition and magnetic susceptibility, and is corroborated by the peak in silt. The presence of the iron pan, although not a reliable indicator, sometimes gives a hint as to the level of the original ground surface because experience on both Gardoms Edge and Big Moor has shown that the it often forms at this level. In this instance the iron pan is at the boundary between 2014 and the old topsoil, although this may be coincidental. The thickness of the A horizon at around 10-13cm is also consistent with soil test pit data from Gardoms Edge (Barnatt et. al. 1998, 1999 unpub.) which showed that most of the A horizons within areas thought to be likely Bronze Age fields fell between 10-20cm in thickness.

The area between approximately 50 and 70 cm represents the sediment in the inner core of the bank, which was thought to be a possible earthen bank. The laboratory analyses indicate that most of this sediment is almost 80% sand, although there is a higher proportion of silt at the base. For the most part therefore, the sand and silt proportions of both 2014 (and 2004 above it) contrast with the original ground surface below, which contains slightly more silt. This indicates that finer material, present in the original A horizon, has been selectively removed from 2014 by the transportation process, suggesting that a fraction of this material can be attributed to slopewash.

However this context contrasted strongly with the one above in the amount of coarse fragments it contained, and therefore cannot be interpreted as purely redeposited material like 2004. Because of the coarse fraction content and the sizes of the stones involved, context 2014 is much more likely to be a largely cultural construct, ie a low earthen mound/bank built by people. This may have been augmented by the addition of redeposited sediment derived from slopewash, explaining why it contrasts so strongly with the former A horizon below, which had a higher proportion of silt. The interpretation that sediment deposition was also taking place is supported to some extent by the dates from samples 204 and 208 – (see dating discussion below). If this is the case, the question of whether this bank was earlier or later than the earliest stone phase is answered by the fact that in section, context 2014 appears to underlie the first stone phase (during excavation this was not clear).

In summary, it is likely that context 2014 is the earliest phase in the structure and was built by people, then received inputs of redeposited sediment. Contexts 2015 and 2016 are probably later additions placed on top of this pre-constructed bank.

In the upper part of the profile, related to the later stages of formation of Feature 2, the loss on ignition peak at 6 cm is related to the mor humus immediately below the present day turf line, which is a classic feature of podsolised soils. That it does not show as a peak on the magnetic susceptibility plot, despite being composed of over 30% organic matter, is no surprise as these humic layers are extremely variable, and some have high susceptibility, whereas some do not. The area between approximately 10 and 50 cm represents the accumulated sediment, which has backed up against and covered the inner bank. For the most part this is mostly nearly 80% sand, suggestive of a sheetwash deposit where the finer material has been carried away. The accumulated sediment also registers as peaks in the loss on ignition and magnetic susceptibility plots, and again these are to be expected. They are the result of both the occurrence of pedogenesis in the sediment since deposition, and the accumulation of interstitial organic matter between the stones of the bank. This sediment shows clearly as a discrete entity when compared to the sediment of 2014, and that of the original ground surface below it, but this does not mean that it represents one single large depositional event. The particle size data is not sufficiently detailed to show individual pulses of sedimentation if these were very small, and a recent soil has formed through the block of sediment, obscuring any traces of past pedogenesis that may have occurred between sedimentary pulses.

There are three dates associated with this sediment however (Figure 24, Table 11), which indicate that there may be different phases of sedimentation present within it. These will be discussed below.

5.3.6 Dates

Moving upwards through the profile, there is one date associated with the earliest sediment, 2014, two dates with the later accumulated sediment, 2004, and one that was originally thought to be associated with 2004, but whose age suggests it is probably associated with the original ground surface.

Table 11 - Trench 2 - OSL Dates

Context	Sample no.	Depth	Lab. Code	Date	Calendar Age
2014	204	60	Shfd01043	3531 ± 182	BC1711-1347
2004	206	30	Shfd01044	2943 ± 162	BC 1103-779
2004	208	35	Shfd01045	4171 ± 232	BC2401-1937
2004	210	45	Shfd01046	6377 ± 423	BC4798-3952

Sample 204 is associated with context 2014, which is the probable first phase of the bank's formation. The calendar age of BC 1711-1347 places it in the early to middle Bronze Age, well within the range expected for this feature.

The date of BC 2401-1937 for sample 208 appears to be out of sequence as it is older than the earthen bank/first phase. This sample was taken from a position outside the bank, very close to the original ground surface, which at this point in the section was difficult to identify with any certainty. This means that if it is redeposited sediment, as its stratigraphic position suggests, and as a comparison with the age of sample 210 also suggests, then it is one of the earliest pulses of sedimentation. Taking into account the slope of the land, the sediment from which 208 was taken would appear to be at around the same level as the sediment from which 204 was taken or slightly lower, making its earlier age understandable.

Sample 210 was taken from slightly below and upslope of sample 208 (Figure 24). Its age of BC 4798-3952 is considerably earlier than that of the other samples and its stratigraphic position suggests that it could well have been taken from the old ground surface. On both stratigraphic and age grounds it is consistent with the age of 208.

Sample 206 gave the latest date in the section, although due to its proximity to the current ground surface, this is a maximum age for the bleaching of the sediment. Its age of BC 1107-779 however, is stratigraphically consistent with the other dates, and is enticingly close to the end of the period when, according to the pollen data cultivation was taking place within the cairnfields (Hicks 1971, Long 1994). The amount to which the calculated age has been affected by the proximity to the ground surface is however likely to be slight (See discussion on OSL method in section 4.4.5). Although this date is liable to be slightly less accurate than the others, the discrepancy should be small and the date suggests that the last of the sedimentation was taking place in the later Bronze Age.

Summary and Discussion

The data from Trench 2 indicates that the earliest phase of the bank was a built earthen mound over which two parallel lines/banks of stone were placed. The early stone phases of the bank are extremely regular in structure and size/shape etc of stone and do not resemble random clearance. Both the sedimentary and stone aspects of this inner bank are most easily interpreted as some sort of deliberately constructed field boundary. The outer stone is placed more randomly, and is more irregular in size and shape, suggesting that it results from clearance at a later date, although the excavation results are ambiguous in this respect.

There were at least one and possibly more pulses of sedimentation involved in the formation of the bank, and these may have been interspersed with the addition of stone cleared from the surrounding area.

The dates suggest that the formation of the bank took place within the Bronze Age. The earliest dates are those from samples 204 and 208, and both of these place the initial phases of construction/sedimentation around the early Bronze Age.

The pollen evidence from Long (1998) suggests that cultivation was occurring in the Big Moor cairnfield throughout the second millennium BC and into the first, when it declined around the time of the Sub-Boreal-Sub Atlantic transition in the later part of that period. The dates from the bank are well within this timespan, and of the two agricultural activities associated with the cairnfields (pastoral and arable), the latter is likely to cause more erosion because it leaves the ground surface comparatively bare of vegetation at certain times when the soils are most vulnerable to runoff, (Boardman 1992). There is a strong likelihood therefore that the redeposited sediment at the bank was generated by cultivation of the land upslope. The soil data do not provide an answer to the question of the cause of erosion however and it is possible that some of the sedimentation was caused by the woodland clearance, also recorded on the pollen diagrams.

This leads on to the question of whether the activity causing the sedimentation was ongoing or episodic, as woodland clearance would perhaps be expected to be more episodic in nature than arable farming. Again the data provide no answers to this. If the most recent date from sample 206 is included, then together the dates potentially span approximately 1600 years if the maximum and minimum dates are used to bracket the period of use. If sample 206 is not included, the dates from samples 204 and 208 span approximately 1000 years. It would appear therefore, that the fields upslope of the bank were either used continuously for 1000 years or that they were returned to intermittently during that timespan. The first possibility is perhaps the least likely. The maximum thickness of sedimentation at the bank is around 50cm. On a fairly steep slope such as this, this is a minimal amount, and would certainly be expected to be higher if the fields were dominantly used for arable. A continuous use would be more likely to be associated with pasture. The alternative possibility is perhaps stronger; that the fields were only used intermittently for arable activity, either because some sort of rotation between pasture and cultivation was being followed, or because they were effectively abandoned and then returned to after a long period. These suggestions are extremely tentative however, because the soil data simply do not provide enough information to form firm conclusions other than, whatever the nature of the activity, it was of low impact given the timespan over which it was probably occurring.

5.4 TRENCH 3 – SK 427250 375225

Trench 3 was situated in the southern part of the Big Moor Central cairnfield (Figure 14), and was a section through what was essentially an elongated cairn (although it could be classed as a short bank). It was one of a line of cairns that ran in a northeast - southwest direction and could have been marking the edge of a former field area. The line of cairns lies at a distance of approximately 70m from the edge of the main shelf, to the south east, and the land slopes gently in this direction at a gradient of around 1:20.

The cairn was selected because it was a slope obstacle and was asymmetrical in shape, being steeper on the downslope side (to the east) than it was on its upslope side. Although the slope was considerably less steep than that on which trench 2 was situated, the distance to the nearest features upslope was similar at around 40m. The shape of the cairn suggested that there may have been some sediment accumulation on the western side. It was therefore considered to be a good candidate for excavation.

The feature was approximately 70cm high, 6m wide, and around 10-15m long. It was sectioned through the centre, where the height was greatest and the asymmetry most obvious, and the section was oriented cross-contour in an east-west direction.

The cairn proved to have been built almost entirely of stone (Figure 28) and contained little sediment. There were several different components to its structure, but most of these took the form of succeeding layers, and so the sequence of construction was generally straightforward, with a few exceptions. Although the general sequence was easy to reconstruct, there was little to suggest whether the layers of stone represented different phases of construction or whether the cairn was built in one event.

Although there was a thin layer of what appeared to be redeposited material covering the cairn, there appeared to be little inside. The presence of redeposited sediment cannot be discounted, but most of the material within the feature was generally suggestive of the accumulation of organic material in the interstices, along with mineral matter from weathering of the stones. Sediment accumulation did not form an integral part of the structure of the cairn as it did in Feature 2. The only sediment of any significant amount was encountered in the final stages of excavation, when it was discovered that the stones of the cairn had been placed on top of and around a pre-existing mound of pale loamy sand (context 3022). This extended from approximately 2.4m E to 4.8m E. Its upper and western boundaries were generally unclear and were usually obscured by the stones of the bank and the interstitial organic matter between them. It was however thicker on the western side of the cairn and thinner on the east.

The sequence of construction was as follows.

Large stones (20-60cm long) were placed over the mound. Those in the centre at the highest point were tightly packed and were placed with their long axis perpendicular to the mound. These sat within organic-rich mineral sediment, which appeared to have accumulated in the interstices and come to rest upon the upper surface of the mound. On the western flank of the mound the stones were less tightly packed and their bases were embedded in an iron pan, formed on top of the mound. A dark humic layer (Bh horizon) overlay the iron pan around the base of the stones. These two associated layers could be seen to rise up through the cairn following the shape of the feature. It may be that the iron pan had formed everywhere on the surface of the sandy mound, but it may also be that this was the position of the wetting front, which was a consistent distance below the surface and so followed the shape of the cairn. The large stones on the eastern flank were flatter than elsewhere, and were placed horizontally, directly on the pale yellow sediment of the mound.

Directly overlying the larger stones was a layer of considerably smaller stones completely covering the eastern and central parts of the cairn, although the larger stones on the western flank were not covered. These were mostly rounded and approximately fist-sized. They were tightly packed with little sediment in the interstices.

Overlying these was a thin layer of what appeared to be redeposited sediment (context 3002). This was thickest on the upslope side of the cairn to the west. Its lower boundary here was unclear because the redeposited material was above the iron pan, on top of which organic material had accumulated obscuring the lower boundary. However its maximum thickness appeared to be no more than 25cm where it had accumulated against the cairn. Elsewhere over the top of the cairn it was only found in patches, although it thickened at the base of the eastern flank where it may have been washed down from higher up the side. Several medium–sized (10-20cm long) stones sat on top of and were partly covered by this sediment on the western side of the cairn. These were presumably later clearance.

The layers of large and small stones constitute the cairn proper and are stratigraphically earlier than the redeposited material, so it appears that the cairn was already in place before the activity that was causing the erosion started. The redeposited material extended upslope to the west of the cairn where its lower boundary with the former A horizon was obscured by an iron pan and accumulated organic material.

Outside the main body of the cairn there were several other features that may have been of a different date. Immediately to the west of the cairn was a small rill-like feature approximately 30cm wide and 15cm deep, incised into the former A horizon. It obviously pre-dated the redeposited material with which it was filled, and it resembled some sort of water-carved channel, but how it had formed is not known. It appeared to post-date the cairn as several stones seemed to have tumbled into it, but this could not be established with certainty.

To the east of the bank were several other features. The earliest was on the original ground surface and was a small kerb–like arrangement of flat stones laid horizontally. Immediately above these was a pile of stones resembling a low revetment (Figure 29). Between the "revetment" and the cairn was an irregular mass of rubble. Whether the revetment was earlier or later than the cairn was unclear as the excavated portion was too narrow to allow a good assessment to be made, but judging by the size of the feature it is probable that it is later clearance piled up against the rubble that was possibly tumble from the cairn.

In summary, the structure of the cairn provides no clue as to whether it was built in phases. The impression gained during excavation from the lack of sediment inside however, was that it was a unified feature built in a single phase. Some later clearance to the west could be more certainly identified, and the revetment and rubble on the eastern side are also possibly later. Whether this is an agricultural feature or not therefore is unclear, but it does appear to pre-date the activity that was causing the redeposition of sediment.

5.4.1 Samples, (Figure 28)

Four column/cube samples were obtained from the north-facing section.

1. Sample 302 was taken at 1.26m E for loss on ignition, magnetic susceptibility and particle size analyses.
2. Sample 309 was taken at 3.25m E, through the maximum thickness of the cairn for the same analyses.
3. Sample 310 was taken at 5.10m E through the section just outside the cairn, also for the same analyses.
4. Sample 315 was taken at 6.9m east from the section to the east of the cairn.

In addition three OSL samples were obtained

1. Sample 303 was taken at 3.2m E from the sandy mound over which the cairn had been built.
2. Sample 305 was taken at 1.80m E from the buried A horizon to the west of the cairn.
3. Sample 307 was taken at 1.70m E from the redeposited sediment on the ground to the west of the cairn.

5.4.2 Results

Table 12 - Sample 311 - Analytical data

Depth	Context	Description	Xlf	LOI %	% sand	% silt	% clay	mean (Mphi)
4	3001	Mor Humus	0.7	88	43	54	2.87	4.3
15	3002	Redeposited Sediment	-0	3	64	33	2.57	4.0
20	3004	Humic	-0	7	72	26	2.07	3.8
22	3004	Humic	-0	8	69	29	2	3.8
24	3009	Buried Soil	0.4	3	70	29	1.83	3.8
26	3009	Buried Soil	0.3	0	69	29	1.99	3.9
35	3009	Buried Soil	0.2	0	52	45	2.43	4.2
40		B Horizon	0.3	0	56	42	2.35	4.1
45		B Horizon	0.3	3	66	32	1.75	3.8
47		B Horizon	0.2	0	73	26	1.42	3.6
57		B Horizon	0.1	3	65	33	1.55	3.9

Table 13 - Sample 310 Analytical Data

Depth CM	Context	Description	xlf	LOI%	% sand	% silt	% clay	Mean(Mphi)
2	3000	Turf	6.7	64	58	39	2.88	4.12
5	3001	Mor Humus	-0	16	75	24	1.48	3.61
12	3002	Redeposited Sediment	0.8	17	76	22	1.32	3.48
17	3002	Redeposited Sediment	1	8	61	37	2.1	3.97
32	3004	Interstitial/Humic	2.6	6	56	42	2.4	4.08
45	3004	Interstitial /Humic	0.3	2	57	41	2.34	3.97
47	3022	Sandy mound	0.5	3	55	43	2.37	4.10
50	3022	Sandy Mound	0.4	3	46	52	2.45	4.21
52		B Horizon	0.4	3	39	58	2.91	4.32
55		B Horizon	0.3	3	43	54	2.87	4.29

Table 14 - Sample 309 Analytical Data

Depth	Context	Description	xlf	LOI	% sand	% silt	% clay	mean (Mphi)
2	3000	Turf	2.8	55.6	62.9	34.9	2.1	4.08
5	3001	Mor Humus	0	14.0	69.5	28.3	2.2	3.78
12	3002	Redeposited	0.1	17.0	46.8	50.3	2.9	3.96
35	3004	Interstitial/Humic	0	3.9	60.1	38.0	1.8	4.15
40	3022	Sandy Mound	0.3	2.5	62.9	34.9	2.1	3.98
45	3022	Sandy Mound	0.15	1.2	69.5	28.3	2.2	3.92
60	3022	Sandy Mound	3.1	2.1	46.8	50.3	2.9	4.26
69		B Horizon	1.95	1.1	60.1	38.0	1.8	3.97
80		B Horizon	1.3	1.4	42.2	55.2	2.6	4.31

5.4.3 Analysis and Discussion

Of the three column samples analysed for this feature, Sample 310 is one of the easiest to interpret, (Figure 30). The large peaks in loss on ignition and magnetic susceptibility at the top of the graphs are related to the turfline and the H horizon directly below. Below this, between approximately 5 and 15cm the section shows an accumulation of sediment between the revetment and later cleared stone. This was interpreted in the field as redeposited sediment resulting from erosion. It forms a patchy covering to the cairn. It is highly likely that the sediment here contains a significant input of material that has weathered from the surrounding stones, and is responsible for the sand bulge in this area on the particle size plot. The loss on ignition values of around 20% at 10cm, are higher than would be expected of a topsoil and are indicative of the accumulation of organic matter in this small sediment trap. The lower loss on ignition values below 45cm of <10% are more consistent with an A horizon, and these are in the correct stratigraphic position to represent the original ground surface. The origin of the large peak in magnetic susceptibility values at 32cm is unknown. The data from 310 does not effectively demonstrate the presence of redeposited sediment.

