Dealing with the Dead: Manipulation of the Body in the Mortuary Practices of Mesolithic North West Europe

A thesis submitted to The University of Manchester for the degree of

Doctor of Philosophy

in the Faculty of Humanities

2011

Amy Gray Jones

School of Arts, Histories and Cultures

Table of Contents

Word count: 74,115

Table of Figures

Tables

Abstract

Amy Gray Jones

Doctor of Philosophy

Dealing with the Dead: Manipulation of the body in the mortuary practices of Mesolithic north-west Europe

3rd March 2011

This thesis focuses on practices of disarticulation and bodily manipulation in the Mesolithic of north-west Europe. While the presence of 'loose human bone' has been noted on Mesolithic sites for several decades, this has often been dismissed as the result of taphonomic factors, such as disturbed graves. Instead, studies of mortuary practices have primarily focused on the cemeteries and issues of social complexity, ranking and status. Disarticulated human bone, which cannot throw new light on such issues, has consequently been ignored. Only with more recent discoveries of larger collections of disarticulated human remains, from secure contexts, has this phenomena begun to be taken more seriously, Cauwe (2001) arguing for example, that disarticulation represents the primary Mesolithic mortuary practice.

Despite this claim, little work has focused on practices of manipulation and disarticulation beyond a few studies of individual sites, thus little is understood about the nature and variability of these mortuary practices. The aim of this thesis is therefore to provide a broad study of disarticulated Mesolithic remains across north-west Europe (though excluding Scandinavia). In order to tackle the methodological issues involved in the analysis of these assemblages, as well as to provide a considered study of the context of these remains, three detailed osteological case studies – Hardinxveld in the Netherlands and Les Varennes and Petit Marais in France – are presented. These are then compared with a series of well-published sites in order to draw out the full parameters of Mesolithic mortuary variability. It is argued here that Mesolithic mortuary practices were complex and were often temporally and spatially extended. These practices of disarticulation and manipulation also appear to indicate a concern with bodily decay and the circulation of body parts. The implications of these practices for the understanding of Mesolithic identities, bodies, and attitudes to death are also drawn out.

DECLARATION

No portion of the work referred to in the thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning

COPYRIGHT STATEMENT

Acknowledgements

The research presented in this thesis would not have been possible without the help and support of many people and organisations. Firstly, I am extremely grateful to have received a postgraduate award from the Arts and Humanities Research Council to carry out this research, and also to have received additional support for several study trips, both in Britain and abroad. I also received the John and Bryony Coles Bursary (2007) from The Prehistoric Society in support of my study visit to Leiden University, to analyse the material from Hardinxveld. Both at Leiden, and during a study visit to the University of Paris X (Nanterre), I was warmly welcomed as a visitor and would very much like to thank Leendert Louwe Kooijmans and Liesbeth Smits, in Leiden, and Frédérique Valentin and Gabrielle Bosset, in Paris, for their generous hospitality and assistance. Several others also dealt with my enquiries regarding access to material and/or data, and for their help I'd like to thank Cyrille Billard, Thierry Ducrocq, Claude and Daniel Mordant, Nicolas Cauwe, Caroline Polet, Peter Woodman, and Jill Greenaway. Andrew Chamberlain, Chris Knüsel and Alan Outram also generously offered their time and advice when asked, and I am especially grateful to Chris Knüsel for supporting the initial proposal for this research. Marion Dowd kindly gave me access to data regarding the site of Sramore before it was published and Stephany Leach gave me access to her PhD thesis and a helpful discussion regarding methodological approaches. Many thanks also go to Chris Meiklejohn, who gave me much encouragement and access to his updated (personal) catalogue of Mesolithic human remains, whilst parts of it were being prepared for publication. I am also especially grateful to Liv Nilsson Stutz, whose own research was a source of inspiration for this project, and who has been incredibly generous with her encouragement and interest along the way.

On a personal level, my years as a doctoral student at Manchester have been much enriched by the community of staff, postgrads, and undergraduates here, and in particular I'd like to thank Hannah Cobb, whose enthusiasm for the Mesolithic rarely fails, for her friendship and support. I have also been lucky to be part of a wider community of postgraduates working on the Mesolithic during this time, and I would like to thank the following friends for making conferences and fieldtrips a source of much intellectual stimulation and fun; Aimée Little, Andy Needham, Ben Elliott, Ed Blinkhorn, Harry Robson, John Piprani, Nick Overton and Ros Wallduck. Of our friends, Dominic Powlesland and Louise Cooke (and Alfie and William) have been especially generous, opening their home to us and providing a place of retreat in beautiful East Yorkshire.

Finally, I'd like to thank three people who have been particularly instrumental to the successful completion of this research. Firstly, my supervisors, Chantal Conneller and Mel Giles, who have provided both intellectual challenge and support in equal measure. Chantal, in particular, has always shown great faith in the value of my research, and has been a source of much encouragement throughout.

And lastly, Barry Taylor, my husband and best friend, who embarked on this doctoral adventure with me and who has been a source of unwavering support throughout, despite having his own thesis to worry about. We have gained a dog, a marriage and (hopefully) two doctorates - I could not have done it without you - thank you.

1 Disarticulation as mortuary practice in the Mesolithic of north-west Europe

1.1 Introduction

Mesolithic human remains have been identified in a wide range of contexts since the 1920's, occurring as isolated or small collections of skeletal elements on occupation sites and middens, and as single burials. But it was not until the discovery of formal arrangements of skeletal material, either in cemeteries or collective tombs, that significant discussion of Mesolithic mortuary practices took place. This generally focused around the treatment of the body in the grave and the presence of accompanying grave goods in order to elucidate aspects of Mesolithic society such as age and sex distinctions and social status and hierarchy. Consequently cemeteries became indicative of increasingly 'complex' social behaviour such as social differentiation, sedentism and territoriality as seen in the work of Chapman (1981) and Clark and Neeley (1987). A focus on the relationship between mortuary practice and issues of social complexity prioritised cemeteries as an object of study and perceived complete, intact burial as the normative burial rite. Unable to address these issues directly, incomplete human remains recovered outside of cemetery contexts were frequently regarded as evidence of disturbed graves, reinforcing the primacy of intact inhumation.

More recently, however, these assemblages of disarticulated human remains have received more attention and have come to be seen as evidence for alternative burial practice (for example (Cauwe, 2001, King, 2003, Conneller, 2006). Despite this there is still little understanding of the character of such mortuary practice(s) and their significance to people in the Mesolithic. As Meiklejohn and Babb state "No study fully explores the possible range of behaviours and/or processes involved across Europe" (Meiklejohn and Babb, 2009: 221).

The aim of this thesis is to understand the nature of Mesolithic mortuary practices that result in the assemblages of disarticulated human remains and to use this to discuss more generally the wider pattern of mortuary treatment in the Mesolithic of west Europe. To achieve this I will undertake detailed osteological analysis of a number of well-excavated and well-recorded skeletal assemblages in order to identify the specific practices involved. This study will be complemented by a wider survey of published literature relating to the known skeletal material from western Europe to explore broader trends in funerary practice. By focusing on the practices involved in mortuary treatment I will consider the physical engagement that living people had with the dead and what this can tell us about concepts of death, decay and the body. These concepts have, until recently, received little attention and this thesis will make an important contribution to our understanding of Mesolithic society.

In this chapter I will show how this disarticulated material has come to be accepted as evidence for alternative forms of burial practice and its potential significance to a wider understanding of Mesolithic society. I will begin by briefly describing the cemetery sites that have dominated the discussion, highlighting the practices observed within them and their interpretation.