The data from samples 309 and 311 pinpoint the presence of redeposited material more clearly. This is visible on the particle size plots as the slightly siltier material at around 15cm on the 309 plot and above 15cm on the 311 plot. The reason this material is finer than the original ground surface is presumably related to the character of the topography. The gradient of the slope above the cairn is very gentle and so it is not surprising that finer rather than coarser material was carried down it. Below 15cm on plot 309 the sediment is coarser, reflecting the interstitial material of the cairn and weathering inputs from the stones. The loss on ignition values here, probably reflect the accumulation of organic material between the stones. The sandy mound shows up as a peak in the sand curve around 50cm, corroborating the field observations that this was completely different material to that within the cairn. The data do not suggest the origin of this material however, and the formation of the mound remains a mystery. In section the mound appeared to be sitting directly on the B horizon of the soil, and the particle size data shows the decrease in sand proportion at the base of the mound.

Sample 311 is the most informative as the data are not complicated by the presence of the cairn. Material interpreted in the field as sediment redeposited from upslope, shows on the particle size plot as elevated levels of silt at 15cm below the surface The loss on ignition and magnetic susceptibility peaks at the very top of the graph occur at the level of the humic layer below the turfline and so relate to this layer. There is a slight peak in the loss on ignition plot between 17 and 22 cm, which is almost certainly related to the Bh horizon and the iron pan. The proportions of sand on the particle size plot start to rise at around 10cm, and the buried A horizon identified in the field shows clearly as a peak at 22cm. This is also illustrated by the magnetic susceptibility curve, which exhibits a prominent (albeit low magnitude) anomaly at the same depth. The particle size data here, suggest that context 3004 is also part of the buried A horizon, but that this was obscured in the field by the presence of the iron pan and the organic material above it. Below the level of the A horizon, the proportion of sand decreases again at the same level as the top of the B horizon, which in the field was similar to the B horizons in most of the other features excavated because it had alternate sandy/silty layers.

5.4.4 Dates

Table 15 - OSL Dates from Trench 3

Sample No.	Context No.	Depth	Lab. Code	Date			Calendar Age
303	3022	70	Shfd01047	7879	±	420	BC6797-5457
305	3009	35	Shfd01048	6593	±	356	BC4947-4235
305	3009	35	Shfd01048	8030	±	467	BC6495-5561
307	3002	20	Shfd01049	2602	±	160	BC760-440

Sample 303 was taken to date the sandy mound under the cairn. This contained pale, almost white patches that appeared to be leached, and to an experienced eye looked "old" (Dr. C Frederick, pers. com.). This has proved to be the case, as it appears that the sediment in the mound was last exposed to sunlight in the Mesolithic period. It also negates the possibility that despite appearances to the contrary (ie its form in section, which was a mound rather than a wedge) that the sediment in the mound could have been material redeposited as a result of Bronze Age agriculture. It unfortunately does not date the cairn at all, except to confirm that it is younger than Mesolithic.

Sample 305 was taken from the buried A horizon to the west of the cairn (context 3009). The palaeodose probability plot for this sample exhibited multiple modes, indicating that the sediment was mixed, and contained material that had been exposed at different times. These modes were analysed on an individual basis to discover the minimum and maximum age of the sediment, and these are shown in Table 15. The most recent date for exposure of part of the A horizon is BC 4947-4235, and the earliest date is BC 6495-5561. When compared to the dates from pollen cores (Hicks 1971, Long 1994) these dates are both earlier than would be expected for farming activity in the cairnfields.

The later date from sample 305 is, on this basis, not likely to be related to exposure of the ground surface due to agriculture. When compared to the date of BC 4947 - 3952, from the buried ground surface upslope of trench 2 however, it is clear that the two buried soils fit into the same timeframe. This supports the interpretation that they are both in fact buried soils, but whether it means anything in terms of human land use is unknown. It also means that the cairn itself must be later than the 4th millennium BC, as the western edge of the feature is sitting on the A horizon, but this was never in doubt. In terms of dating either the cairn or farming activity, sample 305 is uninformative. It is useful however as support for the date from the original ground surface on Feature 2 (sample 210), and the interpretation of that sediment.

The final OSL sample was taken from the redeposited material above the buried A horizon to the west of the cairn (context 3002, sample no 307). This is a maximum date for the deposition of the sediment, as it was taken < 30cm below the surface. The calendar age it produced was BC 760-440, and although like sample 206 from feature 2, there is a possibility that this date may be slightly older than it should be, it fits well within the expected range and suggests slope sedimentation slightly later than that at Feature 2.

5.4.5 Summary of Trench 3

The laboratory analyses have, on the whole, corroborated the field observations; particularly with respect to the presence of redeposited sediment and the buried A horizon. The cairn clearly pre-dates the accumulation of sediment, which is dated to the Late Bronze Age by the date from sample 307. The cairn was constructed sometime after BC 4947-4235 and before BC 760-440, and the date of the eroded sediment accumulating against it implies that agricultural use of the land up-slope was ongoing in the Late Bronze Age. This is in general agreement with the period of land use expected on the basis of other forms of evidence such as pollen, and it is also within the same general period of use of Feature 2 (albeit slightly later). Although the stones of the cairn were placed in layers, there was no sediment separating them that would suggest that the layers represented different phases of construction. The ordered way in which the stones were placed and the apparent choice of stones of similar sizes and shape in individual layers, is suggestive of a relatively planned construction, which is at odds with the more random construction of a clearance cairn. Although the portion excavated was too narrow to make a firm assessment, the possibility exists that the cairn is not an agricultural feature.

The amount of redeposited material present is small. The maximum thickness is around 20cm. This could be (and probably is) because the slope the cairn is on, is not steep and the cairn is an isolated slope obstacle which would provide a rather inefficient sediment trap. The amount of eroded soil present at Trench 3, however, is similar to that at Trench 2 if the slope gradient is taken into account. The gradient at Trench 2 is twice that at Trench 3 and there was slightly more than double the thickness of redeposited sediment at the former than at the latter. The data from both these features, therefore, is suggestive of low-intensity land-use, having minimal erosional impact on the soil.

5.5 TRENCH 4. SK 427205 375100

5.5.1 Location and description

Trench 4 was a section through a stone bank located in the extreme south of the Big Moor Central cairnfield, approximately 110m to the south of Trench 3. It is situated very close to the edge of the main shelf, which is approximately 20m to the south-east, (Figure 14). This area of the cairnfield is characterised by poor field boundary definition and small scattered cairns, and much of the land shows no evidence of having been cleared of stone for agricultural purposes. The only indication of stone clearance in the immediate area was one cairn situated approximately 30m upslope to the west, and this suggests that the area did see some agricultural use. Other than this the nearest archaeological features were around 60m away, so the slope above Trench 4, though shallow, was long and relatively free of obstacles.

The bank runs in a north-east/south-west direction roughly parallel to the edge of the shelf, and the land here is almost flat. It is also badly drained, a condition exacerbated by the presence of the bank, which formed a very effective dam. Less than 20m to the west are one or two small cairns, but other this the nearest cairns are around 50m away, also to the west. The feature is low and long. It is approximately 50cm high by 2m wide and extends for approximately 70m, terminating to the north-east at another stone bank and petering out to the south-west.

This bank was selected, primarily because it was asymmetrical, being steeper on its eastern downslope side than on its western. It also in theory would have formed a slope obstacle as it was parallel to contour, even though the gradient was slight. It was not chosen specifically to contrast with the other features, but it was observed that the land upslope had apparently seen minimal stone clearance, and so the bank provided an opportunity to compare cleared areas with uncleared.

5.5.2 Structure of the Bank

The bank was built of large stones, most over 30cm long, piled loosely above one another, directly above a slight break in slope. During excavation these were classified into three different contexts, primarily because of the presence of organic-rich layers of sediment within the bank, which appeared to separate some groups of stone from others. It was not clear however, whether the organic-rich layers had formed *in situ*, after the construction of the bank, or whether they perhaps, represented successive turflines, forming between different phases of stone addition. The south facing section is shown in Figure 31.

5.5.3 Stratigraphic Sequence – Centre of bank. Sample 402

Context 4000 – turf

Context 4001 – H horizon - the soil humus directly under the turf.

Context 4010 – The upper stones of the bank, which were generally smaller than the lower stones. They were sitting on a thin lens of dark organic material, (see below). The stones were surrounded by the humus layer (context 4001), which had formed around them under the turf on the present ground surface.

Organic lens - This was under the upper stones in the bank and separated them from the lower. It was not entirely established during excavation whether this was a continuation of the humus under the turf to either side of the bank, or whether it was organic material from roots etc., which had accumulated under the upper stones after the bank was constructed. If it was the former, then the upper stones were a later phase of the bank.

Context 4017 - a dark, discontinuous organic layer up to 10cm thick, which where it appeared, separated the upper stones in the bank (context 4010) from the lower (context 4011). Like the organic layer above, it could have accumulated either before or after the construction of the bank.

Context 4011 – Lowest stones in the bank

Context 4003 – Mineral soil – probable former A horizon

Context 4004 – Possible lower extent of A Horizon. Intermediate between A and B Horizons.

Contexts 4006+ – B Horizon

5.5.4 Stratigraphic sequence Upslope of the Bank, (West). Sample 403.

Contexts 4000 and 4001 – turf and humus

Context 4015 – a dark mineral layer – no more than 5cm thick, which ended at the western edge of the bank. Redeposited sediment.

Context 4013 – An organic layer, which also ended at the western edge of the bank. Not as well humified as 4012.

Context 4012 – Organic-rich layer. Possible former turfline representing pre-bank ground surface.

Context 4003 – A mineral sediment. Probable top of buried A Horizon

Context 4004 – Intermediate between A and B Horizons. The boundary between the two was not clear due to the waterlogging of the sediments.

Contexts 4005 – 4007 B Horizon

5.5.5 Stratigraphic Sequence Downslope (East) of the Bank

Contexts 4000 and 4001 – Turf and present-day Humus. 4001 contained thin lenses of redeposited material, which appeared to be weathered mineral sediment that had washed down out of the bank.

Context 4012 – Possible Former Turfline

Context 4003 – Top of Buried A horizon.

Context 4004 – Intermediate between A and B Horizons

Contexts 4005-4007 – B horizon

5.5.5.1 Summary of Stratigraphy

In summary the stratigraphic sequence was the same throughout the bank, up to the top of the organic layer, which was interpreted as being a former turfline, (context 4012). This started at depth with the B horizon, (contexts 4005-4007). Immediately above this was a mineral layer, which appeared to be a buried A horizon, (context 4003). This could be traced throughout the section from east to west. Above this the sequence was different in the centre of the bank and to the east and west.

To the west and upslope of the bank, an organic-rich layer lay immediately above the buried A horizon. This was interpreted as a former turline. It could not be traced through the centre of the bank, where if it was present it was obscured by an accumulation of probable interstitial organic material. It was however present to the east of the bank where again it was overying the buried A horizon, context 4003.

Above the possible turfline to the west of the bank was another organic-rich layer, context 4013. This ended at the western edge of the bank and could have formed due to the non-decay of organic material in the waterlogged conditions upslope.

Above this was a thin layer of mineral sediment, context 4015. This also ended at the western edge of the bank, and was interpreted as sediment from upslope which had been redeposited against the bank

Above this were the present day H horizon and turf.

In the centre of the bank, the lower stones had been placed upon the buried A horizon (and possibly on the turfline). They appeared to be separated from the upper stones by the organic-rich layer 3017 and an organic lens. This suggested that the bank might have been built in two phases. It was considered during the course of the excavation whether the upper stones might represent the later deposition of clearance stone onto the first phase of the bank. The upper stones however, were quite large and of similar sizes, around 10-20cm long, rather than a range of sizes as would be expected with random clearance. They were also quite tightly clustered in the centre of the bank rather than being scattered across the flanks as would be expected with thrown clearance stone. If they were a later phase therefore, they did not seem to be random clearance. Unfortunately the excavated section was too narrow to provide enough information on the structure of the bank to make a more certain assessment, either of any phasing or of the character of the construction of the bank.

To the east of the bank, the possible buried turfline, was again present immediately above the buried A horizon. Overlying this was the present day humus, which contained thin lenses of mineral sediment. These were interpreted in the field as the result of weathering of the stones of the bank, which had been washed down the slope to the east.

5.5.6 Sampling

In order to corroborate the observations made in the field as to the presence of redeposited sediment, and a possible buried turfline to the east and west of the bank, and of a buried A horizon under the bank, it was sampled in three places

At 0.5m E, (upslope). Sample 403.

At 2.1m E. (centre). Sample 402.

At 3.8m E. (downslope) Sample 401.

All three samples were cube columns taken for the purposes of magnetic susceptibility, loss on ignition and particle size analyses. There was insufficient redeposited material to sample for OSL purposes.

5.5.7 Results

Table 16 – Sample 401 - Analytical data

Depth	Context	Description	Xfd	L01 %	% sand	% silt	% clay	Mean (Mphi)
0	4000	Turf	1.0	79	64.4	34.8	0.81	4.084
6	4001	Humus	0.2	88	50.5	44.7	4.84	4.361
7	4001	Humus	0.1	20	64.4	30.8	4.84	4.076
11	Lens	Redeposited	0.1	35	76.1	22.9	0.92	3.376
14	4012	Buried H	0.1	13	44.0	47.3	8.67	4.728
17	4003	Buried A Horizon	0.5	6	83.8	14.9	1.26	2.750
20	4003	Buried A Horizon	0.6	6	81.5	17.2	1.26	2.906
23	4004	Buried A/B	0.8	13	82.4	16.3	1.26	2.800
26	4005+	B Horizon	1.4	7	63.4	32.7	3.88	3.981
31	4004+	B Horizon	2.7	5	61.6	35.1	3.34	3.981
34	4004+	B Horizon	2.6	5	45.6	51.0	3.36	4.379
40	4004+	B Horizon	2.9	4	48.6	47.3	4.08	4.477
45	4004+	B Horizon	1.4	4	50.5	46.0	3.51	4.396
53	4004+	B Horizon	1.0	5	50.5	46.6	2.87	4.401
57	4004+	B Horizon	1.1	4	28.7	66.4	4.82	5.236

Table 17 - Sample 402 - Analytical Data

Depth	Context	Description	Xlf	L01 %	% sand	% silt	% clay	Mean (Mphi)
0	4000	Turf	1.30	84	61.6	37.6	0.8	3.6
15	4001	Humus	4.37	67	72.6	25.9	1.5	3.5
16	4017	Organic-rich	3.01	28	28.7	60.9	10.4	5.3
30	4004	Buried A Horizon	0.60	4	80.7	17.7	1.6	2.9
42	4005	B Horizon	2.52	3	63.4	34.6	2.0	4.1
56	4006	B Horizon	1.46	4	53.7	42.7	3.6	4.4

Table 18 - Sample 403 - Analytical Data

	Context	Description	Xlf	L01 %	% sand	% silt	% clay	Mean (Mphi)
0	4000	Turf	1.57	77	65.9	33.3	0.8	3.47
4	4001	Turf/Humus	1.41	83	72.6	26.2	1.1	3.69
7	4001	Humus	0.08	61	57.4	39.9	2.7	4.16
9	4015	Redeposited	0.06	24	66.0	30.8	3.4	4.08
11	4013	Organic-rich	0.16	33	41.1	55.7	3.2	4.83
17	4012	H horizon	0.35	23	62.7	33.6	3.7	4.11
19	4003	Buried A Horizon	0.68	6	62.8	34.2	3.0	4.14
23	4004	Buried A Horizon	0.47	4	82.2	14.7	3.0	2.82
27	4004	Buried A Horizon	3.21	3	68.3	30.1	1.6	3.73
32	4004	A/B Horizon	0.79	5	68.1	28.2	3.6	3.95
36	4004	B Horizon	1.28	3	64.4	33.3	2.3	4.15
42	4005	B Horizon	2.65	6	54.5	40.3	5.2	4.48
72	4005	B Horizon	1.69	6	59.7	36.1	4.3	4.37

5.5.8 Analysis

Starting with the redeposited sediment, this shows as sand peaks on the plots for samples 401 and 403 at depths of around 10cm (Figure 32). The sorting values on both plots indicate that it is better sorted than the surrounding sediment, which is to be expected of material that has been transported. The lenses to the east of the bank are composed of coarser material than that to the west. This is also to be expected to the west the depositional environment is lower in energy because the slope is less steep. To the east the gradient from the bank to the ground surface is steeper and so coarser material can be transported. On the sample 401 plot the redeposited sediment shows as a peak in loss on ignition values but this is almost certainly because of contamination of the sample by material from the surrounding organic layer. On the sample 403 plot, it exhibits lower loss on ignition values than the surrounding organic sediments. Magnetic susceptibility values on both plots are of a similar order or <5.

The buried turfline at 17cm on the plots for 403, and around 15cm on the plots for 401, exhibits varied loss on ignition values. In sample 401, this is <10%, while in sample 403 it is higher, at between 10 and 20%. This may again reflect the non decay of organic material in the waterlogged conditions upslope of the bank. Similarly, the magnetic susceptibility values in sample 401 for this layer are very low, while there is a low magnitude anomaly on the plot for 403, which probably reflects the larger proportion of organic matter it contains. In both samples it can be distinguished on the basis of particle size as being different from the organic sediment above, as it is coarser textured and worse sorted. On the whole therefore the laboratory analyses, indicate that it is a different entity.

The buried A horizon shows as sand peaks on all three sample plots, from around 20cm in sample 401, 30cm in sample 402 and 20cm in sample 403. On all plots it is coarser textured but better sorted than the sediment above and below. It exhibits low loss on ignition values of generally < 5% although the values are slightly higher at the top of this layer at around 22cm in sample 401. It is only clearly reflected as a prominent anomaly on the magnetic susceptibility plot for sample 403 and so this data is not particularly useful. In view of the similarities in the other data, however, the A horizon stands out as a unified entity which differs from the sediment above and below. In addition its stratigraphic position makes it unlikely to be anything other than a buried topsoil. The data, therefore support the field interpretation.

The final question remaining from the field observations was whether context 4012 the former turfline, was the same entity as context 4017 which was an organic-rich layer under the upper stones of the bank. These two contexts seemed in the field to be texturally different, but 4017 was in the correct position to be a continuation of 4012, and in theory, the differing preservation and depositional conditions in the centre of the bank could have been responsible for the textural variation.

The laboratory data do not suggest that these are in any way connected. The proportions of sand silt and clay are completely different, as are the magnetic susceptibility values. The loss on ignition values are similar, but that is to be expected from two organic-rich contexts. While this may still be a consequence of the different conditions in the centre of the bank, it strengthens the field observations that 4012 is not present under the bank. This suggests therefore that the ground surface may have been deturfed prior to construction of the feature

The base of the A horizon could not be distinguished with certainty due to the waterlogged conditions, which had caused significant gleying in all the sediment at a depth of more than 30 cm below the ground surface. It appeared to be approximately 20cm deep upslope of the bank however, and around 15cms downslope.

5.5.9 Summary and Discussion

Trench 4 was situated in an area of the cairnfield which contains few clearance features, and the absence of any significant additions of cleared stone suggests that the bank may be a deliberate boundary rather than an incidental clearance feature. The portion excavated was too small to draw firm conclusions.

This part of the cairnfield is almost flat, although the bank is placed upon a break in slope, to the east of which the gradient increases. The low relief of the local topography, in addition to the boggy nature of the ground in this area has probably contributed, along with the construction of the bank, to the build-up of organic material on the upslope side. Conversely however, it may have inhibited the build-up of redeposited sediment, as the slope is probably too gentle for sediment to be carried far except perhaps, during more extreme runoff events. Some sediment has accumulated against the bank, but this is a very thin layer. The small quantity of sediment may be a refection of the depositional conditions, or it may reflect a low intensity of land use. The latter is in turn suggested by the infrequency of agricultural features upslope.

The field observations have been confirmed by the analytical data, and this suggests that where there has been any significant accumulation of sediments, even in quite small amounts, they can be identified both in the field and by laboratory analyses. Buried A horizons can also be identified in the same ways, although in this case, the sediment is extremely variable and can be identified primarily by the differences up and down the profiles between the various sediment layers.

5.6 TRENCH 5 – SK 427240 375440

5.6.1 Location and Description

Trench 5 was a section though an earth and stone bank located towards the south of the Big Moor Central cairnfield, (Figure 14). The area in which it is situated is characterised by a diverse set of remains which comprise fields, possible house sites, features resembling stock pens, yards, and garden plots. In addition there are the ubiquitous clearance features, which comprise cairns and linear banks/cairns. Field boundary definition is variable, with many of the boundaries being well defined but discontinuous, and with others being defined only by the presence of cairns that appear to be on boundary lines. Most of the boundaries and field banks appear to be constructed of stone or of a mixture of stone and earth. In addition, some features have been identified by survey as possible lynchets formed by soil erosion, (Ainsworth et. al. 1998). The gradient of the gritstone shelf in this area is around 1:20 or slightly steeper.

The bank is oriented roughly north-east/south-west and is approximately 40m long. It appears to form part of a longer boundary, which to the south-west and north-east is marked by earthen banks and clearance cairns, (Figure 14). This boundary, is one of four that define a roughly rectangular area, that on plan has the appearance of a field. Within this there are several scattered cairns, the nearest of which is around 30m upslope. Although the gradient is not steep, the length of the rectangular field is around 50m. Within it there are few obstacles upslope of the bank. Around the portion excavated the bank curves twice, suggesting that it is respecting the position of other features, possibly house sites that have now disappeared.

The feature is quite ephemeral (Figure 33). It is predominantly flat on its western side up to approximately 3m E where there is a very slight rise in height – no more than 5-10cm. It then slopes towards the east where between 4m and 5.7m the ground surface drops by 40cm. Its maximum height above this ground surface is therefore 40cm. Its width, from the first noticeable rise in height at 3m E, to the base of the eastern slope at 5.7m is around 3m. This is almost an arbitrary distinction. If the eastern slope is not included, the width is nearer 4m.

The purpose in excavating the bank was to learn how it had formed, and to test the hypothesis that it may have formed through the accumulation of eroded soil against a former slope obstacle such as a hedge or fence. It was hoped at the beginning of the excavation, that if this were the case then a unit of eroded sediment would be identified in the top of the bank, either in the field or by subsequent laboratory analysis of the sediment .

During excavation, no such lithological unit was found. The bank was composed primarily of topsoil, (context 5004) onto which small amounts of stone had been added to the east and west (Figure 33). To either side of the centre, (at around 2.5m E and 4.7m E), the A horizon was slightly thinner at 20-25cm, than it was elsewhere, where it was between 25 and 30cm thick. The bank was defined primarily therefore, by a slight thinning of the A horizon on either side, rather than by a thickening of the sediment in the centre. Most of the height in the central area was contributed by the stones, which can be seen in section from 3.25m E to 4.25m E, and by the thickened H horizon that was present in between them, (context 5002).

The stratigraphic sequence was as follows

Context 5001 – Turf

Context 5002 – Humus (H horizon)

Context 5007 – Cleared Stones – an accumulation of medium-large stones sitting on the A horizon between 3 and 4.6m E. There was no order to the placement of the stones and they appeared to be random clearance from the area east or west of the bank.

Context 5003 – A horizon – This is thinnest on the western side at 2.5m E where it is around 20cm thick. It is thickest between 3.5 and 4.5m E and at the western end of the excavated section, where it reaches 30cm.

Context 5004 – Lower A horizon, below iron pan. Although its colour was different due to the different oxidation conditions above and below the iron pan. Its textural similarity with context 5003 indicated that that was the same horizon

Context 5005 – Top of possible sand wedge. This was a patch of sandy material directly below context 5004, between 1.5 and 2.5m E. When first exposed it was thought to be a cut feature, possibly a pit. This idea was eventually rejected however, as no clear edges or cut could be found. In section it can be seen that the surrounding layers slope down into it, rather than are truncated by it as would be expected of a cut feature. It graded down into the B/C horizons becoming progressively more sandy, until at the base of the drawn section it became loose, white, stone free sand. This was excavated to the maximum depth that it was felt was safe, which was approximately 1.4m but the base of the sediment was never found. It may be a periglacial feature such as a sand wedge. The A horizon above this feature between 1.5 and 2.5m E was significantly more sandy than that to either side reflecting the composition and variability of the parent material.

Context 5006 – B horizon. This directly underlay the A horizon everywhere except in the position taken by 5005. It was composed of multiple layers of sands and silts.

5.6.2 Samples

The bank was sampled in order to ascertain if it was possible to identify by laboratory analysis, accumulated sediment or a buried and fossilised A horizon that was not visible in the field.

Two cube column samples were taken from the north facing section, for magnetic susceptibility, loss on ignition and particle size analyses.

Sample 504 was taken from 0.5m E

Sample 506 was taken from 3.6m E

5.6.3 Results

Table 19 - Sample 504 Analytical Data

Depth	Context	Description	XLF	LOI %	% sand	% silt	% clay	mean (Mphi)
5	5002	H Horizon	0.8	47.1	59.5	40.5	0.0	4.1
15	5003	A Horizon	0.1	2.1	80.7	19.3	0.0	2.8
20	5004	A Horizon	0.3	3.7	68.7	28.6	2.7	3.9
23	5004	A Horizon	0.2	5.2	69.5	28.7	1.8	3.8
25	5004	A Horizon	0.3	9.4	70.7	29.3	0.0	3.1
27	5006	B Horizon	0.4	2.4	71.2	26.3	2.5	3.8
35	5006	B Horizon	0.4	2.4	73.5	26.5	0.0	3.3
40	5006	B Horizon	0.4	5.0	65.2	27.7	7.1	4.6

Table 20 - Sample 506 - Analytical Data

Depth	Context	Description	XLF	LO1 %	% sand	% silt	% clay	mean (Mphi)
6	5002	H Horizon	0.4	49.17	57.9	39.4	2.7	4.1
10	5003	A Horizon	0.2	7.91	63.9	27.3	8.7	4.7
15	5003	A Horizon	-0.1	7.56	71.8	28.1	0.1	3.6
17	5004	A Horizon	0.0	4.73	71.8	27.0	1.3	3.7
28	5004	A Horizon	0.3	3.86	52.4	44.1	3.5	4.2
35	5006	B Horizon	0.2	3.48	55.5	43.2	10.5	55.5
38	5006	B Horizon	0.2	2.87	65.9	27.5	6.5	4.5
42	5006	B Horizon	0.2	2.49	52.4	45.2	2.4	4.2
50	5006	B Horizon	0.2	3.39	63.2	32.5	4.3	4.4
53	5006	B Horizon	0.1	1.60	73.0	25.6	1.3	3.6
59	5006	B Horizon	0.1	1.79	70.6	28.6	0.8	3.1

5.6.4 Analysis

The simplified lithology and the plots of all the analyses are shown in Figure 34. There is little in the data from either sample to indicate the presence of redeposited material. Instead, both samples appear to reflect the range of variability of the eastern moors soils. The magnetic susceptibility values show slight variation between samples and between different horizons, but the peaks are exaggerated by the scale of the plots and all of the values are small. The differences between them are actually insignificant and they cannot be used to assess differences down the profiles or between samples.

Starting with the H horizon or humus, this is very similar in both samples. Both have loss on ignition values approaching 50%, contain almost 60% sand and the mean phi values are the same. The only significant difference within this layer was seen in the field, where it was thicker between the stones. Other than this, the data indicates, as expected that both samples come from the same layer.

Moving down to the A horizons, the only aspects of either plots that could be interpreted as evidence of either redeposited material, or a buried soil, is the sand bulge at 10cm on the plot for sample 504, and the sand bulge at 35cm which equates to the base of the A horizon in sample 506. At first sight the peak on the 504 plot looks promising, especially in view of the sorting value of 1. This the lowest standard deviation in either profile, and it indicates that the sediment is better sorted than that below, which accords well with sediment transported by water.

There are at least two factors which mitigate against this however. First, the addition of sediment to the topsoil should result in a thickened topsoil, and the A horizon in the sampling vicinity is not significantly thicker than elsewhere in the bank. If the one data point that is causing the peak is ignored, than all the rest of the sand values are very similar in both samples. On balance therefore the value of 80% sand at 15cm may be just part of the normal variability of the soil and without any other corroboration cannot be treated as significant.

If the data are examined closely, then it is evident that the sand bulge at the base of the A horizon in the sample 506 profile is also not likely to be significant. The values at the bases of both sample profiles are very similar, all around 70% with the exception of the one on the A-B boundary in sample 506, which is closer to the values of the B horizon. No trace of a buried A horizon could be seen in the field and the data from Features 2-4 suggest that where these are present they can be identified. It would be unsafe therefore to read more into the data from Trench 5 than the normal variability of the parent material.

5.6.5 Summary

The profile and laboratory data do not suggest that the bank formed through accumulation of sediment. If this did happen however, the lack of any lithological signature for it suggests that sedimentary inputs were of a sufficiently low magnitude to be incorporated into the soil as they were deposited, ie. sedimentation was proceeding at the same or at a slower rate than pedogenesis.

The thinning of the A horizon to either side of the bank could be an indication that material has been removed from these areas. There was no indication of rilling on either side of the bank however, which would indicate that the soil had been removed by water, and in any case the bank was parallel to contour so this possibility is unlikely. The most likely scenario is probably therefore that the bank is a built feature. In section it appears to be no more than a slight scraping of the topsoil into a mound. Alternatively, it could represent the stacking of turves that had been stripped from the fields. This explanation is also unsatisfactory, because presumably this would result simply in a thickened A horizon in the centre, rather than a thinning to either side.

5.7 TRENCH 6 - SK 427240 375440

5.7.1 Location and Description

Trench 6 was a section through an earthen bank in the central-north part of the Big Moor Central cairnfield (Figure 14). This area is characterised by fields with good boundary definition provided by earthen banks. The fields are generally rectangular, long and thin. A small excavation was carried out in the 1980s in order to clarify the nature of the field boundaries and four radiocarbon dates were obtained from bulk charcoal samples taken from within the two banks excavated. The dates thus obtained ranged from BC 1620- 1324 to BC 1253-830 which suggested that the banks were formed in the Bronze Age, (Ainsworth et. al. 1998).

The earthen bank excavated here, was almost 100m long and formed the common boundary to four fields which extended out from it to the east and west. It was situated on a gradual slope of <1:20. The bank was selected for excavation primarily because it was asymmetrical and was thicker/higher to the west, (upslope), while its eastern flank was steeper. The purpose of the excavation was to investigate the possibility that it had formed due to the accumulation against a slope obstacle, such as a hedge or bank, of material eroded from upslope.

5.7.2 Excavation results

Excavation showed that the bank as a stratigraphic entity was ill-defined. The only clue to its existence was the slight slope to the east, from around 4. 5m E. (Figure 35). From this point, it dropped approximately 30cm over a distance of 2m. To the west there appeared to be no slope and from 4.5m E to the western edge of the excavation trench the ground surface was level.

There were no identifiable additional strata in the area around 4.5m E at the top of the slope that were suggestive of redeposited material. Put simply this means that all that could be seen in this area was the A horizon which ran through the section.

The stratigraphic sequence was as follows:-

Contexts 6001 and 6002 were the turf and H horizons respectively.

Contexts 6003 and 6004 were the A horizon, through which an iron pan had formed at 10-15cm below the surface. The differences between these contexts were mainly related to the amount of organic matter they contained plus the colour changes caused by different oxidation conditions, and these in turn were a consequence of podsolisation. In addition, although the two were texturally very similar, the sediment above the iron pan was slightly coarser than that below.

At its thickest part, between 4 and 5m E., the A horizon was 30 cm thick. Beyond this to east and west, it remained a fairly constant thickness of around 20 cm. It would seem therefore that the only lithological expression of the bank was a thickened A horizon in the area between 4 and 5m E.

Contexts 6005 6006 and 6007 were the B horizon, and in section this was seen to be composed of alternating sandy and silty layers which extended down to an unknown depth. Compared to the soils at the other features, the B horizon under Feature 6 was clay rich, although the amounts involved were still low. From the B horizon down the profile had the appearance of sediment that had formed *in situ* from weathered bedrock.

5.7.3 Samples

Five cube columns were taken at 0.5m E, 2.4m E, 4.5m E, 5.8-5.9m E and 6.6m E in order to attempt to identify analytically, any accumulated material that could account for the thickend A horizon in the "centre" of the bank. Sample 602 taken at 4.5m E was felt to be the most representative as it was where the A horizon was thickest, and this was processed.