1.2 The cemetery evidence

Until relatively recently, research into Mesolithic mortuary practices in northwest Europe has focused on a small number of cemeteries discovered in Scandinavia (Vedbæk (Bøgebakken) and Skateholm I and II) and northwest France (Téviec and Hoëdic). However the cemeteries are all relatively small, ranging from 10 graves (14 inhumations) at Hoëdic to 57 graves (62 inhumations) at Skateholm I and seem to represent a very incomplete sample of the Mesolithic population. The cemeteries at Téviec, Hoëdic and Vedbæk have all been disturbed, destroying an unknown number of graves and the excavations at Skateholm II are not thought to have recorded the entire cemetery (Albrethsen and Brinch Petersen, 1977, Larsson, 1988, Schulting, 1996). Furthermore the cemetery at Skateholm I, which was excavated in its entirety, only contained six child burials, and no children older than one year were recorded at Vedbæk, making it unlikely that either form a representative sample of the wider Mesolithic population.

All the cemeteries exhibit a range of mortuary practices as displayed through the form of burial, position of the body in the grave and the character and quantity of accompanying artefacts or grave goods. However, there is considerable variation between the cemeteries in the particular practices that took place.

The mortuary practices at Vedbæk were both uniform and structured. The 17 graves were similarly sized and arranged in parallel rows (Albrethsen and Brinch Petersen, 1977). All but one of the burials was supine and most of the graves were furnished with grave goods including red deer antler (onto which the body was sometimes placed), perforated teeth (both animal and human) and tools made from stone, antler and flint. In the majority of the graves parts of the skeletons were also covered with red ochre, particularly around the head, torso, pelvis and legs. All but three graves contained a single inhumation, though two (graves 8 and 15) contained double inhumations, (in both cases the burial of an adult female and a young infant) and one contained three burials (two adults and a one year old child). Only two burials deviated from the general pattern of funerary practice. One, the burial of a young woman, was placed in a crouched position, the only burial not to have been placed on its back and one of the few to lack grave goods. The other grave contained grave goods (red deer antler and several tools), but no body and appeared to have been reopened and then backfilled sometime after the grave had been closed.

In their analysis of the cemetery, Albrethsen and Brinch Petersen argued that the choice of grave good was determined by the sex, and to some extent, age of the deceased with male burials typically containing tools and female burials items of adornment. They also suggested that certain practices, such as placing bodies on red deer antlers, were restricted to older individuals of both sexes and were therefore indicators of age. Unfortunately, the methodology that the excavators employed to undertake this analysis was highly problematic. In a number of cases the human remains were too poorly preserved for osteological analysis and grave good assemblages were used to determine the sex of an individual. This created a circular argument where the burial was sexed on the basis of artefacts and was then used as evidence for the differences in grave good deposition. The excavators also sexed one burial as male simply because it was interred with a female (who was sexed on grave goods only) and a child, interpreting it as the burial of a family.

This emphasis on identifying broad patterns of normative behaviour also restricted the interpretation of those burials that deviated from the norm. Several burials were accompanied by grave goods attributed to both sexes, suggesting a more complex relationship between artefacts and sex, but this remained largely unexplored. Other burials had been treated in unique ways, such as the crouched burial, the empty grave and the body of an adult apparently weighed down with stones. But despite the fact that those individuals had been set apart by their treatment in death, these practices received little or no attention. As a result, the complexities of mortuary treatment at the Vedbæk cemetery and the social practices they represented were ignored at the expense of more generalised patterns of behaviour.

In contrast to Vedbæk, funerary practices at the two Skateholm cemeteries were far more varied. At Skateholm I, 57 graves (containing the remains of 62 individuals) and eight graves containing dogs were recorded. The graves were orientated in a number of different directions and the bodies placed in a number of different positions including supine, crouched, seated and, in one case, prone. Five of the graves contained double inhumations, including a neonate placed on the hip of an adult woman who had been placed in a seated position (grave 6) and two crouched adult males (grave 63) (Larsson, 1988, Larsson, 1989a). At Skateholm II 22 graves were recorded, most aligned with the local topography, and included two double burials and the grave of a dog. Unlike Skateholm I, there were no multiple burials and none of the bodies had been placed in a crouched or prone position. As well as human burials the Skateholm cemeteries also included the burials of dogs, either accompanying human inhumations or in graves on their own. One dog was buried with red deer antler and flint tools and covered with red ochre in a manner that paralleled the human burials. Another was buried with a single flint blade and several others were covered with red ochre.

Burials at both of the Skateholm sites were furnished with grave goods, which included red deer antler, animal bones, perforated animal teeth, and bone and flint tools, though these were generally found in higher numbers at Skateholm II. The use of red deer antler as a form of grave furniture was also more prevalent at Skateholm II and was only found in one grave at Skateholm I. As at Vedbæk, part of the body was also covered with red ochre, particularly around the head, torso, pelvis and legs in graves at both of the Skateholm cemeteries.

As at Vedbæk a relationship between mortuary practice and age and sex was observed by Larsson at the Skateholm cemeteries. At Skateholm I, for example, most male burials were positioned with their feet together whilst older women were buried with their hands in front of their faces (Larsson, 1989a: 372). Similarly, tools tended to occur in male graves (Larsson, 1993: 49). However, Larsson argued that the placing of grave goods was not simply a reflection of an individuals' sex, or their position in a ranked society (*ibid*.: 52). At Skateholm I the largest quantities of grave goods accompanied the burials of older adult males and young adult females, individuals whose death, Larsson argued, would have been seen as a significant loss by the rest of the community (*ibid*.). In this case grave goods represented the feelings of the living community towards the deceased rather than an individual's status in a stratified society.

The relationship between funerary practice and social identity at Skateholm was more recently discussed by Chris Tilley (1996). Noting the wide range of burial practices exhibited at the site, Tilley suggested that the cemetery represented an 'essentially egalitarian society' (1996: 35). He argued that, rather than membership of a particular class in a social hierarchy, the mortuary practices at Skateholm 2 represented 'personal differences between members of society' (*ibid*.).

As well as exploring normative patterns of behaviour Larsson also discussed the wider aspects of mortuary treatment and considered the significance of some of the more unusual examples of funerary practice. In particular he argued that inhumation in the cemeteries of Skateholm I and II was not necessarily the only form of burial practice undertaken in the area. In particular, the removal of skeletal elements from several graves, and the dismemberment of another body prior to burial, suggested that other forms of mortuary treatment were being practised at the site (Larsson, 1989b) and that the remains of the dead were somehow important to the living society (Larsson, 1990). Similar observations were made by Tilley (1996) in his review of the funerary material from Skateholm and Vedbæk and have gone on to form the basis for much more detailed work carried out by Liv Nilsson Stutz (see below). Larsson (Larsson, 1989a) also suggested that elements of the population, distinguished for example on the basis of age, may have been afforded burial at other sites, a point that is supported by the under-representation of children at Skateholm I.

However, amongst the intact burials, alternative burial practices were also represented at Skateholm. A number of graves provide evidence for the removal or manipulation of parts of the body, presumably following death. At Skateholm I an adult male had been dismembered and the body parts placed in the grave (grave 13) whilst another adult male had the bones of the left lower arm and left thigh removed after the body had been interred and the flesh decomposed (grave 28) (Larsson, 1984: 20-22). Body manipulation is also evidence at Vedbaek in the presence of human tooth beads, amongst the grave goods (Albrethsen and Brinch Petersen, 1977:9).

Very different forms of mortuary practice were recorded at the cemeteries of Téviec and Hoëdic, on the coast of Brittany, northwest France. At Téviec ten graves, containing the remains of 23 individuals, were recorded cutting through the lower layers of a shell midden (Péquart *et al.*, 1937, Schulting, 1996). Seven of the graves contained multiple burials and one, grave K, contained the remains of six individuals. These do not appear to have been contemporary, as the remains of earlier inhumations were moved to accommodate the later burials. Where they have not been disturbed the burials were laid out in a range of ways including flexed, seated and supine (Péquart *et al.*, 1937). An empty grave, interpreted as a cenotaph, was also found at the site. Associated with the graves were a number of hearths, located either on top of the grave or adjacent to it. Those placed on the grave were generally smaller and contained red deer and/or wild boar mandibles whilst those that lay adjacent to the grave were larger and contained significant deposits of charcoal and burnt bone. At Hoëdic nine graves, containing the remains of 14 individuals, and an empty grave, were found in a depression beneath a second shell midden (Péquart and Péquart, 1954, Schulting, 1996). As at Téviec several of the graves contained multiple, consecutive, burials where the remains of the later burials had disturbed the earlier ones.

At both sites several of the burials were accompanied by grave goods including perforated shells and artefacts made from bone, antler and flint. An incised child's rib was also found with one of the multiple burials at Téviec and is thought to have come from a separate burial. Six of the burials (four at Hoëdic and two at Téviec) were also furnished with red deer antler that had been arranged into a 'structure' over the deceased's head. At Téviec at least one of the graves (grave D) was lined with stones and in another, grave K, stones had been placed around the skull of one of the burials (Schulting 1996).

Schulting (1996) interpreted the funerary practices at Téviec and Hoëdic as evidence for two forms of social differentiation: one based on age and sex, the other on an ascribed or achieved status. Sex, and to some extent age, were expressed through a preference for particular types of shells used on items such as bracelets and the character and quantity of different types of grave goods (with adult males having more grave goods in total and more 'utilitarian' artefacts). Age was also expressed through rituals that took place during the burial as none of the child graves were associated with hearths. Ascribed status was displayed through the antler structures placed over the head of the deceased and bone pins that were placed on the body, possibly to hold an item of clothing together. As Schulting states "It is likely that the garments worn by these individuals were of superior quality; clothing is one of the earliest-appearing, and effective, means of communicating difference in status" (Schulting 1996, 346).

As at Vedbæk and Skateholm, interpretation of the mortuary practices at Téviec and Hoëdic focused on issues of social differentiation, in this case based on age, sex and status, expressed through normative patterns of behaviour. As a result the significance of many other aspects of funerary practice, such as collective interment, the disturbance of earlier graves, and the curation and manipulation of skeletal material remained unexplored.

More recent work has begun to address issues associated with the treatment of the body through a reanalysis of the material from Vedbæk (Bøgebakken) and Skateholm. Using the French taphonomic approach *anthropologie de terrain* to reconstruct the actions of the mortuary ritual, Nilsson Stutz's work (2003) focused on the ritual practices of handling the body. She concluded that whilst there were a number of practices represented, primary inhumation was the dominant funerary rite. Normal, or 'proper', burials consisted of the inhumation of intact cadavers, shortly after death, usually singularly and accompanied by artefacts, ochre and sometimes structures of wood or antler. She demonstrated that the alternative practices, such as the removal of elements from grave 28 (Skateholm I), were deliberate acts which involved the re-opening of graves once enough time had passed for the decomposition of the soft tissues to have occurred. Despite this example, and the grave containing a dismembered corpse, she suggests that the processes of decomposition of the body were known about but that generally they were hidden through practices which attempted to mask the unpleasant process of decay. Practices of body manipulation, which appear to acknowledge these natural processes, she suggests only occurred in exceptional circumstances.

Strassburg (2000) has challenged the assumptions underlying much of the previous work on the cemeteries by suggesting that these were actually places where non-normative burial practices took place, and that they were locations for ensuring the removal of powerful or dangerous people (for example those who suffered violent or unusual deaths) from circulation amongst the living (Orme, 1981). They were therefore far from representative of the normative beliefs that structured mortuary practices.

There are two key points that I wish to draw from this summary of the cemetery record. The first is that the cemeteries do not contain a representative proportion of the Mesolithic population. To begin with, even allowing for taphonomic factors, the cemetery record is too small to represent c. 6000 years of inhumation. Even though cemeteries, such as at Vedbæk and Skateholm, have been partially destroyed and others have been submerged by subsequent sea level rise, the number and size of cemeteries across northern Europe is comparatively small. There is only one formal cemetery known for the whole of the British Isles (Aveline's Hole, Somerset), two from the north coast of France and none from the interior. Furthermore the demographic profile of these cemeteries also suggests that they are only representative of a small part of the population. There are no individuals between the ages of 1 and 18 years at Vedbæk, for example. Whilst this again may be partly explained by the incompleteness of the cemetery record, it has led a number of researchers to suggest that elements of the population were being buried away from cemetery contexts (e.g. Larsson), or that those buried in cemeteries were unusual individuals (Strassburg, 2000).

Secondly, it is clear from the cemetery record that whilst inhumation may appear to be the principal form of funerary treatment it was not necessarily the final stage of mortuary practice. As Larsson and Nilsson Stutz (2003) have shown, once interred in the ground, graves could be re-opened and elements or whole bodies removed sometime later. In other cases, such as grave 13 at Skateholm, bodies could be dismembered prior to burial. Similar practices were observed at Téviec where at least one element was removed from a grave, decorated and re-interred with another individual.

This suggests that mortuary practice may not have been focused on cemeteries but may have extended to other sites where practices such as dismemberment took place, or where disinterred skeletal elements or whole bodies could be taken, a fact that is supported by the relatively small size of the cemetery populations and their demographic profiles. In the remainder of this chapter I will review the current evidence for mortuary treatment outside of formal cemeteries and show how it has been used to develop the idea of disarticulation as a mortuary practice in the Mesolithic of north-west Europe.

1.3 Disarticulation as mortuary practice

Human skeletal remains have been found outside of formal cemetery contexts since the early 1900s and were included in the comprehensive cataloguing of Mesolithic human remains undertaken by Newell and colleagues in the late 1970s (Newell *et al*. 1979). This showed that human remains had been found within a wide range of contexts at sites across north-west Europe, such as occupation horizons, middens and caves, and varied in size from isolated elements to small assemblages of skeletal material representing the remains of several individuals.

The first analysis of this material was undertaken by Larsson *et al*. (1981) who collated information on human remains that had been recovered from occupation deposits on Scandinavian sites since the 1920's. They were the first to suggest that such finds (later referred to as the 'loose bone phenomenon') may be the result of alternative forms of intentional burial practice and not simply the remains of disturbed inhumations. The starting point for this analysis was previously unreported material from the Late Maglemose site of Ageröd I (southern Sweden) where a small assemblage of scattered human bone was found within undisturbed occupation layers associated with three 'huts' and an overlying peat deposit.

The authors placed these remains in the context of a further 22 Mesolithic sites from Scandinavia which had yielded isolated human bone elements (three from Sweden, one from Norway and 18 from Denmark). The material ranged in size from single elements to larger assemblages of multiple bones and included remains from Maglemose, Køngemose and Ertebølle sites. They recognised two patterns that led them to believe that these remains represented an unknown burial practice. Firstly, the pattern of elements, with no bones from the shoulder, torso or pelvic girdle represented, suggested that the distribution of these bones was not random. Secondly, they observed that these sites showed a degree of overlap with sites where faunal remains had been preserved, suggesting that they were not simply the remains of disturbed primary burials (Larsson *et al.*, 1981). In conclusion they suggested that these remains represent a burial practice which "may have involved sufficient destruction of the body prior to burial that pieces were lost" (Larsson *et al.*, 1981: 166) in contrast to those who were "accorded primary ritual burial" in cemeteries such as Vedbæk (Bøgebakken) and Skateholm.