5.7.4 Results

Depth CM	Context	Description	LFAv	L0I %	% sand	% silt	% clay	mean (Mphi)
5	6002	Humus	2.85	25	68.9	29.3	1.9	4.4
10	6002	Humus	1.90	5.3	68.9	29.3	1.9	3.9
15	6003	A Horizon	2.05	5.4	73.2	26.7	0.1	3.4
21	6003	A Horizon	1.75	6	76.4	23.6	0.1	3.4
25	6004	A Horizon	1.85	5.9	60.8	36.6	2.6	4.1
30	6004	A Horizon	1.85	7.0	60.8	37.6	1.7	4.0
35		B Horizon	1.85	6.1	68.6	30.3	1.1	3.7
40		B Horizon	2.00	5	62.7	32.9	4.5	4.2
45		B Horizon	2.20	2.4	42.1	54.9	3.0	4.9
50		B Horizon	1.70	2.4	42.1	54.9	3.0	4.9
55		B Horizon	1.85	2.6	53.3	43.5	3.2	4.4
60		B Horizon	1.90	2.0	65.9	32.9	1.2	4.0
70		B Horizon	2.00	1.9	41.2	53.9	4.8	4.6
80		B Horizon	1.85	3.3	49.7	47.5	2.7	4.5

5.7.5 Analysis

There is little in the analytical data to suggest that there was a discrete lithological unit hidden in the top of the A horizon (Figure 36). The magnetic susceptibility curve displays a very slight anomaly at 15cm, but this is not accompanied by a peak in the loss on ignition data at the same level. The loss on ignition data in fact show little variation in the A horizon down to 30cm so there is no hint of any difference down to this level that would suggest that any additional material is present. The only hint that sediment may have been added comes from the granulometry, the data from which shows a peak in the sand curve at 20cms. This is accompanied by slightly lower mean phi values compared to the sediments above and below indicating that the material is question is slightly coarser. The sorting values also indicate that the material is slightly better sorted and so may have been transported.

There is no clear evidence of a buried A horizon. The field observations did not identify such a feature, and the laboratory data are similarly uninformative. If a buried A horizon was present then it should be manifest in the data from 20-25cms down. There are differences at this level, but none that are consistent. The loss on ignition values are elevated compared to the contexts above, but there is no corresponding anomaly in the magnetic susceptibility values. The granulometry data indicate that the material between 25 and 30cms is siltier than in the present A horizon and worse sorted. Therefore in terms of particle size, this sediment can be distinguished from that above. However, the particle size plots show alternating layers of finer and coarser material all the way down the profile, through the B horizon and it was obvious from the excavated section that these were natural. There is no reason to suspect that the variation in the A horizon is also anything except natural. Ultimately the best interpretation of this profile is that it is a soil which has developed *in situ* from the weathered bedrock, and the variation within it reflects the variation in the parent material.

5.7.6 Summary

The field observations show that the A horizon is thickest at around 30cm at the apex of the bank, between approximately 4 and 5 m E. Beyond this, both up and down the slope it returns to a thickness of around 20cm, which is similar to the A horizon thickness encountered around the other features excavated. If the bank was formed by natural processes therefore, it would seem that it formed by accumulation of sediment from upslope, rather than by erosion of sediment from its downslope side. However if this is the case then the evidence contrasts with that at other excavated features, where redeposited sediment and buried A horizons have been clearly visible. Here, neither field observations nor laboratory analyses have been able to pick out either a discrete concentration of redeposited sediment, or a (trustworthy) buried A Horizon. This could be because the A horizon in the bank has not been protected by an overlying feature, and so podsolisation and soil formation has mixed the redeposited sediment in with the topsoil and obscured the picture. This may have happened to some extent, but it is unlikely to be the only factor involved, as redeposited sediment has been identified upslope of other features where there was no protective covering of rocks.

Alternatively it may be because the accumulation of the sediment at the bank was sufficiently slow for the sediment to be absorbed into the A horizon as it was accumulating. This is perhaps more likely than the first hypothesis, and if it were the case it would suggest perhaps that different activities were happening upslope of Trench 6 than were taking place upslope of Trench 4. Trench 4 is on a similar slope to Trench 6, but the redeposited sediment is clearly visible. There is a possibility therefore that the activity around the former was more damaging to the soil than the activity around the latter and so it added redeposited sediment to the bank at a faster rate than it could be absorbed into the A Horizon. A further possibility however, is that the soils at Trench 6 were coarser in general, and therefore their transport required runoff events of greater magnitude, which occurred less frequently.

The final hypothesis for the formation of this bank is that it has not accumulated naturally and is either deliberately man-made or is an incidental by product of hoeing or tilling activity.

5.8 TRENCH 5 GARDOMS EDGE – SK 427475 373500

Trench 5 was an earthen bank in the Gardoms Edge caimfield that was excavated in 1999 as part of the Gardoms Edge project. In that year one of the foci of the project was the northem part of the caimfield (area 3, Figure 13). This was characterised by slightly larger caims, many of which were located in a roughly rectangular area delimited by one earthen and two stone banks. In contrast to other parts of the caimfield, the caims here seemed to form a more regular, almost grid-like pattem. This difference in the size and spacing of features suggested that perhaps the land was more formally divided than elsewhere, or that the land use had been different. Both of these scenarios hinted at chronological differences between area 3 and those places where the fields seemed smaller and the caims more irregularly spaced.

Trench 5 was a section through the earthen bank forming the southem boundary to the rectangular area. The purpose of the excavation was to investigate how the feature had formed, and to test the hypothesis that it had formed by the accumulation of eroded sediment against an obstacle. An altemative hypothesis was that it may have formed from the erosion of sediment on its northem side, and this was also considered. The bank was oriented roughly east-west, and was approximately 100m long. It was asymmetrical, being steeper on its northem side, but the apex of the slope on this side was no more than 10cm above the ground surface to the north. In this area of the caimfield, the land sloped to both the north and east. The slope to the north was hardly noticeable at around 1:50. That to the east was steeper, at approximately 1:20. As the bank was oriented east-west, it was actually parallel to the main slope, and was not therefore an obstacle to sediment movement in that direction.

5.8.1 Results of Excavation

Like at Trench 6 on Big Moor, there was no lithological entity that defined the bank, and in section it appeared simply as a thickened A horizon between 3.5 and 5.8m N, (Figure 37). In this area, the A horizon reached a thickness of 20-25cm. Outside this area to the north, (downslope) it was thinner, reaching a maximum of 20cms. Outside to the south (upslope) it was thinner still, reaching 10-15cms. The only other field observation that indicated any difference between the A horizon inside and outside the area of the bank, was that inside the bank, the A horizon contained fewer coarse fragments than it did outside (less than 10% compared to 10-15% to the north and south).

5.8.2 Samples

Two cube column samples were extracted from the bank.

Sample 501 was taken downslope at 6.5m N.

Sample 502 was taken through the centre of the bank at 4.5m N.

5.8.3 Results of Laboratory Analyses

Table 21 - Trench 5 Gardoms Edge Sample 502

Depth cm	Description	Xlf	% sand	% silt	% clay	Mphi	Std. Dev
3	Turf	-2.57	33.4	60.9	5.7	5.2	2.5
6	H horizon	0.00	40.8	54.2	5.0	5.0	2.4
8	A Horizon	-0.03	41.5	53.7	4.8	5.0	2.4
12	A Horizon	-0.82	46.0	48.0	6.0	5.1	2.6
17	A Horizon	-1.44	50.6	44.5	4.9	4.9	2.5
22	A Horizon	-1.44	53.0	42.1	4.9	4.9	2.5

Depth cm	Description	Xlf	% sand	% silt	% clay	Mphi	Std. Dev
1	Turf	-24.5	54.2	40.7	5.1	4.9	2.5
3	H Horizon	0.0	47.9	47.4	4.7	4.9	2.5
10	A Horizon	-0.5	46.4	48.0	5.7	5.1	2.6
15	A Horizon	-2.4	50.1	44.4	5.5	5.0	2.6
20	A Horizon	-1.9	36.4	58.6	4.9	5.0	2.5
25	B horizon	-3.7	31.9	62.5	5.6	5.2	2.5
30	B horizon	-1.3	27.5	66.8	5.8	5.3	2.5
35	B horizon	-0.9	28.4	65.0	6.6	5.3	2.6
40	B horizon	-0.9	27.7	65.7	6.6	5.3	2.6

5.8.4 Results of Laboratory analyses

There is nothing in the laboratory data from sample 502 to suggest that the A horizon in the centre of the bank, has been augmented by the addition of redeposited material. Figure 38 shows the plots for the laboratory analyses. On the particle size plot, the proportions of sand silt and clay remain fairly constant from the top of the A horizon at around 7cm below the surface, down to the base. The mean phi values indicate that the sediment in the centre of the A horizon at 12 cm, is slightly finer than that at the bottom, but the difference is minimal and probably not significant. Likewise the sorting values at the same depth, indicate that the same material is worse sorted, but again the difference in values is so low that this also cannot be taken as significant. The magnetic susceptibility values show a slight increase towards the bottom of the graph but no significant anomaly which would indicate either the presence of redeposited material or a buried A horizon.

The inference here is therefore the same as that for Feature 6 on Big Moor. Either the thickened A horizon within the bank was caused by material added so gradually that it was incorporated into the A horizon rather than fossilising it, or the bank was built by people. Of the two possibilities, the second is probably the more likely, because the orientation of the bank is cross contour, and therefore if the bank is the only trace left of a pre-existing feature, that feature was not a slope obstacle.

The alternative hypothesis was that the bank may have formed through erosion of material from its northern side. Again, the lithology does not suggest this. If the area downslope of the bank had been eroded, then some truncation of the A horizon to the north of the bank would be expected. The A horizon to the north is actually slightly thicker than that to the south, so no truncation is evident. The sediment in the centre of the bank contained a slightly lower proportion of coarse fragments than that outside the bank to the north and south, but these were evenly distributed throughout the profile including the top. If the deposition of sediment was of a sufficiently low magnitude so as to leave no trace in the top of the A horizon, then presumably runoff events were of equally low magnitude. If this was so then it would be hard to account for the deposition of coarse fragments of the size present in the top of the A horizon within thebank. The variation in coarse fragment content is therefore inconclusive.

The laboratory analyses from sample 501 to the north of the bank are also uninformative (Figure 38). If the A horizon had been truncated then it would be expected to be coarser in the upper part, due to the loss of finer material which would be more easily transported. The A horizon is slightly coarser in its upper part but again the difference is minimal, as are the differences down the profile in all the other analyses. There is therefore no evidence from either the lithology or the laboratory analyses to support the hypothesis that the bank formed from erosion.

5.8.5 Summary

There is nothing to indicate that the bank was formed by erosion of material from its northern side. Neither is there any evidence to support the idea that it formed by accumulation of material coming from the south. This is also unlikely to have happened because the steeper slope is east-west, parallel to the bank. Therefore if sediment had been moving, it was far more likely to have moved in that direction and would not have accumulated on an east west orientation. If, despite this the bank did form by accumulation, then it would seem that material was added in quantities small enough to be incorporated into the soil as the sedimentation was occurring. From this it appears that any erosion that might have occurred, was not of a sufficiently high order as to fossilise the prehistoric A horizon.

5.9 TRENCH 9 GARDOMS EDGE – SK 427485 373505

5.9.1 Location and Description

Trench 9 was a section through a cairn that had been built on the earthen bank that was sectioned by Trench 5, but was located approximately 50m upslope to the west, (Figure 13). It was selected for excavation primarily because of its asymmetry, which suggested a build-up of eroded material on its southern side, but also to investigate the relationship between the cairn and the bank below. The cairn was therefore half sectioned, and on reaching the "natural" a sondage was dug to the level of the C horizon.

5.9.2 Excavation and Stratigraphy

There was no order to the placing of the stones in the cairn, that was suggestive or anything except clearance of stone from the surrounding area. In the top of the cairn however was a cupmarked stone. The significance of this is not known as no other evidence of a ceremonial or ritual function was found.

The upper stones of the cairn were of mixed size and shape, and were placed apparently randomly over the lower stones, and the cairn as a whole had been placed on, and around a large earthfast boulder. There was nothing in the placement of the stones to indicate whether or not the cairn had been built in phases.

The lower layers of stone appeared to have been placed on a buried A horizon which was immediately below the prehistoric A horizon. In Figure 39 this is shown as context 9020, which is immediately to the north of the earthfast boulder. In the field it was lighter in colour and texturally different slightly finer than the A horizon above. The shape of this layer as it appeared in section, suggested that it had been truncated (Figure 39). The layer dipped and pinched at approximately 3.4m N. From this point, (apart from a small patch at 4.1m N), it was not visible in section until 4.75m N where it formed a layer around 10cm thick, which extended to the end of the section and presumably beyond. At the northern end of the section it was immediately overlying context 9010, the B horizon and was immediately beneath context 9019, (the A horizon). Underneath the cairn however it was immediately above context

9011. This was a sandy layer, whose pale colour suggested that it was heavily leached, and which also pinched and disappeared to the north in the same way as context 9020. The stratigraphic sequence under the cairn is shown below.

Stratigraphic Sequence at 3.55m N - Sample901

Context	Description
9001	Turf
9002	H Horizon
9012	Interstitial sediment and organics
9019	A Horizon
9020	Buried A horizon
9011	Leached layer
9010	B horizon

5.9.3 Samples

Columns of cube samples were taken for magnetic susceptibility loss on ignition and particle size, these were –

Sample 907 taken at 1.5m N

Sample 901 taken at 2.45m N

Sample 902 taken at 3m N

Sample 903 taken at 4.65m N

In addition Samples 908 909 and 910 were taken for OSL dating purposes. These have not yet been processed however, as, because of financial and time constraints, it was decided to prioritise the Big Moor samples.

5.9.4 Results

Table 22 - Sample 901 - Analytical Data

Depth	Context	Description	Xlf	% sand	% silt	% clay	mean (Mphi)	std. dev.
14	9012	Interstitial	2.5	57.0	38.9	4.05	4.53	2.4
16	9012	Interstitial	1.2	55.8	39.3	4.9	4.68	2.7
20	9012	Interstitial	1.3	47.9	47.4	4.65	4.91	2.5
22	9019	A horizon	0.9	53.2	40.7	6.14	4.89	2.9
26	9019	A horizon	1.2	45.3	49.0	5.71	4.87	2.8
31	9019	A horizon	0.9	53.3	41.7	5	4.74	2.7
35	9019	A horizon	2.2	48.4	46.4	5.17	4.79	2.7
37	9020	Buried A horizon	4.2	49.8	45.4	4.79	4.74	2.7
40	9020	Buried A horizon	1.5	54.3	42.3	3.41	4.47	2.4
52	9011	Leached	1.1	57.2	39.4	3.37	4.43	2.4
68	9011	Leached	0.4	53.9	42.3	3.85	4.58	2.5
62	9010	B horizon	0.5	57.1	40.2	2.64	4.25	2.1
68	9010	B Horizon	0.6	57.4	37.2	5.4	4.8	2.9

5.9.5 Analysis and Discussion

The bank and cairn were excavated in order to investigate a) - the relationship between the cairn and the bank, and b) – how the bank was formed. With reference to the relationship between the cairn and the bank, the excavation demonstrated that the cairn was placed above the bank and was therefore later.

As far as the formation of the bank was concerned, there are three possible ways in which this could have formed.

- It could have formed by the accumulation of eroded sediment against an obstacle such as a hedge or fence.
- It could have been built by people.
- It could be formed from the removal of material from downslope.

Figure 40 shows the results of the data analysis for the sediment in and under the cairn. Starting with the uppermost levels of the feature, in the sediment at the top of the cairn (context 9012) there appears to be at least two elements. At 14cms there is moderately fine sediment with a high proportion of sand sized particles, and just below at 16cms, there is finer material, both of which show up as anomalies on the magnetic susceptibility curve. This is interesting as, approximately one metre further north in the section, context 9012 is overlain by context 9013 which was coarser textured, and also appears to the south of the cairn immediately overlying the earthfast boulder. It is possible then, that 9013 overlays 9012 within the cairn but was not identified in the field. Given its stratigraphic position, it is probable that 9013 is a product of weathering of the stones in the cairn. 9012 could be material redeposited from upslope, which in this case was to the west of the section. This could not be firmly established from the stratigraphy however as the section had been excavated parallel to, rather than cross contour owing to the orientation of the feature.

Below this from approximately 20-30cm, context 9019, which is the prehistoric A horizon, (now podsolised) is represented on all the data. It has a very slight stratigraphic expression on the magnetic susceptibility curve and shows as fairly fine but badly sorted material on the mean and sorting plot, which is to be expected as it ranges in size from sand to silt, containing similar proportions of both. It can be identified as a unit, therefore, even though the top is sandier and coarser than the base.

Context 9020, the buried A horizon shows from around 35cms, as a prominent anomaly on the magnetic susceptibility plot, a small increase in the percentage of sand, and slightly lower phi values. These indicate that it is slightly coarser textured than the sediment above and below, but the standard deviation indicates that it is better sorted.