The analysis of these loose bone assemblages was developed further through the work of Meiklejohn and Denston (1987) on the assemblage of non-articulated human remains recovered from three of the late Mesolithic middens on Oronsay (Argyll, Scotland). The basic pattern of elements represented was directly compared by the authors to the Scandinavian 'loose' bone finds (above) and other loose bone assemblages from Mesolithic Europe, a further 19 sites from Germany, Britain, Benelux, France and Spain, as recorded by Newell *et al*. (1979). They observed three distinct groups in this data, which they thought represented separate taphonomic and/or disposal patterns. The first, which included material from Germany, France (excluding the cemeteries of Téviec and Hoëdic), and some British sites (though not Oronsay), followed the Scandinavian pattern where the bones of the trunk, shoulder and pelvic girdle were under-represented. The authors suggested that, as the missing elements were amongst the most fragile bones in the skeleton, taphonomic factors, rather than funerary practice, may account for their absence. However, they also noted that the elements that are recovered from these sites, such as teeth, crania and the extremities, are those parts of the skeleton most likely to become detached if bodies were placed on scaffolds (possibly for drying) prior to subsequent inhumation. They argued that the burial of these bodies may never have occurred or, if it did, that it took place away from the site.

The second group were assemblages that were dominated by teeth and included the French sites of Téviec and Hoëdic (though not the formal cemeteries) and several of the Swifterbant sites of the Dutch late Mesolitic/early Neolithic (*ibid*.). The authors argued that, whilst these may have resulted from similar funerary practices to group one, teeth may also be lost during life, either through the natural loss of the deciduous dentition (milk teeth) or as a result of dental/gum disease or trauma, and that in many cases it would be hard to distinguish between the two processes (*ibid*.). As a result this makes it very difficult to assign either a cultural or natural cause to assemblages of this type.

The third group was represented by the material from Oronsay itself which the authors suggested resulted from an alternative form of mortuary treatment. They argued that the range of elements represented at Oronsay and the large number of hand and foot bones made it different from the other assemblages found across northwest Europe. They considered that remains were interred elsewhere, with certain skeletal elements being intentionally removed and brought to Cnoc Coig.

A more detailed understanding of the processes and practices that resulted in this third, Oronsay group, was developed through subsequent spatial analysis of the material (Meiklejohn *et al.*, 2005). This showed that the majority of the material was deposited in five spatially distinct concentrations, which themselves formed two distinct categories (*ibid*.). The first, which made up the majority of the material, consisted of two groups dominated by hand and foot bones, some possibly deriving from the same individual (*ibid*.). The second consisted of three much smaller groups and some isolated elements deriving from disparate areas of the body (*ibid*.). This led Meiklejohn and colleagues to suggest the presence of two separate processes that were responsible for the deposition of human remains within the midden. The first, the hand and foot bones, were thought to derive from intentional practices, such as excarnation on scaffolding over the midden (though the authors find excarnation to be an unsatisfactory explanation). However, the assemblage could derive from exposure of bodies on the midden, with the larger skeletal elements having been taken away from the midden and smaller elements left behind (Pollard, 1996: 204, Bradley, 1997: 14-15, Telford, 2002: 295-7, King, 2003: 135). The second group was shown to be statistically similar to the ‘loose bone’ finds from Scandinavia, which the authors considered to be the result of a taphonomic phenomenon rather than "the product of purposive cultural behaviour" (*ibid*.: 102). Although they never suggest what these processes may be, they do point out that "the most obvious source [of the human bone]... is from inhumation burials elsewhere, on or off the site" (*ibid*.: 102).

The work undertaken by Larsson *et al.* and Meiklejohn *et al.* began to demonstrate that apparently stray finds of human bone discovered outside of cemetery contexts may be the result of, as yet unidentified, patterns of mortuary practice. Analysis showed that this material could be the result of a number of processes, both natural and cultural, and that different processes may be responsible for the deposition of remains at the same site. Both Larsson *et al.* and Meiklejohn *et al.* recognised that there may be off-site activities, such as excarnation, that could result in the loss and final deposition of isolated skeletal elements, which also raised the possibility of there being other sites in the landscape where funerary practices took place. However, further understanding of these practices was limited by two issues: firstly, by the persistent belief that much of the material may result from disturbed graves rather than intentional practices (e.g. Meiklejohn); and secondly that when 'other' practices *were* recognised they remained secondary to burial in cemeteries (e.g. Larsson). These issues prevented any more detailed consideration of the nature of these 'off-site' practices, or of their significance within Mesolithic belief systems.

As well as the loose bone assemblages from occupation sites and middens, disarticulated and redeposited human remains have also been found in deliberately constructed features, such as pits. Unlike the material from occupation horizons, which may be the result of taphonomic processes, the deposition of human remains into these features is more clearly the product of mortuary practice and has consequently received more detailed analysis. The results of this work have demonstrated that Mesolithic funerary practice was not restricted to inhumation within formal cemeteries and that other types of practice, which included the deliberate manipulation and disarticulation of human remains and their curation and collation, also occurred.

The most spectacular, or perhaps macabre, example of this is at the site of Ofnet (southern Germany) where the skulls of 34 individuals were deposited in two pits and covered with red ochre (Orschiedt, 1999). With evidence for intentional removal of the head and for traumatic injuries suggesting a violent death, there has inevitably been debate as to whether these burials are the result of a violent episode, with the heads taken as trophies, or a separate burial rite (as discussed by Hofmann, 2005).

Assemblages of human remains have also been found deposited in pits at the site of ‘Petit Marais’, La Chaussée-Tirancourt, (Somme) in northern France (Ducrocq and Ketterer, 1995). Here the excavators recorded the cremated remains of a number of incomplete individuals within one pit, and the partially disarticulated remains of another individual within a second shallower feature. The lack of burning in the pit led the excavator to conclude that cremation took place elsewhere, before the remains were brought to the site for deposition.

Probably the most important work to be carried out on material of this type was undertaken by Cauwe (2001) on the human remains from two early Mesolithic caves, the Grotte Margaux and Abri des Autours, both located in the valley of the river Meuse, in southern Belgium. Described as ‘collective tombs’, the Grotte Margaux contained the remains of around ten people, possibly all adult females, whose bodies had been disarticulated and covered with red ochre before being brought into the cave. They were deposited within a small pit and spread across an adjacent stone ‘pavement’ which was surrounded by further stones. Cauwe showed that the remains were subject to further manipulation in this context; all of the remains on the pavement derived from those deposited in the pit, but the converse was not true, suggesting that deposition initially occurred in the pit and that to make room for new interments elements were moved out onto the pavement, in this way becoming mingled together (*ibid*.). Cauwe suggested that not all of the people deposited here were treated in the same way, each skeleton was incomplete in varying ways, there was no pattern in the elements that were missing and there were no remains of children. For example several individuals were very incomplete, one person was less disarticulated than the rest, and there were cut marks on one skull (on the forehead, cheek bones and base of the cranium) suggesting that the head was intentionally separated from the rest of the body and the lower jaw from the skull whilst the body was still fleshed (*ibid*.).

The second collective burial, Abri des Autours, held the remains of at least five adults and six children who were again deposited both within a small pit and dispersed across the floor of the cave (*ibid*.: 154). Despite good preservation, there was repeated absence of certain bones, such as the cranium and upper and lower leg bones, indicating that their removal had been deliberate after deposition (the presence of teeth and foot bones indicated that heads and legs were at one time present) (*ibid*.: 156). Some individuals were at least partially articulated when they were brought into the cave, as a few anatomical connections were still maintained, but there was also evidence for movement of bones within the tomb. In the corner of the cave a crevice in the rock wall contained 32 hand and foot phalanges from at least four individuals, clearly indicating the intentional movement of material. The body of a cremated individual had also been introduced to the cave and deposited within the pit. This was certainly a secondary burial as there was no indication of burning inside the rock-shelter and several bones from the head and feet were missing.