The leached layer below, (context 9011) has low magnetic susceptibility values which distinguish it from the buried A horizon above, but are not sufficiently different from those of the B horizon below to be diagnostic. The particle size data however, indicate that 9011 is texturally similar to 9020. Other than the sharp anomaly in the magnetic susceptibility curve, at 37cm, the data for these two contexts are very similar. On the basis of the granulometric data at least, they appear to be one unit, which is different to those above and below.

In summary, the laboratory data has generally corroborated the stratigraphic field observations and has supported the interpretation that several different sedimentary units are present within and under the cairn. These comprise two apparently different sediments in the interstices of the cairn, the prehistoric A horizon on which the stones of the cairn were placed, an older buried A horizon and a leached layer. In addition, there are some indications in the data that the buried A horizon and the leached layer, despite appearing completely different in the field, may be the same entity.

Taking into account both the field observations and the laboratory data, there are several possible scenarios as to how the bank may have formed. First, assuming that the top of the prehistoric A horizon, (context 9019) represents the top of the bank, there are few indications that this material may have accumulated. The only hints of this might be the higher proportion of sand and the slightly coarser texture, at around 25cms and the slight increase in magnetic susceptibility values at the same level.

Mitigating against the idea of accumulation however, is the fact that there was no lithological unit *in the prehistoric A horizon* that could be identified in the field as accumulated sediment. There was sediment *above* the A horizon, (context 9012) which appeared to be redeposited, but this was a clearly defined separate unit and so could not account for the thickening within the A horizon. This sediment clearly post-dates the thickening of the prehistoric topsoil. The bank also runs east-west, which is parallel to the main slope, and if it marked the line of a former hedge or fence, those features would not have been slope obstacles. It does not seem possible therefore that sediment would have accumulated in this direction due to slopewash

The second way in which the bank may have formed is by the erosion of sediment from its north side. (Presumably this would mean that there was a hedge or fence running along the line of what is now the bank, and material was being removed from the northern downslope side of that). In support of this scenario, the A horizon outside the bank to the north is thinner than it is inside the bank. However, the profile at Trench 5 Gardoms Edge which was the same bank, showed that the A horizon to the north of the bank was thicker than that to the south. If the bank had been formed by erosion from the north, this would not be expected. Taking the results of both excavations together therefore, there seems to be no consistent indication that the A horizon to the north of the bank had been eroded.

Like Trenches 5 and 6 on Big Moor therefore, it is possible that the bank was a built feature as none of the natural processes can fully account for its formation.

Two questions remain. The first relates to the presence of stones within the bank sediment and how they came to be in that position. Their stratigraphic position in relation to the buried A horizon suggests that they may have been placed upon this surface and subsequently covered.

The second question is that of what truncated the buried topsoil, and this is difficult to answer. Looking at the section, a possible answer is that the topsoil was truncated by being scraped up to make the bank. This scenario would explain how the A horizon inside the bank was buried, and how that immediately outside the bank was truncated, but it does not explain how the buried A horizon beyond the bank further north was fossilised. This is a question that neither the field observations not the laboratory data can answer.

In summary therefore, the only probable accumulated sediment that was identified during the course of the excavation was context 9012, which may have moved down the slope from the west and covered part of the cairn. Context 9013 is more likely to be material weathered from the stones of the bank. Context 9019 was firmly identified in the field as the prehistoric A horizon, which is now podsolised. A thickening of this A horizon is all that defines the bank as a feature, and the idea that that thickening was the result of accumulation of sediment against an obstacle is unlikely, given that the bank is oriented parallel to the slope. In addition, no firm evidence of redeposited sediment has been found within the A horizon, either in the field or in the laboratory data, despite the fact that the identification of context 9012 suggests that, where it exists, such sediment can be identified in the field. Therefore, the alternative hypothesis - that the bank was built - seems at least as likely, if not more so, to be correct.

5.10 SOIL LOSS

Few of the geomorphic field observations and excavations provided evidence of significant prehistoric soil loss. The general impression gained from the sedimentary sequence at the nick point, and from examination of sediments in the cairnfields was that post prehistoric transport routes were the only features to show obvious signs of erosion and sedimentation. The hollow ways form conspicuous rill and gully-like erosional features in several parts of the upland landscape but the depositional areas associated with these features were much less obvious. Excavations of presumed prehistoric slope obstacles yielded the only evidence of prehistoric soil loss. It was clear that using these two types of feature, a rough quanitified comparison of soil loss caused by each type of activity could be calculated.

Prehistoric agricultural soil loss could be estimated by a calculation of the amount of sediment accumulated against slope obstacle features downslope from presumed fields. With the transport routes, the calculation of soil loss could be estimated from the sediment removed from gullies on the hollow ways. Although each method, obviously measured different factors, each could provide a figure for soil loss per square metre of land surface, which could then be used to compare the effects of the two activities. Furthermore, because a hollow way crosses the same surface as one of the prehistoric fields, the estimates apply to soil loss on the same slope in two different periods and provide a direct comparative example of how these two distinctly different forms of land use have affected this landscape.

The best candidates for the calculations were the prehistoric bank, which was sectioned by trench 2 on Big Moor, and the hollow way formed by the pack horse route, which was adjacent to and ran immediately east of it (Figure 41).

There were several reasons for choosing these features. First - of all the prehistoric features examined on either Gardoms Edge or Big Moor, the bank had the most sediment backed up against it. In fact it was the only one which had any significant amount of sediment build up. Second, part of the bank had been excavated and the volume of sediment embanked against the feature could be estimated from the trench section profiles. In addition, the bank had been sectioned for excavation at its highest and widest part, so presumably, unless the composition changed significantly along its length, this part contained the most sediment and therefore could be used to estimate the maximum volume of sediment build up. Third, the hollow way next to the bank was on the same slope, with the same aspect and the same soils, which meant that all these factors could be discounted at the outset, as explanations for any differences in results. Finally the proximity of the features meant that the effects of the two activities on the same area of land could be directly compared.

However, it must be stressed that the exercise was designed as a quick and easy way of obtaining some idea of the relative intensities of past erosion. It was not possible to measure fully the exact amount of sediment movement associated with each feature, and it is not suggested that the data are comprehensive in that respect. The results are intended to provide a reasonable approximation of soil loss within the existing time constraints and the limitations imposed by the fact that the features are scheduled ancient monuments, which negated the possibility of large scale excavation.

Furthermore, these estimates rely upon certain assumptions, which need to be considered when viewing the results. In the case of the bank, there are three worth considering in detail. First, it is assumed that the bank caught all the sediment that was moving downslope. There is essentially no way to test this assumption, but given the height and orientation of the bank it is probably a reasonably safe one. However, if a significant amount of eroded soil were being carried past the bank rather than being deposited against it, it would be expected that this material would be present in the nick point and/or the alluvial fan deposits, as both are a short distance downslope. Neither of these features was found to contain any datable Bronze Age sediments, which suggests that either any Bronze Age soil loss derived from this slope was subsequently eroded from these areas, or there was no significant soil loss during this period. The results of the luminescence dating of sediment behind the bank clearly indicates that there was some soil loss from this surface during the Bronze Age, but the lack of sediment in the nick point and alluvial fan may support the assumption that there was little eroded sediment bypass of the bank.

The second assumption is that the bank does not vary significantly in composition along its length, by changes in either stone or sediment content. This did not appear to be the case on close inspection of the unexcavated portion, but can only be satisfactorily tested by digging the entire feature. However, the Bronze Age sediments within the excavated section of the bank contained almost no stones, so it is unlikely that any other section would contain significantly fewer. In addition, the bank was sectioned at its highest and widest point. The sediment content of other parts of the bank may therefore be lower, but is unlikely to be significantly higher than in the excavated part, and the actual volume of sediment within the bank may similarly be lower but is unlikely to be much higher than the calculated volume. The calculated volume should therefore be seen as close to a maximum figure.

The third assumption is that the dimensions of the sediment source area are realistic. This is the most problematic assumption because the size of Bronze Age fields are not known and have in this case been assessed from the presence of clearance cairns. The area used in the calculation for the bank assumed that the field lay immediately upslope from the bank and ended at the next nearest prehistoric features. These features may not be contemporaneous with the bank. If they are younger, the size of the field used in the calculation will clearly be smaller than the maximum possible based on the topography, and the calculated soil loss (in cm/m^2) will overestimate the true value. On the other hand, there is no way of knowing how much land was cleared at any one time. If the cleared area were smaller than the proposed sediment source area, then the calculated soil loss (in cm/m^2) will underestimate the true value. The implications of this are discussed further below.

In the case of the hollow way, it is assumed the geomorphic expression of the feature accurately reflects the soil loss on this surface. In reality, there is likely to be local deposition of sediment within the hollow way, and the true amount of soil loss on this slope could only be obtained by excavation, and this was not done. Furthermore, the erosional complexity of this feature is quite high owing to its braided nature. The method we used to estimate soil loss of this feature was expedient but not necessarily very precise. For this reason the minimum and maximum values should both be considered.

5.10.1 Method

For each feature soil loss was calculated in stages, using drawings of either the cross-sectional area of accumulated sediment (as in the case of the bank) or the cross sectional area of soil loss as indicated by surface topography (as in the case of the hollow way).

For the bank, the calculations were based upon the excavation section drawings from which the profiles of accumulated sediments visible in section were first outlined, and then traced on to graph paper (Figure 42). The area of the sediment present in the two cross-sections was then calculated by simply counting the squares or part of squares on the graph paper. The volume of sediment accumulated against the bank was then estimated by multiplying the cross-sectional area by the length of the bank (19.5m) which provided minimum and maximum values. To estimate soil loss the area of the field had to be assumed, and as was mentioned previously, this was assumed to be the land immediately upslope of the bank, whose northern boundary was the bank itself and whose southern boundary was formed by the nearest slope obstacles (prehistoric cairns). This formed a rectangle that was 19.5m wide and 47m long (Figure 41). Soil loss was calculated by dividing the volume of sediment behind the bank (in m^3) by the size of the most likely area over which soil loss could have had occurred (in m^2), to give a volume of soil loss in cubic centimetres per square metre.

The packhorse route is represented by a hollow-way, between 8.6 and 10m wide which is heavily braided and rilled in places. After careful examination of the rills, four profiles were drawn across the feature on the same slope section as the presumed prehistoric field. The cross-sections were drawn by erecting a level string line across the hollow way, and then the topography of the surface was established by measuring down from that line to the ground surface at 10cm intervals (Figure 43). The results were plotted directly on to graph paper at a scale of 1:20. Examination of the profiles showed that some of the high areas between the rills were higher than the adjacent land either side of the hollow way and therefore probably represent deformation or pushing up of the soil. For this exercise therefore, the original ground surface was taken to be the current ground surface to either side of the hollow-way, which was then extrapolated across the width of the feature.

The cross-sectional area for each profile was calculated by counting the squares or part of squares on the graph paper below the inferred ground surface. The volume of soil lost was then calculated by multiplying the cross-sectional area of the hollow way by the measured length, which was arbitrarily designated as the same length as the presumed prehistoric field behind the bank, or 47m. Four measurements were made and only the maximum and minimum values are used in the comparison. This is because this method of estimating soil loss on such an irregular feature is considered to be fairly imprecise, but could be done without excavation. More precise methods could have been used, but for the purpose of this exercise, the time required could not be justified. It is recognized that the hollow way is a much longer feature, but the purpose of this comparison was to compare directly, soil loss on the same slope in two different periods.

The results of the calculations and measurements are shown in Table 23 below.

5.10.2 Results

Table 23 - Comparison of Packhorse Route and Prehistoric Erosion

Feature	Cross-section Area (m^2)	Length (m)	Volume (m^3)	Sediment Source Area (m^2)	Soil Lost (m^3/m^2)
Bank E-facing	1.43	19.5	27.88	916.5	0.03
Bank W-facing	1.46	19.5	28.60	916.5	0.03
Pack Horse route MINIMUM	1.19	47	55.93	418.3	0.13
Pack Horse route MAXIMUM	1.87	47	87.89	418.3	0.21

What the results show quite clearly is that far more soil per square metre of land surface was lost from the pack horse route, than from the area which was the probable site of the Bronze Age fields. The latter lost approximately 3 cm/m^2 throughout the life of the bank. If the Bronze Age fields were, for example, only half the size of the potential source area used in the calculation, ie. 458.25 m^2 the maximum amount lost per m^2 would still be only 6cm/m^2. The minimum amount lost from the pack horse route was 13 cm per m^2 so at the least, this feature lost double the amount of soil and at most it lost up to 7 times as much. One obvious reason for the rate of soil loss from the pack horse route is that erosion was channelled by the hollow-way. It is possible to envisage a scenario in which animals and humans travelling in wet weather over a small area of land, would soon remove the vegetation cover, leading inevitably on the light sandy soils of the gritstone, to erosion and the formation of a hollow-way. Once such a feature had formed, it would serve to channel surface water and so would accentuate erosion, a process that can be seen in operation on most of the footpaths on the moors today. The magnitude of soil loss on the hollow-way can therefore be understood in terms of simple physical processes. For the purposes of this project however, the magnitude of the soil loss caused by agriculture, or rather the implications for our understanding of that activity are rather more complex and will be discussed further in the next chapter.

TRENCH 2 GARDOMS – SK 427240 373270

Location and Description

Trench 2 was dug in order to investigate part of the prehistoric pit alignment which runs for approximately 360m east-west across the eastern part of the Gardoms Edge cairnfield (Figure 13) where for much of its length the bedrock is shale. It paralles a stone bank, around 70m to the north, which has been interpreted as a boundary feature, and the similarity in alignment of the two has raised the question of whether this is significant to their interpretation and whether they are contemporaneous.

The alignment varies in character along its length, particularly towards its western end. Here it becomes more of a ditch and the upcast from the digging of the ditch is in some sections more of a continuous bank. In other areas further to the east individual pits can be made out on the ground, associated with individual mounds of upcast.

Excavation

An evaluation trench in the 1998 season had established that a pit near the top of the slope to the east of the main cairnfield had been lined with clay, despite being on a clay rich substrate, (Barnatt et. al. 1998 unpub). In the 1999 season, it was decided to half section two adjoining pits and the associated upcast (Figure 44). The purpose of the excavation was to find out more about the morphology of the pits, to see if more were clay lined and how they might vary, to obtain environmental samples from the peaty pit fills, and to see if any material was present which might shed some light on the function and date of the feature. The excavation revealed that the two pits sectioned had both been clay-lined, were around 50cm deep and had a diameter of around 1 to $1^{1/2}$m, (Barnatt et. al 1999-2000). They were filled with peat, which had presumably accumulated after the period of use, due to the more or less permanently waterlogged conditions towards the base of the features, (ibid). There were also silt bands within the peat, which suggested that some inwash of soil from the surrounding area had occurred while the peat was developing, (ibid).

Sampling

During the excavation a peat monolith had been extracted from the fill of the eastern pit, (Figure 44 - trench 2 section drawing no. 222) for pollen analysis, and a sample for radiocarbon dating was subsequently taken from the basal peat in the monolith. The buried turfline under the upcast bank to the south of the pits had also been sampled for radiocarbon dating purposes, (Figure 44 drawing 208) and it was decided to run these samples as part of this research to try to bracket the use of the pit, and to obtain dates from Gardoms Edge for comparison with those obtained from Big Moor. The dates are shown in Table 24.

Results

Table 24 - Radiocarbon Dates from Pit Alignment

Material Sampled	Context No	Depth from surface	Type	Lab. No.	Age	C14 Calibrated (Oxcal) (95% prob)	Calendar Age (OSL)	Context No
palaeosol	2018	39	C14	AA-43264	2105	±	43	210 BC-10 AD
Pit fill (peat)	2052	25	C14	AA-43265	2097	±	44	210 BC-10 AD

Discussion

The assays returned ages that were statistically indistinguishable, indicating that the time from the digging of the pit to its subsequent filling was a maximum of around 200 years, and dating the pit to the Iron Age. The pit fill from which the pollen monolith and the radiocarbon date (AA 43265) was extracted, was composed of unhumified peats. These had higher mineral contents from the base up to around 16cms. They were covered by better humiifed peats with lower mineral contents which extended from 16cms up to the top of the fill. The monolith was analysed at the University of Sheffield by K Seddon for an undergraduate dissertation. The context numbers of the pit fill are shown in Figure 44 drawing 222.

The results of the analysis indicated, for the dated basal peat, (context 2052) a vegetation cover of heaths and grasses in the Iron Age that was comparable to that recorded by Hicks, (1971) and Long (Long et. al. 1998) for the same period on other moors. Through the monolith however, Seddon found significant correlations between the relative proportions of grasses and the amount of mineral sediment in the peat. Where the proportion of grass pollen increased, the mineral content of the peat increased and the proportions of the pollen of heaths decreased.

The peat in the centre of the monolith (Contexts 2051 and 2038) contained the highest proportion of grass pollen, the lowest proportion of calluna pollen and also evidenced the lowest loss on ignition values, of between 20% and 50% compared to 60% to 80 % from the peats above and below. From this data, the dominance of grass pollen seems therefore to be associated with landscape instability, evidenced by the inwash of mineral matter to the peat. Unfortunately the upper layers of the pit fill are undated and the fluctuations cannot therefore be assigned to a period. The association between sediment inwash and high proportions of grass are however interesting in view of the proposals of both Hicks and Long, that the further reductions in tree cover seen in the Roman period may be connected to grazing activity. The first phase of sand inwash at the nick point on Big Moor is also accompanied on the nick point skeletal pollen diagram, by the lowest levels of Calluna pollen (20-35% of TLP.) and by a prominent peak in the poaceae totals (Figure 45). These similarities may be coincidental, but they provide food for thought on the nature of the land-use on Gardoms Edge in the Roman period and the effects that land use had on the stability of the soils.

Summary

It has been argued for some time that the cairnfields continued in use through to the later first millenium BC, (Barnatt 2000, Bevan 2000, Long 1994, et.al. 1998), and the dates appear to confirm this. While excavation of the pits has not clarified their function, the dates still indicate a human presence in the cairnfield in at least the Iron Age. The work by Seddon also indicates that landscape instability continued for an unknown period after the pits began to fill with peat, but the association between landscape instability and a upsurge in the pollen of grasses is similar to that recorded for the Roman period in the nick point data. If this is more than coincidence, it supports the positions taken by both Hicks (1971) and Long (1998) that grazing activity continued in the cairnfields into the Roman period.

6 DISCUSSION AND CONCLUSIONS

In conceptual terms this project was designed to examine two kinds of evidence; that relating to local activity within the cairnfields, and evidence derived from sedimentary deposits in contexts that could provide a larger-scale and longer-term view. In practical terms these two types of context can also be thought of as upland and lowland environments, although the two environments were not physically very distant. The shelves on which the cairnfields are located were for these purposes the "upland" environment, where it was expected that the erosion would be taking place. The valley bottoms or the bases of slopes were the "lowland" environments, where it was expected that the products of erosion would be deposited. In fact the lowland environments examined were places where eroded sediment *must* be found, if it had been deposited at all in the near vicinity of the cairnfields.

This framework encountered a problem of sorts when the project was in the prospecting stage. In prospecting on Gardoms Edge, the obvious place to look for redeposited sediment was at the base of the slope separating the mostly westerly part of the northern cairnfield from the eastern parts. At this point, there is a band of shale forming the lower ground between the slope of the Chatsworth Grits, rising to the west, and that of the Rivelin grits rising to the east (Figure 12). Most of the cairnfield remains are located towards the tops of these slopes while the shale is relatively free of upstanding features. The only place for runoff from these slopes to go is down onto the shales, and so two large test pits were dug at the base of the slope in search of redeposited sediment. It was expected that this would be easy to spot, as test pitting during the Gardoms Edge Project (Barnatt et. al. 1997, 1998, 1999) had confirmed that the clay-rich soils on the shales were completely different to the sandy soils of the grits. Nothing was found initially however, except for a thin band of seat earth or coal (which caused great excitement at first, until it was realised that it was not a buried turfline).

A buried turfline or H horizon, covered by around 10cms of redeposited material was eventually discovered further north along the same base of slope during the 1999 season of excavations. It was a localised phenomenon, which was only present in two test pits on one east-west transect and it did not amount to a significant sequence of sedimentary deposits such as that recorded by Boardman (1992) on the South Downs. A long-term sedimentary sequence did not seem to exist therefore for Gardoms Edge. This was one of the first indications that evidence for significant prehistoric erosion of the topsoil, would be hard to find. The evidence for erosion that was found during the course of the project will be the first issue to be dealt with in this chapter. This will then be followed by a discussion of the dates obtained. As there is considerable overlap between the chronological and sedimentary aspects of this study, the dates obtained will also be referred to where this aids discussion, in the soil erosion section.

SOIL EROSION

The Archaeological Features (upland).

Trench 2, the stone and earth bank at the northern end of the Big Moor cairnfield, contained the largest deposit of accumulated sediment discovered on either Big Moor or Gardoms Edge. The sediment was easy to identify because of its position relative to the stone components of the bank, and was clearly evidenced by the laboratory data. Although it was on a relatively steep slope with a distance of approximately 50m to the nearest slope obstacles, the bank had only accumulated around 50cms of sediment. The results of the comparative study of soil loss at the packhorse route and trench 2, indicated that this 50cm represented a maximum of around 3cm/ m^2 of soil lost from the fields above the bank. This is a trivial amount given the steepness of the slope and it would not have caused major truncation of the prehistoric A horizon.

A similar picture was observed at trench 3, where the maximum amount of sediment that had accumulated against the upslope side of the cairn was 25cms. Approximately 1m further upslope this depth was closer to 5cm. This is only half of the depth of sediment that had accumulated at trench 2, but the slope was only half as steep as the one above that feature. The potential length of the field from which the sediment had probably come was similar at around 50m, and although there were more slope obstacles west of trench 3, these were in the form of scattered cairns which would have formed a relatively ineffective barrier to runoff and sediment movement.

The cairn at trench 3 would have also been fairly inefficient at obstructing the downward movement of sediment, and so might be expected to have accumulated proportionately less sediment than the bank at trench 2. The fact that it was sectioned at its highest point where prior to excavation the amount of sediment build-up seemed to be greatest, compensates to some extent for this. Towards the edges of the cairn, it appeared in the field that less sediment had accumulated, and so the depth of 25cm is probably a maximum. Taking the above factors into account, the accumulated depths of sediment at both features is comparable and this suggests that the erosion of soil around Trench 3 was also minimal.

At Trench 4, the stone bank in the southern part of the Big Moor Central cairnfield, the maximum depth of redeposited sediment was around 5cm. This was the smallest amount of accumulation encountered. There are two possible reasons for this. First, trench 4 is situated on the shallowest slope of any of the features examined, and there is a possibility that only the highest intensity runoff events would have provided sufficient energy to mobilise and deposit sediment in this area.

Second, there were fewer archaeological features upslope of the bank, and if the number of features is an indication of the amount of agricultural activity it seems that the immediate area may have seen less use. This impression was reinforced by the stoniness of the ground immediately upslope of the bank, which suggested that the land may not have seen any significant stone clearance. In addition, the bank itself did not appear to have been augmented by the addition of clearance stone, although the last two observations are based on a 1m wide trench, which is too narrow an excavated area from which to draw firm conclusions. These scenarios are not mutually exclusive and both could apply.

Trench 9 on Gardoms Edge was the only other context where any redeposited sediment was firmly identified. The situation here was slightly different to that of the other features because this was the only one that was orientated cross contour, and consequently the only one where the excavation trench was parallel to contour. It was excavated in this way in order to section the width of the underlying bank, but unfortunately this precluded the possibility of seeing in section the full depth of any sediment build-up. The redeposited sediment identified was a thin covering between the top stones of the cairn, no more than a few centimetres thick, but it was clearly identified in the field and by the laboratory analyses.

Unfortunately comparisons with trenches 2, 3 and 4 on Big Moor, suggest that the amount of redeposited sediment found on the tops of features, provides little indication of the depth of sediment accumulated against them. The amount of sediment above the features is as much an indication of the spacing of the stones and whether these are positioned so as to trap sediment, as it is of the amount of sediment deposited. Because of this it was not possible to make a reliable estimate of the amount of sediment that may have accumulated against the upslope side of that bank.

Together, these four features form the entirety of the contexts in which redeposited sediment was clearly identified in the "upland" facet of the project. On two of the features, the redeposition of the sediment was dated to the prehistoric period. It is assumed that redeposition of sediment at the other two was of similar date, although this cannot be established for certain. On none of the features could the amount deposited be interpreted as representing significant soil loss from prehistoric fields. On all, the scale of sedimentation seemed to be similar or less than that at trench 2, and this by comparison to the erosion on the packhorse route was minimal. This becomes particularly apparent if the possible timespan over which deposition could have occurred is considered. Taken together, the maximum spread of the dates from trench 2 including errors, is 1600 years (BC 2401 – BC 779) although this is based on the earliest possible to the latest possible dates and so could well be an over-estimate. A more cautious assessment is achieved by taking the mid-points of the earliest and latest calendar dates. If this is done, the timespan is still in excess of 1000 years (BC 2169-943). The results from these features therefore, suggest erosion was not a serious problem for the Bronze Age farmers. There are two possible reasons for this. Either the agriculture practised was not damaging to the soil or whatever was causing the erosion was of short duration.

It is possible to draw only one conclusion as to the nature of the land use, and that is that it is highly unlikely that over the period indicated by the dates the fields were used continuously for arable farming. With the light sandy soils of the grits, much more severe erosion would be expected if this were the case. If continuous cultivation is discounted then there are two other broad possibilities. One is that the land-use was dominantly pasture, the other is that the fields were only used intermittently for arable.

If the land use was pastoral then it is a possibility that there would be periods of over-grazing that could produce erosion, the cumulative effect of which could be the sedimentation observed. Unless overgrazing occurs however, arable is more likely to generate erosion than stock rearing. Given the pollen evidence that cereals could have been cultivated around Big Moor from the Neolithic (Long 1994) it is perhaps more likely that the low levels of sedimentation were caused through intermittent use of the land for arable. It should be noted here that the possible cereal cultivation in the Neolithic was recorded in Long's Lucas Fen core. The term "around" Big Moor is used because Lucas Fen is in the north-western part of Big Moor. Whether intermittent arable took the form of complete abandonment between periods of use, or some sort of rotation between pasture, arable and fallow, cannot be inferred from the data gathered here, although either of these are possible.

The Earthen Banks, (Upland) - The Accumulation Hypothesis

The remainder of the "upland" features excavated were earthen banks. These were very ephemeral, and some were no more than 10-20cms higher than the surrounding ground surface. In trench 6 on Big Moor and trenches 5 and 9 on Gardoms Edge, (which were the same bank), the only defining feature was a thickened A horizon, and this was no more than 5 to 10cm thicker than the A horizons outside the banks. In neither the field nor laboratory data was firm evidence found of any accumulated sediment that would suggest that erosion of the land upslope was implicated in their formation. The bank on Gardoms Edge was also oriented in the wrong direction to have formed by the accumulation of sediment from upslope.

There are other factors that strengthen the non-erosion case. The first is that on trenches 2, 3 and 4 from Big Moor, and trench 9 on Gardoms Edge, redeposited sediment could be identified in the field. Although the identification was aided by the stratigraphic position of the sediment relative to the features, it was also clearly identified by the laboratory analyses (usually the granulometry) in most instances. This was true both of sediment that covered parts of the features and of layers of redeposited material upslope of the features. It suggests that if redeposited material were present, it should have been possible to observe this in the banks. The fact that it was not is noteworthy.

The second is that where it was present in the features, even in very thin layers, the eroded sediment had buried and fossilised the former A horizons on which it was found. These also could usually be clearly identified, both in the field and laboratory. The fact that except for trench 9 on Gardoms Edge no fossilised A horizons could be found, suggests strongly that accumulation was not the formation mechanism.

The regular layout of the earthen field boundaries in the centre of the Big Moor Central cairnfield provides a good opportunity to examine this issue (Figure 10). Barnatt (1999) not unreasonably given the low relief of the earthen banks which is not suggestive of any practical purpose, postulates that they have formed from the accumulation of eroded sediment against obstacles. He also suggests that the transport mechanisms were either wind or water.

In the centre of Big Moor, the land slopes gently to the north and east. If the main method of sediment transport was sheetwash, then the greatest accumulation would be expected to occur against obstacles oriented roughly north-west/south-east, ie. parallel to contour. Little or no accumulation would be expected against hedges or fences oriented cross contour as these are not slope obstacles. The survey map for this area of the cairnfield shows clear earthen banks oriented both parallel to and cross contour.

The only way in which transport by water can account for the banks running cross contour, is if runoff was channelled along the side of a hedge or fence and rills or gullies formed on either side, leaving the area under the boundary effectively pedestalled. The regular character of the banks argues against this, but more importantly there is no evidence of rills or gullies down the sides of the banks today. Again a comparison with other features is useful here. On the upslope side of trench 3 there was a small channel that looked like a water-carved feature. Whether it was or not (and excavation did not clarify this) it shows that even very slight channels or depressions can remain archaeologically visible. Therefore if they had ever formed, rills or gullies should be seen down the sides of the banks, at least when they are excavated. This is particularly true as once created they would continue to channel runoff, and over time this would be expected to make them more rather than less obvious. There are no rills or gullies visible down the side of the banks running cross-contour on Big Moor today, and none were observed during the excavation of Trench 5 on Gardoms Edge, despite the fact that it too was oriented cross contour. There was a truncated A horizon to the east of Trench 9, but this did not have the appearance of a rill and was below the level of the prehistoric A horizon of which the bank was formed. It cannot therefore be implicated in the formation of that feature.

The second manner in which the features may have formed by accumulation is if the transport mechanism were aeolian. The prevailing winds are westerly or north-westerly and with a little imagination, the layout of the banks could be made to fit with the wind direction(s). The problem with this idea is again there is no evidence to support it on any of the features examined. Aeolian sediment would be expected to display mean phi values of between 1 and 3, and should be well sorted, with sorting values of around 0.5 (Ahlbrandt 1979, Goudie & Warren 1987). The particle size data indicated that although mean phi values were sometimes in the right size band, there was no sign of sufficiently well sorted sediment. Sorting values were usually over 1 and frequently over 2. In the distribution of the sediments in relation to the features, there was also nothing that cannot be explained in terms of the relationship between slope, and energy for transportation. Aeolian material would be expected to be deposited dominantly downwind of obstacles (ibid). With not only the features excavated, but also those examined in the prospecting stage with a view to excavation, the accumulation of sediment always appeared to be related instead to slope. Where it has been identified the bulk is always upslope of an obstacle irrespective of prevailing wind direction, and in trenches 2, 3 and 4 on Big Moor, the redeposited sediment was clearly seen to have accumulated to the greatest depth on the steepest slopes. The redeposited sediment simply does not fit the criteria for aeolian transport, and it would be foolish to assume that one mechanism is responsible for the transport of sediment, when all the available evidence points towards another.

Returning to the overall layout of the earthen banks, this is therefore not particularly suggestive of accumulation of material transported by either wind or water. With regard to erosion from the downslope side of the features, many of the above arguments apply equally to this process. It could have been a factor in the formation of some of the field boundaries that are oriented parallel to contour but not the others. Even in the ones orientated parallel to contour there is little or no evidence for this in the form of truncated or thinned A horizons downslope of the features. The only thinning which was observed tended to be on the actual slopes of the banks, and at the ground surface beyond these the A horizons returned to their former thicknesses.

The possibility that the banks were made by people must be seriously considered and there is some evidence to support this possibility. First trench 5 on Big Moor which was defined by the thinning of the A horizons outside rather than a thickening inside the bank. It is difficult to account for this morphology in any way other than the scraping of topsoil into a mound. There is also trench 2 on Big Moor. The inner core of this bank was a low earthen mound, which although the laboratory data indicated that it might have received some inputs of sedimentation, also contained stones too large to have been easily transported by water. The lack of stones in the accumulated sediment above this context supports this observation. The best-fit interpretation of the mound within trench 2 is also that it was a built feature.

The only aspects of the earthen banks that support the accumulation theory are the facts that some, but by no means all, are asymmetrical and basically have the appearance of lynchets. Although it is by far the less likely possibility, the idea that some may have formed through accumulation cannot be completely discounted. If this has happened then the redeposition of sediment must have occurred at a slower rate than pedogensis. The material that accumulated must have done so in small increments which were incorporated into rather than deposited above to fossilise the prehistoric A horizon. If this is the case it is still not indicative of high levels of erosion.

In summary, neither the amounts of redeposited sediment found on four of the excavated features nor the composition and layout of the earthen banks, supports the premise that erosion was in any way significant in the Big Moor Central cairnfield. This also applies to Gardoms Edge, although here the basis for this conclusion is not as strong, as only one feature was excavated in that cairnfield (although it was sectioned in two different places).

Lowland

The preliminary search for redeposited sediments on Gardoms Edge failed to discover any trace of significant deposits, despite the fact that there was essentially only one area (other than against features) where they could be deposited if they existed. Where redeposition did occur on this cairnfield it was very localised, which suggests that it was small scale and may have been of low intensity.