The work at sites such as Grotte Margaux in Belgium and Petit Marais, in France, has had a number of consequences for the study of Mesolithic mortuary practices. Firstly, it showed that funerary practice was not restricted to inhumation in formal cemeteries but consisted of a range of different processes undertaken in a range of different contexts. These included the deliberate deposition of human remains in cut features (other than graves in cemeteries) and the cremation of bodies either individually or collectively. Cauwe's work showed that at particular places there may have been more formal structures of deposition which included the manipulation of the body in certain ways and the removal of particular elements of the body, perhaps leading to the curation and/or use of these elements in further practices. Secondly it showed that skeletal material was moving between sites, and that mortuary practice extended across a wider landscape. At Petit Marais, the remains of several cremated bodies were brought onto the site and deposited in a pit, whilst at Abri des Autours specific parts of bodies were taken away.

Thirdly it showed that in many cases a significant element of mortuary practice was the deliberate disarticulation or dismemberment of the body. This clearly occurred in a number of ways. At Petit Marais the body was disarticulated before being buried whole whilst at Grotte Margaux complete fleshed bodies were brought into the cave where they were subsequently disarticulated and certain elements removed. Further evidence for deliberate disarticulation can be seen in cut marks recorded on human bones. In addition to those observed on the Bavarian skull burials and at the Grotte Margaux (above) cut marks have been observed at an increasing number of sites across north-west Europe. At the late Mesolithic site of Polderweg-Hardinxveld (Netherlands) cut marks were recorded on a single clavicle which was deposited along with other isolated skeletal elements within a 'refuse' zone surrounding the settlement (Louwe Kooijmans, 2001b, 2003). At the cave site of Grotte des Perrats (Charente, western France) late Mesolithic human and animal bones showed butchery marks, indicating defleshing and the gouging of eyes, and cutting off of ears, tongue and lower jaw (Boulestin, 1999). At a contemporary river-side settlement site in the north of France, Noyen-sur-Seine (Seine-et-Marne), both animal and human remains again showed evidence of butchery and burning (Auboire, 1991).

The recognition that bodies were being disarticulated, and that elements could be taken away to other places, has challenged the interpretation of loose bone finds as deriving from disturbed Mesolithic graves. The practice of disarticulation through exposure or excarnation could result in a number of different patterns of isolated bone finds. The small bones of the extremities, for example, could become detached and lost, whilst larger elements could be dispersed and removed by animals. Furthermore, whilst some elements of the skeleton were selected and retained for deposition the remainder could have become dispersed within what have been described as domestic refuse deposits. This is supported by the discovery of human bone with cut marks within refuse deposits at Hardinxveld. Equally the selection and subsequent curation of isolated elements could result in human remains being circulated within a population for a period of time, before their eventual deposition within 'domestic' contexts.

The recognition of disarticulation as a significant aspect of mortuary practice has been taken up by a number of researchers, especially with regard to the evidence for death and burial in the British Mesolithic, which has traditionally been a relatively neglected topic.

King's (2003) study of Mesolithic and Neolithic funerary practices in Britain and Ireland collated human skeletal material directly dated to the Mesolithic, the majority of which was recovered as isolated bones (the exceptions being the individual buried at Gough's Cave (Somerset) and the cemetery of Aveline's Hole (Somerset)). Drawing on this material both King, and later, Conneller (2006), reject the idea that disarticulation was the result of post-depositional or taphonomic processes (as suggested by Albrethsen and Brinch Petersen, 1977, Larsson *et al.*, 1981, Schulting and Richards, 2002: 1017) and, pointing to the wealth of similar material from continental Europe and the work of Cauwe (2001) especially, suggest that disarticulation was the major mortuary practice of the British and Irish Mesolithic. King also observed that given the frequent occurrence of human bone in occupation contexts, the dead were circulated amongst the living in the same way as is outlined for the Neolithic (*ibid.:* 142). Furthermore he suggested that the pattern of opportunistic deposition and processing of bodies (and other materials) across the landscape in both the Mesolithic and Neolithic represents one tradition of action, even if different specific meanings may have been involved. By recognising common practices of disarticulation and manipulation of the body he suggests that the Mesolithic and

Neolithic should be brought together in one long-term trend of continuity. Similar observations were made by Bradley (1997: 15) with reference to the persistence of certain Mesolithic practices into the Neolithic in a wider north-west European context. Similarly Cauwe also suggests that the Early Mesolithic collective tombs in Belgium are not only the origin of Middle and Late Neolithic collective tombs in Western Europe but form part of a long-standing tradition of manipulation of bodies that extends back into the Upper Palaeolithic (2001: 161).

1.4 Disarticulation as social practice

Despite this recognition of disarticulation in the work outlined above there has been comparatively little work on the social significance of this practice as a form of mortuary treatment during the European Mesolithic. As King has noted, whilst Neolithic bone assemblages are seen as evidence for a complex, multi-staged mortuary process, with exposure, dismemberment, and circulation of the dead amongst the living and through the landscape, similar Mesolithic assemblages have not been treated in this way (2003: 142).

Isolated material has often been approached from a purely scientific perspective. The only other analysis of the skeletal material from Britain and Ireland, for example, was concerned with the study of stable isotopes in order to explore prehistoric diets, particularly over the Mesolithic–Neolithic transition. This major area of study, initiated by the doctoral research of Richards (1998) and Schulting (1998), has been responsible for dating much of the material to the Mesolithic, but has tended to dominate the analysis of the human remains (e.g. (Schulting and Richards, 2002)). Whilst collating the known Mesolithic human material, and bringing attention to the many isolated remains, the focus on diet and subsistence has inevitably taken precedence over the practices that resulted in their deposition, and research has rarely been concerned with the social significance of this material within Mesolithic world views. Perhaps this is partly due to the perceived notion that isolated remains are of little value, in contrast to whole bodies, and were not part of the primary burial ritual.

Sometimes, however, the social significance of complete inhumations can also be marginalised, perhaps due to their rarity. For example, the recent osteological analysis of the Mesolithic burial at Gough's Cave (Somerset, England) has been divided into six papers, each dealing with a separate area of the skeleton (hand bones (Trinkaus, 2001), axial skeleton (Church *et al.*, 2002), pelvis and lower limbs (Trinkaus, 2003), age and sex (Trinkaus *et al.*, 2003), body size and shape (Holliday and Churchill, 2003), cranium, and dental remains). I can think of no other examples where the osteological analysis of a single inhumation has been divided in such a way; the rarity of this find is perhaps responsible for its over-analysis and the consequential removal of the body from its wider socio-cultural context. This results in a publication that is dedicated to the burial but that omits any mention of the archaeological context or its wider significance. This burial, referred to as 'Cheddar Man', has also been the subject of a study which established a genetic relationship between the Mesolithic burial and modern inhabitants of the Cheddar area through analysis of mitochondrial DNA (Barham *et al.*, 1999). As has been noted however, these studies have not addressed what these remains can reveal about Mesolithic practices or life-ways (Conneller, 2006).

By contrast the work of Conneller (2006) has taken the subject further by exploring the practices responsible for the disarticulation of the body and their significance within Mesolithic society. There are two aspects of this work that I wish to draw upon. Firstly, that by their disarticulation and subsequent deposition people were extended across the landscape (Conneller, 2006: 162). The analysis of disarticulated material has shown that after disarticulation the body was frequently manipulated and/or moved within the same site or between different locations before it was finally deposited. The curation of material is implied, whether only for short periods prior to deposition or for longer periods where remains circulated with the living, perhaps with specific people, such as relatives (*ibid.*). Deposition of disarticulated remains in places in the landscape extended these bodies across space, both physically and conceptually, so that journeys through a landscape were also encounters with those persons (*ibid.*). This is also true for animal bodies, which through hunting, butchery and transportation were also disarticulated and "stretched out across a network of places" (*ibid.*: 162).