The Nick Point and Alluvial Fan – Big Moor

Although two long-term sedimentary sequences were found on Big Moor, it appeared from the radiocarbon dates that neither contained much if any, sediment deposited in the Bronze Age. At both these features, radiocarbon dating samples were obtained from sediments as close to the base of the sequences as possible. For the nick point this was at 225cms, which was 10cms from the base of the profile. For the fan this was at 77cms, which was around 20cms from the base of the profile. The date from the nick point was AD 240-420. That from the fan was BC 100 - AD 900. In both these cases there is sediment below the level at which the radiocarbon dates were obtained, and in theory that sediment could be Bronze Age. In the case of the nick point, that means there is only 10cm, which could contain Early Roman, Iron Age and Bronze Age sediment. While this is possible, it is perhaps unlikely and if the sequence did contain Bronze Age sediment, presumably there could not be a great deal. On the face of it the nick point sediments support the upland picture. However, the reason for the apparent scarcity of Bronze Age sediment in the nick point may be that in the Bronze Age the stream was entrenching rather than depositing.

There are 20cm of sediments below the level of the radiocarbon date in the fan and this, though it is imprecise, could indicate that these were deposited prior to the last centuries of the first millennium BC. The fan was deposited at the confluence of the stream with Bar Brook, and this is a completely different depositional environment to that of the nick point. Before the nick point sequence was deposited, the small valley of the tributary stream would have been much steeper, and the gradient would have provided more energy for the transport of alluvium. This gradient may not have been significantly decreased until the Bar Brook valley floor was reached, and so the earliest sediments are likely to have been deposited in this location. The fan is therefore far more likely to contain Bronze Age sediment than is the nick point, and the base of the fan contains 10cm of fine sand, which in theory could have been transported from the cairnfield.

At this point the validity of the date from near the base of the fan profile should be assessed. The earliest period that this could represent is the later Iron Age and it is possible that the sediments relate to that period. Given the large error however, they could also relate to a much later period, in which case the possibility that Bronze Age sediments are present is weaker. The premise that Bronze Age material may have been deposited at the fan cannot be discounted, but neither can it be relied upon. If it is present, then presumably there is less than 20cms of it. It is debatable whether this can be taken as an indicator of significant soil loss. Given the inaccuracy of the date, and the ambiguity that surrounds the possible presence of sediment of that age in the fan, there is nothing concrete in the evidence from this feature that contradicts the conclusions drawn from either the nick point or the cairnfield features.

Overall therefore, it seems that erosion is unlikely to account for either the formation of the earthen banks, or for any of the subsequent changes in farming or settlement patterns that have been inferred from the pollen evidence.

CHRONOLOGY

Upland

The dates for the upland facet have been obtained from trenches 2 and 3 on Big Moor. These have confirmed that the observed sedimentation occurred in the prehistoric period. The dates obtained range from the Mesolithic through to the late Bronze Age/early Iron Age, and they cluster in certain periods.

Trench 3 provided the earliest dates. The earliest was from the sandy mound under the cairn, which proved to have been last exposed to light in the Mesolithic. The mound was curious; it appeared to have no former ground surface beneath it, although it was heavily leached and this could have obscured any visible traces. There was also no indication of how it had formed, and whether this had anything to do with human activity. It has however, been forcefully argued in recent decades that Mesolithic peoples may have significantly disturbed the vegetation cover on the gritstone uplands (Tallis 1975, 1991, Tallis and Switsur 1990) so the possibility that human activity may be implicated cannot be dismissed.

The next dates in the sequence are both from A horizons outside the excavated features and there is one from each of the two trenches from which dates were obtained. That from trench 2 gave an age of BC 4798-3952, and that from trench 3, BC 4947-4235. These are both in the Late Mesolithic, Early Neolithic periods. The earliest date from the eastern moors that has been attributed to possible agricultural activity is BC 4214-3385, which is the date for the elm decline at Totley Moss (Hicks 1971, recalibrated to 2 sigma by Barnatt 1995). This was attributed by Hicks to pastoral activity. The dates from trenches 2 and 3, while in a similar period, are earlier, but they are also earlier than the growth of peat in the bog from which she obtained the Totley Moss core. Compared to hicks' data, both of these dates seem to be too early to be associated with agriculture. Up to the early 1990s however the same would have been said of the possibility of arable activity occurring on the limestone at this time. Since then the publication of two pollen sequences from the limestone, one from Lismore fields and the other from a valley bottom site in the White Peak, has raised the possibility that clearance for pasture and arable was occurring from 4th millennium BC. (Wiltshire & Edwards 1993, Taylor et. al. 1994). Because of the lack of corroborating evidence, agriculture cannot at present be inferred from the dates presented here. The closeness of the dates from both trenches to the time when agriculture may been starting on the east Moors, could however be more than coincidence.

The next dates are within the time period that is associated with agricultural activity. Both relate to the early Bronze Age. The first of BC 2401-1937 is inferred to relate to an early pulse of sedimentation before the construction of the bank. The second, of BC 1711-1347 is from the earthen bank that was the earliest phase of the later stone and earth structure, and whose function seems likely to be that of a field boundary. Both these dates are early to mid-Bronze Age and they place both the feature and the inferred agricultural activity in this period. This accords with the pollen evidence of Long (1994, Long et. al. 1998), which indicated that cereal cultivation was taking place on Big Moor from at least the early Bronze Age.

The date for the formation of the earthen mound has additional implications. At its earliest the bank could have been built in the early Bronze Age, in which case it would sit comfortably within the range of early Bronze Age dates which previously have only come from ceremonial or funerary remains on the moors (see Barnatt 1995). At its latest, it could be middle Bronze Age and in this case it would be very slightly later than most of these features. This said, it would still be earlier than is suggested by the artefactual evidence obtained from the Gardoms Edge Project (M Edmonds pres com.), which suggests that the agricultural and settlement activity may be associated predominantly with the later Bronze Age. Where within the Bronze Age this date is considered to fall is a matter of outlook, but there are two possible ways of interpreting it. Either it is Early Bronze Age, in which case it is the first agricultural feature to be placed into the same time frame as the ceremonial features. Or it is closer to the middle Bronze Age. In this case it would be possible to argue that as sedimentation apparently started before the bank was constructed, the decision to build a bank came later in the sequence and may thus be an indication of a change in the character of occupation through time.

The last dates from the upland features are those from the later sediment in the bank at trench 2 and the redeposited sediment immediately upslope of the cairn at trench 3. Both of these dates also fall into a similar timeframe, which is the mid -late Bronze Age. Of these the date from trench 2 is slightly earlier, at BC 1103-779 compared to BC 760-440 for that from trench 3. Because both these dates were obtained from sediments that were at, or slightly higher than 30cm below the surface, there is a possibility that they may be overestimates (see Chapter 4). Despite this possibility, both of these dates are consistent with the late Bronze Age activity suggested by the artefactual evidence from Gardoms Edge. They are also consistent with the increasingly obvious signs of agricultural and arable activity recorded in Hicks' and Long's pollen cores (Hicks 1971, 1972, Long 1994, et. al. 1998). The date of BC 760-440, while it was obtained from sediment closest to the surface and therefore has the greatest potential for error, accords well with the assumed late Bronze age dating for the final throes of cultivation activity inferred from the pollen data.

The trench 3 date that is from sediments interpreted as redeposited, is the latest one of BC 760-440. This places sedimentation at this feature at a slightly later date than that at trench 2. Unfortunately, dates from two features are not a sufficient basis from which to make an assessment of whether the two areas of cairnfield were being farmed at the same time or consecutively, so the issue of contempraneity remains to be addressed.

Finally if taken together, the dates from both trenches suggest that activity was taking place well within the periods that are suggested by other forms of evidence, both environmental and artefactual, the former of which has been dated by a completely independent method.

The last upland feature examined was the pit alignment on Gardoms Edge. This was not excavated as part of this project, but it was sampled in order to obtain dates for comparison. The dates bracketed the apparent period of use of the pit to within a two hundred year period in the later Iron Age. Given that the pit alignment is a long feature, which must have required a certain degree of effort to excavate, its existence does not sit well with the idea that the cairnfields were abandoned by this point in the Iron Age. It is not known whether the pits were agricultural features, but their existence suggests that people were still using the cairnfields in the Iron Age period.

Lowland

Because no long sedimentary sequence was found on Gardoms Edge, the nick point and fan on Big Moor proved to be the only lowland sequences. Contrary to expectations, none of the sediment in the nick point proved to be prehistoric and it is possible that the same was true of the fan. The nick point was still informative however, particularly with respect to some aspects of the arguments relating to erosion and to abandonment of the cairnfields.

Before these are discussed, there are various factors that have to be taken into account in interpreting either sequence in terms of human activity. First is the fact that the various sand layers only represent those instances where runoff events were of sufficient magnitude to mobilise and deposit material. To some extent therefore this is a climatic or at least meteorological factor operating independently from other landscape variables. However, for material to be mobilised, a stability threshold must be crossed (Schumm 1979, Wagstaff 1987) and the level of that threshold depends on such things as topography, the nature of the soils and perhaps most importantly, vegetation cover.

Human impact, particularly on the vegetation cover, can lower the stability of the ground surface, leading to increased erosion. Pollen, including the skeletal pollen diagram prepared during the course of this project (Figure 45) and documentary evidence, give some clues as to what may have been happening in terms of land use and vegetation changes at various periods. This aids in assessing possible human impacts.

There is no known archaeological field evidence on Big Moor for the period covered by Phase I of the nick point sequence, and the only hint of human activity comes through pollen analyses. The dates from the pit alignment on Gardoms Edge have however shown that there is at least one feature in that cairnfield that would correspond to the early part of that period.

Phase I of the nick point sequence corresponds to the area below 200cm in the skeletal pollen diagram constructed from the profile monoliths (Figure 45). The Roman date of AD 240 – 420 from near the base of that phase, means that that area of the nick point pollen diagram can be correlated with Hicks' zone B3, and Long's Big Moor zone BMT5, (which is zone C on her regional pollen zonation). The start of Hicks' zone B3 was dated at Leash fen to BC 60 - AD 140 and the end to AD 330 - AD 510, (Hicks 1971, 1972). Long dated the start of this zone to BC 380 - AD 194 on both her Big Moor and regional diagrams, by correlation to her Stoke Flat core (Long 1994 Long et. al. 1998).

According to both Hicks and Long, this zone is characterised by the first large-scale falls in tree pollen, (on Big Moor from 50-70% of the total land pollen to 20-30%), an upsurge in heaths and grasses, and the commencement of peat accumulation on Big Moor (Hicks, 1971, Long 1994). These changes can be identified on all pollen diagrams from the Eastern Moors, (Long 1998, (see also Tallis 1964, Tallis & Switsur 1973) and appear to be a regional phenomenon. Both Hicks' and Long's data also show an increase in cereal pollen, although both authors concluded that this was probably coming from outside the cairnfields, which by now were abandoned (Hicks 1971, 72, Long 1994, et. al 1998). According to Long, in contrast to the apparent decline in arable activity at the cairnfields, fungal spores and pastoral pollen indicators suggested an increase in grazing, and she inferred that this might be linked to the dramatic clearance of woodland. She postulated that either the woodland was deliberately cleared to provide pasture, or that grazing levels prevented regeneration of trees and acted indirectly to reduce the amount of woodland.

Both authors argued that there may have been a link between the wetter conditions of the Sub-Atlantic period and the cumulative effects of woodland clearance, which led in the Late Iron Age/Early Roman period to waterlogged conditions and the onset of peat accumulation. Despite this, neither was able to isolate a distinct climatic signal from the palynological data. A similar situation exists with the nick point data, from which no climatic signal can be distinguished. It is entirely possible however, that woodland loss and an increase in grazing in the supposedly wetter conditions of the Sub-Atlantic, may be implicated in the start of sedimentation at both the nick point and the fan.

That the increase in grazing activity could have contributed to the landscape instability is supported to some extent by the pollen data from the pit alignment on Gardoms Edge (Seddon 2002 unpub). In the data from the middle of the pit fill monolith there was a clear correlation between a period when grassland pollen was more abundant than heaths, and a phase of mineral inwash into the peat of the pit fill. Although the zone in which this occurred is undated, the peat from which the data came is less than 10cm above that dated to the Iron Age and so there is a possibility that it may relate to the Roman period.

The base of the nick point diagram Figure 45, which equates to Phase I also shows a higher proportion of grasses and lower proportion of heaths than at any other point. Here the pollen of trees and shrubs comprises around 30% and 50% of the total pollen respectively. The pollen of heathland plants, most notably *Calluna,* is at its lowest level on the diagram at <20%, while grasses and herbs comprise around 50% of the total. If the elevated levels of grasses in the relevant zones on the nick point and Gardoms Edge diagrams are an indication of the creation of pasture, then this data would lend support to Long's conclusion that an increase in grazing activity may have occurred, possibly contributing to the woodland loss

Observations that can be made on the moors today give indirect support to this theory. On Gardoms Edge, the western part of the moor from the top of the scarp up to a distance of 200-300m east, is part of the Chatsworth estate of the Duke and Duchess of Devonshire. Further east of this area the land is owned by the Peak District National Park Authority, and a wire fence separates the two. The grazing levels on the Chatsworth estate land are higher than those on the land owned by the National Park Authority (J Barnatt pers. com.). Both are on the same bedrock, none of the land is improved, and both areas constitute rough grazing but there is a clear difference in vegetation on either side of the boundary fence. The Chatsworth estate land is grassland, the

National Park land is heather moorland and the difference is purely related to the stocking levels.

An increase in grazing activity also provides an answer to the question of why, if the moors were abandoned as various authors have argued, did the woodland not regenerate. Arguments that soil deterioration had degraded the land to the extent that woodland regeneration was not possible (eg. Hicks 1971) do not make sense. Trees grow on the heavily podsolised soils of Big Moor and Gardoms Edge today and those on the Gardoms Edge cairnfield, (a small birch wood) are known to have become established naturally, after animals were excluded from the area for four years in the late 1950s (J Barnatt pers. com.). Less than two miles away, mixed deciduous woodland grows on the tops and the scarp slopes of both Froggat and Baslow Edges, and on the scarp slopes of every edge between Big Moor and Stannage Edge approximately 7 Miles to the north. Trees can quite clearly grow successfully on the moors and neither soils nor climatic constraints can be used to explain why forest has not regenerated on a larger scale since prehistory. We are therefore left with the possibility that human management of the landscape, rather than environmental constraints is responsible for the continuance of open conditions from the Roman period onwards. If this is the case then the logical conclusion to draw is that these uplands were never abandoned, but rather that the ways in which they were used changed. This is a premise supported by the dates from the Gardoms Edge pit alignment, which indicate clearly that people were still carrying out some activities on that moor in the Iron Age.

If the landscape instability evidenced in the nick point, alluvial fan and pit fill data is the result of continuing agricultural activity in the form of grazing and/or forest clearance, then it is worth considering what the scale of the activity may have been. The use of uniformitarian principles to examine this issue is probably more appropriate here than it would be if applied to, for example, the Eastern Moors in the Bronze Age. In Phase I, the moorland was in the process of becoming established and the ecosystem was apparently becoming more similar to that of today. Therefore present conditions, can perhaps be used as an analogy for the past at least in terms of the grass/heaths component of the landscape, which by some point in the Roman period was contributing approximately 70% of the total pollen on Big Moor (Long 1994,).

Personal observations of the moors today have led to the conclusion that the landscape is remarkably stable. There are almost no signs of sediment movement, even after controlled burning of the heather. The exceptions to this are after uncontrolled and accidental fires, and in those areas where the vegetation cover is missing. At present this condition is confined almost entirely to footpaths and tracks. On these transport routes however, erosion is frequently severe, and this effect can be seen on present day heavily used footpaths. Today therefore, the vegetation cover appears to be a very effective stabilising factor.

Returning to Phase I of the sediment sequence, there are consequently two alternative scenarios that can be envisaged from its character, one is that the sand pulses represent episodic human activity in the form of tree removal or periods of higher grazing intensity. Intuitively however, this is not a completely satisfactory explanation for the ongoing minor sand inwash events that do not show up as distinct layers, but appear to have been incorporated into the ground surface. The second alternative is that clearance coupled with pastoral agricultural activity was ongoing, resulting in minor amounts of erosion that only produced distinct layers when runoff was exceptionally severe. In this scenario, the individual sand layers are effectively a climatic signal, ie. a measure of flood intensity and frequency.

The mobilisation of sediment requires the crossing of a geomorphic stability threshold and human disturbance of the ecosystem can lower that threshold and facilitate flood erosion (Wagstaff 1987). With the second scenario therefore, the evidence of individual runoff events can be used in conjunction with other data to infer ongoing human disturbance, but cannot be used to infer changes in the character or scale of that disturbance.

In summary, the first phase of landscape instability coincides with a phase starting in the late Iron Age or early Roman periods, of dramatic woodland loss and a possible increase in grazing (Hicks 1971, 72, Long 1994 98, Seddon 2002). These are not necessarily the sole factors that could be responsible for the landscape instability but the coincidence between the onset of sedimentation at the nick point and the fan and the vegetation changes recorded in the pollen data, suggests strongly suggests that the two are linked. This data also suggests that even if settlement may have moved, there is little reason to assume that the gritstone uplands were abandoned after the Iron Age.

In the next zones from both Hicks' and Long's cores (Hicks zone C and Long's zone BMT6 from Big Moor) there are continuing falls in tree pollen to less than 20% of the total, and the pollen from moorland plants reaches the levels it is at today. A similar fall in tree pollen is shown at approximately 200cm on the nick point diagram, along with a corresponding increase in *Calluna* and fall in *Poaceae,* suggesting that this records the establishment of the moorland that was noted by both authors. Neither Hicks nor Long were able to date this zone with any precision, but both concluded that it related to the post Roman to Domesday periods.

The dates from the nick point suggest that the second phase of landscape instability occurred in the Post Roman to early Medieval periods. The sedimentation in Phase II is slightly different in character to that in Phase I and an increase in intensity seems to be indicated.

Documentary evidence records that the land around Big Moor (whether this included Big Moor is not known) was used for grazing in the Medieval period. There is evidence of monastic use of the edges of Totley Moor to the North of Big Moor, and Beeley Moor to the south where the monks of Beauchief Abbey grazed large numbers of cattle and sheep (Pegge 1801, in Eyre 1966). Although it is not known if this monastic use extended onto Big Moor, it is known that before the Parliamentary Enclosure Awards of the 1800s, Big Moor was part of the wastes and commons of Bubnell, Curbar and Holmesfield (Ainsworth et al 1998) villages surrounding Big Moor today. In this period the moor would have been used as common pasture by the inhabitants of those villages who would also have had the right to cut peat, wood etc. for fuel (Eyre 1966). There is a strong probability therefore, that the moor was used for grazing from the medieval period onwards, and that this activity was the cause of the second phase of landscape instability.

The change in sedimentary regime that starts In Phase II however suggests that something more than grazing starts to affect the catchment in what is probably the early Medieval period. At some point between the Roman period and the Norman Conquest, the pattern of settlement had changed from dispersed to more nucleated, and many of the villages in the Peak appear to have been established around this time (Barnatt & Smith 1997). A new nucleated pattern of settlement might necessitate the establishment of new transport and communication routes, and for the Medieval period there is ample documentary evidence that there were numerous transport routes and tracks crossing the Peak District (Dodd, & Dodd 1980). The main method of transporting goods at that time was by packhorse (ibid) and there is a strong likelihood that the change in sedimentation that started to happen in Phase II is linked to the establishment of a packhorse route.

There were eight packhorse routes across Big Moor (Ainsworth et. al. 1998) evidenced by holloways and the nearest one crosses the tributary stream less than 30m upslope of the nick point. The proximity of the two means that sediment eroded from the path had to pass through the nick point, and it is almost certain that some, if not most of it will have been deposited there. The nick point radiocarbon dates suggest that the sedimentary change of Phase II commenced around the 11th or 12th centuries, which is a much earlier date than was previously assumed for the establishment of this path (J Barnatt pers. com.).

However, documentary evidence only gives minimum ages for such routes, as by the time they are mentioned in the earliest documents they are already established, and the length of time they have been in operation is not known. Certainly the transport of goods was as necessary in the Medieval period as it was in the Post-Medieval, and examples of the scale of this activity come often from monastic records. Thus in 1280 it is recorded that the monks at Dieu la Cresse, which was in the limestone area of the Peak, exported annually to one customer, twenty sacks of wool each weighing 20 stones (Dodd & Dodd 1980). Dodd & Dodd estimate that this would have required a train of 30 packhorses. While Leek is a considerable distance away from Big Moor, other monastic lands were within a few miles, as are several surrounding villages to the east and west.

In Phase III the rate of sedimentation continues to increase and by Phases IV and V the change in sedimentation is pronounced and deposition is rapid. In Phase V the two dating methods indicate that 50cm of sediment was deposited in something over 100 years. This is in contrast to around 50cm over around 1000 years in Phases I and II. In the later phases however, the number of possible causes for the sedimentary increase rise in direct proportion to the increasing amount of documentary evidence that is available. First, the dates indicate that at least parts of Phases IV and V are within the Little Ice Age and it is possible to hypothesize that this climatic worsening may have increased runoff levels.

Although this may be true, the complexity of the interactions between climate and different human activities such as transport and agriculture means it is unsafe to postulate simple binary links. It is easy to hypothesize that an intensification of trade in periods of economic upturn can lead to increased use of transport paths and more erosion. It is also foreseeable that worsening, ie. wetter, weather would cause more erosion on transport routes without necessarily any increase in use. Both these possibilities could cause increased sedimentation. Alternatively, if the weather made travel on specific paths more difficult, this could have led to those paths being used less than more favourable ones and sedimentation could actually have decreased, depending on the extent to which the ground surface could recover between runoff events. A further possibility is that increases in grazing levels stimulated by economic or other factors could increase erosion, particularly in periods of higher rainfall. To put this in perspective, levels of less than one sheep to four acres are necessary for the maintenance of a thriving Calluna-Eriophorim vegetation cover (Shimwell, 1974). Present grazing levels are around 1 sheep per 14 acres but levels as high as 1:1.4 acres have been recorded for the Edale Valley in the north of the Peak District in the 1800s (ibid).

It is also possible that a prolonged period of bad weather may lead to certain areas being, or being perceived as, bad-risks in terms of profitability or subsistence. This could lead to a decrease in grazing and therefore in erosion. The particular mixture of economic, social and climatic processes in operation at any given time in the Medieval period is impossible to ascertain. However it is possible to postulate that a transport route once established, would be more susceptible to erosion than the surrounding land because it would channel and so concentrate runoff. If the packhorse route was established in Phase II, therefore, it is likely that erosion along it would have increased in subsequent phases with any or all of the above possible changes.

The increasing coarseness of the sediments perhaps lends some support to this. On the slope between the nick point and Trench 2, the holloway is down to bedrock in places and the subtle increase in coarseness up through the profile could be the result of erosion of the B and even the C horizons of the soil. Medieval use of the packhorse route therefore remains a likely cause of the sedimentation in Phases III IV and V.

In Phase VI, which covers at least part of the post-medieval period, the existence of the packhorse route is not really in question. Prior to the first turnpike roads, paths and tracks such as the ones that cross Big Moor were the only overland communication routes. Consequently, in the Post-Medieval period when industry and the acquisition of raw materials such as lead or coal was starting to increase in importance, such routes must also have seen increasing use.

There is ample evidence of industrial activity in the area in this period. Coal mining was taking place on Beeley Moor three miles to the south of Big Moor in the 1500s (Hopkinson 1957). Within a mile of the nick point there are bell pits representing small scale coal mining or prospecting attempts on Big Moor itself, which probably date from the 1700s and possibly earlier (Ainsworth et. al. 1998). There are also numerous small dayworking or quarrying pits on Big Moor, which could date to any time from the Medieval period onwards. Finally, lead has been mined and smelted in Derbyshire from the Roman period onwards (Ford & Rieuwerts, 1975) but this activity became increasingly significant in the Post-Medieval period, peaking in the 1700s (ibid). All these activities could well have contributed to an increase in use of transport routes, along with the transport of such commodities as salt from Cheshire, and agricultural produce from the Peak District (Ainsworth et al 1998).

The construction of the turnpike roads from the mid 1700s onwards heralded the decline in use of the old transport routes, (Dodd & Dodd, 1974, Ainsworth et. al. 1998). This raises the question of whether the cessation of sedimentation at the nick point is linked to the decline in use of the packhorse route. This idea accords with the theory that the sedimentary changes in the exposure are linked to the use of this path, and if correct would also provide a ballpark figure for the date of the halt to sedimentation. Frustratingly, there is no way to date either the final deposition of sediment or the abandonment of the packhorse route. However, one possible interpretation/summary of the entire sequence is the start of sedimentation in the Iron Age, as woodland loss and grazing caused the crossing of a geomorphic stability threshold that was lower because of the wetter conditions of the Sub-Atlantic. Initially this resulted in low sedimentation rates occasioned by dominantly agricultural impacts in the

Roman to Early Medieval periods. This was followed by increased sedimentation caused by the proximity of a transport route. The rate of sedimentation further intensified in the late and post-Medieval periods, either because of increased use of the route or because once created, the holloway channelled runoff, which then had more erosive power. This continued until the creation of turnpike roads took traffic onto different routes and agriculture again became the dominant human activity in the landscape, at which point sedimentation ceased.

AN OVERVIEW

The sedimentary data have suggested that soil erosion was occurring through the Bronze Age, but in quantities too small to have made any significant difference to the topsoil and presumably to the productivity of the agricultural land. If this is the case then it has several implications for the application of current models. At the larger scale, one of the most pressing questions concerns the issue of the "sustained" farming proposed by Barnatt, which is intimately related to what the character of occupation might have been.

An indirect way to approach this is to examine the scale and intensity of the erosion that is presumed to have been caused by agriculture. The scale of the erosion almost certainly precludes the possibility that any of the fields were cultivated on a continuous basis. It does not preclude the possibility that all the observed sedimentation was the product of cultivation, and it is entirely possible that most of the soil movement was occasioned by this form of land use. If this was the case, then the most likely scenario is that the cultivation of any one area was intermittent. This fits with Barrett's interpretation that upland remains of this character represent a long-fallow system of land-use (1994). However Barnatt's model does not exclude an intermittent use of certain fields either for cultivation or pasture. It simply proposes a greater sense of connection to specific areas, and implies perhaps a greater degree of sophistication and deliberation in the organisation of agricultural activity. Intermittent cultivation could have taken the form of either the total abandonment of cultivation plots after productivity had dropped, the periodic but intentional return to certain areas perhaps on a generational timescale, or the application of an agricultural rotation between arable and pasture. All these would fit with the scale of the observed erosion.

There is other circumstantial evidence that hints at Barnatt's interpretation. The process of formation of the bank at trench 2, Big Moor, in which sedimentation played a part, apparently happened over a very extended period. This implies that the use of the fields above, perhaps on an intermittent basis, covered an equally extended period. Barnatt has pointed out that not all the land that was apparently favourable for agriculture was utilised (1999). If there was other land available, and there was no sense of connection to any specific area, why would these fields see such an extended period of use? Of course there are numerous possible answers to this question but one is certainly that there *was* a sense of connection.

It is also tentatively possible to interpret the evidence from trench 2 in terms of a possible change through time in the way that the land was organised. As Edmonds and Seaborne have argued, given that the occupation of the eastern gritstone probably covered upwards of two thousand years, it is almost certain that changes in the character of that occupation must have occurred (2001). The diversity and complexity of the cairnfield evidence may be a product of such changes.

One observation that was made during the course of the project is pertinent to the issue of possible changes through time in the character of occupation. Two of the features excavated, trench 2 on Big Moor, and trench 9 on Gardoms Edge were composed of apparently built earthen banks, which had been augmented by the addition of clearance stone. On both occasions, the banks were the earliest identified features. In the case of trench 2 on Big Moor, this earliest stage was dated to the early –middle Bronze Age.

In the case of trench 9 on Gardoms Edge, the bank was undated but formed the boundary to an area (area 3) where during the 1999 season of the Gardoms Edge project some of the earliest artefacts on site were recovered. The artefacts were associated with a large cairn which was possibly funerary, but which became a focus for later clearance. The artefacts recovered from the vicinity of the cairn were indicative of a later 3rd and early 2nd millennium date and included plano-convex knives, thumbnail scrapers, barbed and tanged arrowheads and a fragment of possible Beaker, (Barnatt et. al. 1999-2000). In the same season of excavation a house site was discovered nearby. This was associated with artefacts indicative of a later Bronze Age date, and the house may relate to a subsequent agricultural use of the area, during which the cairn was augmented by clearance.

It is not known where in this sequence the earthen bank fits, only that it too was augmented by later clearance and so is earlier than at least some of the agricultural activity. However the only other place on Gardoms Edge other than area 3, where the same combination of prominent cairns in a gridlike pattern and a putative earthen boundary is found, is at the southern extent of the Gardoms Edge system within current farmland. It is also in this area that the only ringcairn on Gardoms Edge is located. It is tentatively suggested here, again on circumstantial grounds, that the earthen banks may constitute some of the earliest features. It may be worthwhile to test this hypothesis through the further excavation of some of these remains.

The evidence that is now emerging is elucidating the later, as well as the earlier stages of the occupation of the cairnfields. The dates from the pit alignment on Gardoms Edge cast serious doubt on the premise that the cairnfields were abandoned in the later Bronze Age. The evidence from pollen reinforces this doubt. There is evidence that cereal cultivation ceased at some point in the later Bronze Age or early Iron age and the data from this project does not contradict this inference. But what is the large-scale deforestation and postulated increase in grazing activity that occurs from the Iron Age onwards, if it is not evidence of continued human activity? The evidence from pollen that the land was being cleared of trees through the Iron Age and Roman periods is consistent with the start of sedimentation at both the fan and the nick point, and it is inferred here that the two are connected. Given the evidence of continued agricultural activity that is inferred, the notion that the eastern moors were abandoned is becoming increasingly unsustainable.

It may be possible to argue that the moors were abandoned for settlement in the Iron Age but even this is open to question. We still do not know what the character of settlement was. This may have been seasonal through much of the sequence. Barnatt, Edmonds, Seabourne and Bevan have all postulated that tranhumance could have been one possible form that the occupation took. Hicks certainly inferred such a regime for the Iron Age. If the cairnfields did form part of a pattern of transhumance that included the gritstone and other zones in the Iron Age, then is this not a facet of the settlement pattern?

At the nick point sequence, a change in sedimentation appears to coincide with the establishment of a transport route. Some at least of the transport routes in the Peak may have come into being as a result of a more nucleated settlement pattern that began to form in the Pre-Conquest period. This may be the time in which the moors were abandoned for settlement. This is obviously a tentative suggestion that stretches the limits of inference for the available data, and it is a suggestion not a conclusion. As Bell has pointed out however, transport routes are one manifestation of social relationships (1996) and as such, could provide valuable data through which former settlement patterns and use of the landscape could be explored. If activity on more of these could be dated, it might help to elucidate the changing character of the settlement pattern and could therefore be a worthwhile subject for research.

CONCLUSIONS

One of the primary aims of this project was the dating of agricultural activity within the cairnfields. The objectives were;-

- To add detail to the present chronology.
- To elucidate the earliest and latest parts of the sequence of activity.
- To obtain dates from different cairnfields, and parts of cairnfields to see if activity in these may have been contemporary.
- To obtain dates which would elucidate the chronological relationship between monuments and agricultural features.

Three dates have been obtained from sediments accumulated against archaeological features. These sediments have been assumed to be the product of erosion from agricultural fields. They suggest that the inferred agricultural activity was taking place from the early 2nd millennium through to the later 1st millennium BC. The dates thus obtained corroborate the evidence from pollen cores, which suggest a similar timespan of agricultural activity.

The earlier parts of the sequence of occupation are represented by the above dates. Those that relate to the later parts of the sequence and cover the period of supposed abandonment have been obtained from a pit alignment on Gardoms Edge and a long sedimentary sequence in a "lowland" environment on Big Moor. These suggest that activity was continuing in the cairnfields in the Iron Age and Roman periods.

From the creation of the pit alignment on Gardoms Edge, it is inferred that activity was continuing at that site in the Iron Age. No firm inference could be made as to when cereal cultivation ceased, but it is inferred that the commencement of sedimentation at the nick point is evidence of landscape instability, which may be related to the continuing pastoral activity indicated by pollen data. It is concluded therefore that the cairnfields were not abandoned for agricultural purposes in later prehistory. The issue of whether they were abandoned for settlement has not been resolved.

A date obtained from the earliest phase of construction of an agricultural feature suggests that some of these features may be broadly contemporary with the monuments in the cairnfields.

The aim of comparing the dating of agricultural activity between Gardoms Edge and Big Moor has not been achieved. This remains to be addressed by future research. The objective of comparing dates for activity in different parts of the Big Moor cairnfield has similarly not been achieved because sediment at only two features has been dated. It is felt that this is not a sufficient basis from which to draw any conclusions.

The other primary aim of this project was to provide information on the character of the occupation of the cairnfields by an assessment of the scale and impact of farming activity on the soils. This took the form of the testing of two hypotheses.

- That prehistoric agriculture produced significant soil erosion
- That certain features had formed through the accumulation of eroded sediments against former boundary features such as hedges or banks.

It is argued here that the second of these two hypotheses has not been upheld and it is concluded that most of these features may be built, rather than the product of erosion and natural transport mechanisms.

The first hypothesis is similarly discounted for the Bronze Age. It is concluded that Bronze Age agriculture did not cause significant erosion of the topsoil. The nature of the agriculture in this period cannot be inferred, but the indications are that it was of small-scale or low intensity. It is concluded that the impact of agricultural activity increased from the Roman period and possibly the Iron Age, but that the most significant sedimentation occurred after the Roman period. This appears to be related to the establishment of a transport route, rather than to agriculture.