This brings us to the second theme developed by Conneller (2006: 159), that disarticulation of the human body may reveal much about the relationship between animals and humans. She argues that where the practice of disarticulation and dismemberment was carried out by people (as indicated by cut marks) there are obvious comparisons that can be made with the butchering of animals. She illustrates this point using the example of cut marks noted on both human and animal bone relating to the defleshing of the head and the removal of the tongue on the Late Palaeolithic remains from Gough's Cave (Somerset, England).

Alternatively, she argues, bodies may have been disarticulated through the actions of animals, such as carrion birds or scavenging mammals. This suggests a different type of relationship, where humans disarticulated animals through butchery and in turn animals were responsible for the disarticulation of humans (*ibid*.). This reciprocal relationship finds support in the types of hunter-gatherer ideologies suggested by various ethnographic studies which stress a relationship between humans and animals based on mutual respect (*ibid*.).

Further parallels in the treatment of animals and humans have been noted at a number of sites. In particular, at Oronsay, analysis of the skeletal material revealed a number of close relationships between the remains of humans and animals (Nolan, 1986). Firstly, direct comparison of the representation of human body parts with those of animals found that the pattern of human elements was most similar to those recovered for red deer and pigs and least similar to the representation of seal and otter (*ibid*.: 256). That is to say that the predominance of human extremities is paralleled by the bias of skeletal extremities of red deer and pig in the animal bone assemblage.

> "Indeed were these bones identified as belonging to some other mammal, one would almost certainly conclude that they indicate an exploitation pattern similar to that of red deer and pig, in which animals were killed and butchered elsewhere and selected portions of them brought to the site" (*ibid*.: 256-257).

Secondly, one of the major concentrations of human bones, consisting almost entirely of hand and foot bones, was deposited directly above a group of seal bones, almost entirely from the flippers (*ibid*.: 255). The remains of the two mammals were considered stratigraphically contemporary, representing a single deliberate event, an indication that there was some commonality in the treatment of human and seal remains. How the distribution of human bone relates to other faunal remains and artefacts within the midden remains an area for further research.

Another indication of the parallel treatment of humans and animals is the occurrence of disarticulated human teeth which have been perforated, presumably for use as beads or pendants. Recovered on occupation sites and in graves, for example at Skateholm, these mirror those more often made from red deer and wild pig (Larsson, 1984, Bradley, 1997).

The classic example of the parallel treatment of human and animals in Mesolithic mortuary practices are the dog burials at Skateholm (Sweden) (Larsson, 1990). Of the nine dog graves in the Skateholm cemeteries, some accompanied humans into their graves and others were accorded their own separate burial, strewn with red ochre and occasionally accompanied by grave goods. One particular burial of a dog was as well furnished as the most richly furnished human grave; a red deer antler had been placed along its spine, a decorated antler hammer on its chest and three flint blades were placed by its hip (grave XXI at Skateholm II, (Larsson, 1989a)). Larsson comments that if the number and quality of grave goods is thought to equal status then this would have to be considered a 'Big Dog' (Larsson, 1989a). As well as being the only domesticate these burial practices set dogs apart from other animals. At the very least, as Tilley (1996) observed, they may have been important for hunting which may explain their association with grave goods from red deer.

Not only were dogs buried in similar ways to humans there is also evidence that they were also subject to disarticulation and manipulation in the same way that humans were. One female burial (grave VIII) was accompanied by a decapitated dog and other graves at Skateholm contain only parts of dogs, a mandible for example, indicating that some dog bodies were treated differently. Recent discoveries of dog remains at the late Mesolithic site of Polderweg-Hardinxveld in the Netherlands (Louwe Kooijmans, 2001b, 2003) further illustrate their treatment. At this site an unfurnished dog burial and a concentration of unbroken disarticulated dog bones directly mirror the unfurnished human burial and the feature containing the disarticulated remains of at least one individual on the site. As mentioned above, the disarticulated remains of human bodies were also recovered from a refuse or 'toss' zone around the settlement and this also contained the disarticulated remains of dogs and other animals, creating further links between the treatment of people, dogs and other animals.

The varied treatment of the body in death, including its disarticulation, was not limited to human bodies. Dogs appear to be set apart from other animals in that they were the only species that were routinely buried as whole bodies. As Conneller has discussed, hunter-gatherers may not have perceived animals in the way that we do and the relationship between animals and people in the Mesolithic can be specifically explored through this material.

1.5 Disarticulation, bodies, and personhood

Practices of disarticulation in the Neolithic period have been equated with ideas of partible or dividual personhood (eg. (for example Fowler, 2001, Jones, 2005). In contrast, the only discussion of personhood in the Mesolithic comes from a study of the early aceramic Ertebølle in southern Scandinavia, based mainly on the inhumations from the cemeteries of Vedbaek and Skateholm (Fowler, 2004). As a counter-point to the notion of 'individuality'

Fowler stresses the relational nature of identity and argues that "the people buried in the Ertebølle cemeteries consisted of multiple elements, the incorporation and/or practical use of which actively transformed their natures" (*ibid.*: 153). Drawing on a series of ethnographic examples he demonstrates that societies may identify objects, plants, animals and even places as persons, or quasi-persons, and that, amongst other practices, the treatment of the body in death, and grave goods in particular, were central to the mediation of relations between these social beings. For Fowler, the evidence for the dressing and wrapping of the body in animal hides, the colouring of the corpse with red ochre, and the provision of bone and flint tools, that were held and worn along with sometimes hundreds of beads, demonstrates that a person was composed of a diversity of relationships with animals, places and other humans, a multiply-authored composite of relations which brought the whole community together in their person (*ibid.*).

In order to define personhood in the past we must focus on the treatment of non-humans as well as humans. For example, Fowler suggests that similarities between the treatment of dogs and humans after death in the later Mesolithic of southern Scandinavia, indicate that dogs may have been emergent persons or even parts of persons. Disarticulated remains provide much potential for the discussion of these themes, though we must use caution against taking a literal view of the archaeology and must not automatically equate the physical disarticulation of the body with dividual types of personhood.

1.6 Disarticulation and cannibalism

Disarticulated human bones have often been equated with practices of cannibalism, especially when cut-marks are also observed on the bones, for example "Cannibals in the Cavern" at Kent's Cavern (Chandler *et al.*, 2009) and Hardinxveld (Smits and van der Plicht, 2009: 64). This is particularly the case for remains that are deposited in 'non-funerary' contexts, especially where they are deposited in the same context as animal bone or with what is regarded as 'refuse' material. The positive identification of cannibalism is usually based on the recognition of similarities in treatment between animals and humans, such as the incidence of cut-marks and fracturing, discard patterns, and element representation, for example. The implication is that because animal remains are butchered and consumed therefore people were. There are a number of problems with this approach. First is the issue of equifinality: that different practices may result in the same observed pattern of changes. There are other, funerary, practices, such as ritual defleshing and dismemberment of the body, that may cause the same pattern of treatment to be observed but that do not involve consumption of the remains.

Secondly, when consumption of remains can be identified, ethnographic accounts show that the motivation and significance of the practice may extend beyond nutritional needs or the denigration of enemies, and can be much more complex and varied. By way of illustration, the Wari' of western Brazil carried out two different types of cannibalism: they consumed their defeated enemies (as an expression of dominance and denigration) but they also ate their relatives after death (Conklin 2001). This funerary cannibalism, in contrast, relates to expressions of compassion and cycles of renewal, and its purpose, through literally "consuming grief", is emotional healing. These potential differences in how cannibalism may be experienced are often not emphasised when the practice is identified, though the importance of context had been emphasised (Knüsel and Outram, 2006: 268). In addition, given that relationships with animals may have been more complex than hunter and prey, consumer and consumed, (as discussed above) we may also need to rethink the implications of the consumption of animals (who may have been seen as persons) as well as humans (some of whom may not have been seen as persons).

1.7 Towards a systematic study of disarticulated Mesolithic remains

It is clear from this review of the mortuary record of north-west Europe that far from being the dominant form of funerary practice, inhumation within formal cemeteries was just one of a number of ways in which the body could be treated after death. Bodies could be placed collectively in communal burials, dismembered and deposited as complete skeletons or disarticulated and deposited as partial bodies in a range of contexts. Nor were these practices mutually exclusive. Graves could be opened and skeletal elements removed just as disarticulated elements could be added to a complete burial. It is also clear, however, that whilst practices of dismemberment and manipulation have been explored within cemeteries (e.g. Nilsson Stutz) assemblages from outside of cemetery contexts have received relatively little attention. This has perpetuated the long standing dichotomy between the burial in cemeteries, or similarly formal arrangements of bodies, and alternative treatment of the dead involving disarticulation and dismemberment. However, this division between the two is clearly a false one. Skeletal material was removed from cemeteries such as Skateholm just as it was brought into sites such as Autours and Margaux suggesting that cemeteries were just one part of a wider, funerary, landscape. Seen in this way the loose bone assemblages from occupation sites or middens and the collections of skeletal material from pits and other features represent an important, and still largely neglected, aspect of Mesolithic funerary practice centred around the disarticulation and manipulation of the human body.

To conclude this chapter I will now outline the ways in which the practice of disarticulation, as a form of mortuary practice in the European Mesolithic, can be studied through the analysis of human skeletal material from outside of cemetery contexts. Central to this is an examination of the *châine opératoire* of disarticulation and body processing through a systematic osteological study of skeletal material found outside of cemetery contexts. This will focus on the identification of individual skeletal elements, the presence/absence and location of cut marks, and patterns of fragmentation and fracture type. The merging of osteological analysis with a social approach to the material will represent a significant advance in the study of these remains, since the few social approaches to disarticulation have proceeded through literature review only, with no re-examination of the original material. In fact, aside from the analysis of material from the Oronsay middens (Meiklejohn *et al.* 2005) there has been no systematic, comparative osteological study of material from non-cemetery contexts, the majority of which is in a disarticulated state. Furthermore, the work at Oronsay was carried out before methodologies for fragmented assemblages were developed, and the accompanying increase in osteological studies focusing upon taphonomy (e.g. Outram *et al.*, 2005, Andrews and Bello, 2006, Knüsel and Outram, 2006).

Through this analysis I will explore four principal themes that result from the recognition of disarticulation as a form of mortuary practice. First, I will consider the physical practices and processes involved in the manipulation of the body. Apart from the work of Nilsson Stutz, Mesolithic funerary studies have tended to focus on the final stage of the burial act, the deposition of the body into the ground. Just as inhumation conceals the processes of decay, so the study of inhumation has obscured the wider range of social processes surrounding the treatment of the dead. In contrast, by its very nature, an exploration of disarticulation requires an understanding of the processes and practices that transform a human body into separate, and sometimes isolated, skeletal elements. These processes may have involved physically dismembering the body, encountering decayed bodies or allowing animals to consume the flesh, challenging western sensibilities regarding death, decay and hygiene and 'respectful' treatments of the dead.

Secondly, I will explore the way that disarticulation may have formed part of wider systems of belief regarding the relationship between humans and animals. Animals frequently played a part in Mesolithic mortuary practices through their inclusion as grave goods and certain animals, notably dogs, were afforded similar treatment in death as humans. These relationships, and the concepts that underlie them, are brought out further through the practices of disarticulation. As Conneller (2006) has pointed out, disarticulation may have involved the active participation of animals to deflesh or disarticulate exposed corpses, whilst the dismemberment of humans required the same processes and knowledge as butchering an animal. These relationships are also seen in the depositional contexts that disarticulated bone has often been found, such as middens and refuse deposits, where the disarticulated remains of humans have frequently been found amongst assemblages of other animals. Clearly then, animal:human relationships operate on a range of different levels, each of which may have articulated different ways of perceiving people, animals and the relationship between them.

Thirdly, I will consider the significance of disarticulation to Mesolithic concepts of the body. As a number of authors have now demonstrated, Mesolithic mortuary practices often involved the dissolution of the skeleton into separate elements and the retention and manipulation of parts of the body amongst the living society. As well as removing skeletal elements or dismembering a body human bones could be retained, decorated and even worked into artefacts such as bone points (Woodman, pers. comm.). This raises a number of important issues regarding ideas of the body, individuality and the self. For example, where human remains were circulated amongst the living, were they considered to be a person, part of a person, or something else and were objects made from human remains considered to be different to those made from other materials?

Finally I will explore the practice of disarticulation across the landscape, looking at the relationship between processes and practices and the places that human remains are deposited. Unlike traditional views of mortuary treatment I wish to consider funerary practice as a dynamic process that involved an ongoing negotiation between the living and the dead that extended beyond individual sites and across the landscape.

2 Methodology: Discovering mortuary practice

This chapter describes the methodology used to explore the full range of mortuary practices carried out in the Mesolithic of north-west Europe. The analysis focuses on material from the modern countries of Great Britain, the republic of Ireland, France (north of the Loire), Belgium, Luxembourg, The Netherlands and Germany (Figure 2.1). After collating all known Mesolithic human bone from within this study area through a detailed literature review, key sites were selected for detailed osteological analysis. Material from three sites – Hardinxveld-Polderweg in the Netherlands (Chapter 3), Petit Marais (La Chaussée-Tirancourt) (Chapter 4) and Les Varennes (Val de Rueil) (Chapter 5), both in Northern France – were re-analysed by the author to gather sufficient osteological detail to inform on practices of disarticulation. This material was chosen because it derives from high quality, recent excavations. This permits evidence from multiple taphonomic indicators to be integrated with analysis of the contextual archaeological detail of the site. The aim of the osteological analysis was to differentiate deliberate practice from the results of taphonomic processes, in order to identify specific mortuary practices and explore patterns in body treatment. Sufficient published detail was present for a number of other sites in the study area – Grotte des Perrats and Noyen-sur-Seine in France; Abri des Autours in Belgium; and Cnoc Coig in Scotland – to permit comparisons to be made between these and three assemblages that were the focus of the detailed osteological analysis. This will be discussed in chapter 6.

This chapter begins by outlining the various taphonomic processes and agents which act upon human remains, and may influence the pattern of remains recovered, and goes on to show how the recording of multiple taphonomic indicators can be used to reconstruct mortuary practices.

2.1 The methodological approach

In order to achieve the aims set out in Chapter 1, the objective of the osteological analysis was to record the material in such a way that the treatment of the body could be identified and burial practice characterised. To do this it was necessary to use a methodological approach that could disentangle the effects of the many different processes, both cultural

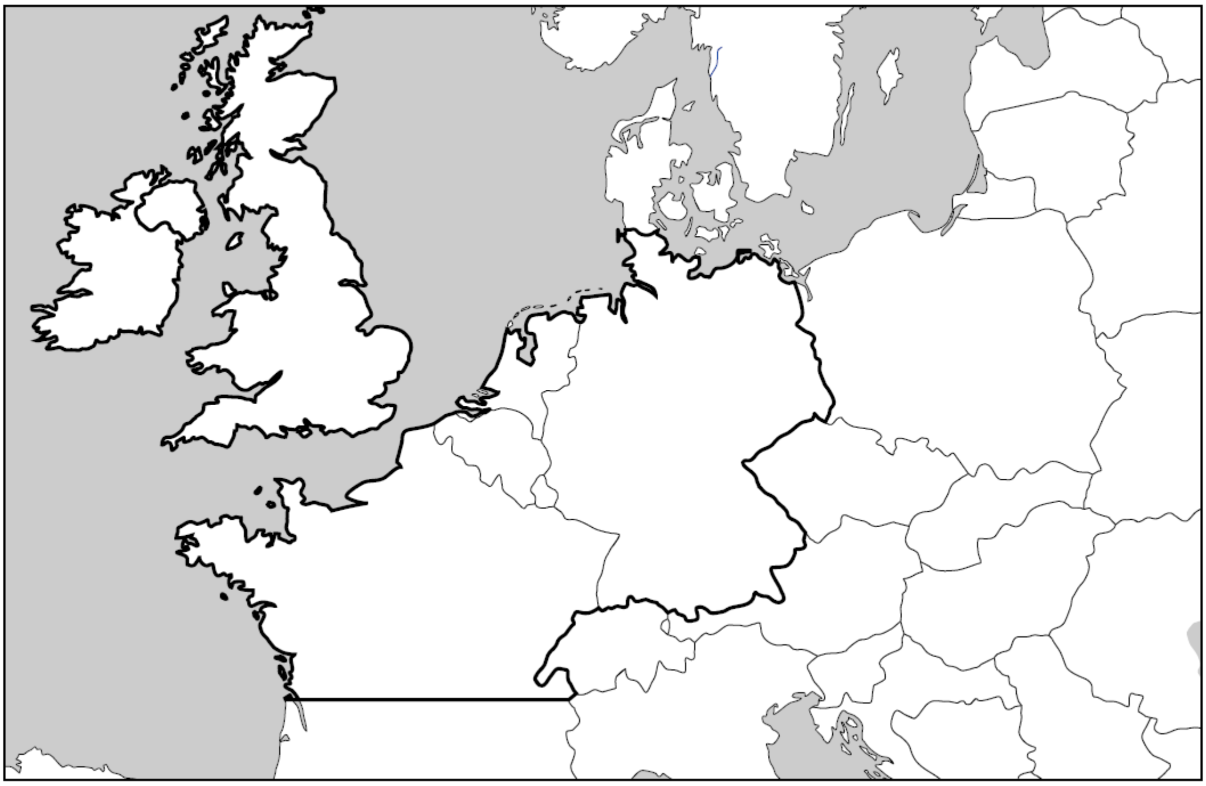

Figure 2.1 Map of the study area

and natural, that have acted upon the material. Assemblages of human remains are a complex mix of the results of the peri- and post-mortem treatment of the body, its deposition and post-depositional history. The body's decomposition, disarticulation, dispersal and accumulation may vary according to the specific depositional environment and the actions of other agents, such as humans and animals.

The primary objective of the osteological analysis was therefore to employ osteological techniques to understand and reconstruct the processes through which these assemblages have been formed, and specifically to distinguish deliberate practices from the results of other taphonomic processes. A further, second, objective of the analysis was to obtain anthropological data to identify *who* was treated in these ways. By identifying the age and sex of the bodies subject to different practices, differences in their treatment could be investigated. Whilst the physical body does not equate to the totality of a person's identity, biological sex and chronological age can provide a starting point for these discussions. This is dealt with later in the chapter (section 2.3.7).

2.1.1 Taphonomic analysis - Translating patterns into practices

The first objective is therefore concerned with taphonomy, literally meaning the "laws of burial" (Efremov, 1940) or, as (Olson, 1980) chose to describe it, the reconstruction of the life history of a fossil from the time of death to the time of recovery. The occurrence and frequency of skeletal elements recovered from a site might reflect the deposition of incomplete skeletons, the selective removal of certain elements (by both human and non-human agencies), or the differential survival of the bones. This is the problem of equifinality - that taphonomic processes may create apparently similar patterns and therefore confuse the behavioural inferences drawn from them (Knüsel and Outram, 2004: 85). The goals of taphonomic study therefore include: the determination of factors causing differential preservation, destruction or surface modification of the bone assemblage; interpretation of selective transport of elements; defining decomposition and disarticulation sequences and their effects, and discriminating human from non-human agency (Haglund and Sorg, 1997b). In the case of the Mesolithic assemblages studied here, taphonomic indicators can assist in answering fundamental questions about their origin. For example, do scattered human remains represent the remains of the deliberate dismemberment of the body, excarnation practices, disturbed burials or something else?

Traditionally the preserve of palaeontology and archaeology, the field has been particularly advanced by the recent contributions of forensic anthropologists, not least in exposing an inherent bias towards skeletal material, as Haglund & Sorg have described it, the "myth of flesh" (1997a: 3). This, they note, is the tendency to "treat skeletal elements as though they had always existed without the encumbrances of skin, muscle, ligament, and other soft tissue" (*ibid*.). This is perhaps due to a combination of the nature of our data, which is skeletal, and our own contemporary (western) experiences of death, where fleshed bodies are rarely encountered; the dead are dealt with by specialist technicians, and decay is delayed until funerary rites have taken place.

The physical properties of the fleshed (dead) body have also received surprisingly little attention in archaeological narratives/descriptions of mortuary practices, despite an increasing concern with the body in archaeology, since the early 1990's (see, for example, Kus, 1992, Thomas, 2000, Hamilakis *et al*., 2002, Joyce, 2005, Borić and Robb, 2008). The influence of developments in body theory within the humanities and social sciences (for example Shilling, 1993, Strathern, 1996) has led to an emphasis on the importance of the body as a cultural construct and a social product, but this has been at the expense of the equally important physicality and biological reality of the body (Nilsson Stutz, 2008: 19). Even when burials are the subject of analysis "the physical reality of death and the changes of the body ensued by it, are almost completely absent" (*ibid*.: 20). As Nilsson Stutz suggests, only through a deeper understanding of the biological body can we understand the materiality of death, "what death actually is: what it looks like and smells like" (*ibid*.: 22). For it is with a cadaver that, through mortuary practices, the living have a direct engagement. A social being disappears and is replaced with a cadaver that is in a continuous state of inevitable and irreversible transformation (*ibid*.).

It is this process of transformation which is negotiated through the treatment of the body, and may be handled in varying ways: observed, hidden, delayed, harnessed or accelerated, (Nilsson Stutz, 2008: 23), to varying degrees, and possibly at different stages in the sequence, and by different agents. A few ethnographic examples serve to illustrate the varying ways in which the living can be involved with the dead; for example, amongst the Wari' of Brazil, funerary rites include the consumption of the often decomposing flesh of loved ones by their relatives (Conklin, 2001); in the death rites of the Berawan of Borneo the body of the deceased is clothed and displayed, and provided with gifts and food (Metcalf and Huntington, 1991: 91); Tibetan sky burials involve defleshing and pounding the remains of the body in preparation for consumption by vultures. Whilst these are obviously very different practices, they demonstrate the varying ways in which the living may interact with the cadaver. Unless we have some understanding of the materiality of the dead body, and the way it changes, we cannot begin to consider the nature of these engagements. As well as identifying specific burial practices in the Mesolithic, this thesis also aims to explore the experiences of those performing them. In order to address this I have chosen to describe the decay process in some detail (below) with the aim of providing reference points for practices that may be carried out on the decomposing cadaver.

Recognising the changes that the cadaver undergoes after death is also important because the various stages of decomposition may significantly alter the intended arrangement of the body in a burial. This underpins Duday's (Duday *et al.*, 1990, Duday, 2006, 2009) methodology of *l'anthropologie du terrain* or 'field anthropology' (and recently renamed 'archaeothanatology' by Duday (2009: 3)) which records the precise position and orientation of skeletal remains in the ground in order to reconstruct the handling of the body and identify the effects of the decomposition of the cadaver. The original positioning of the body changes as the various soft tissues (organs, muscles, or ligaments) decay and detailed recording of even very slight, post-depositional movement of the skeleton, not only reveals the condition of the body when it was buried but also allows for the identification of now-decayed grave architecture, such as coffins or pillows, physical trauma or handicaps, and can indicate whether burial was primary, secondary, multiple (simultaneous burial) or collective (successive burial) (Duday, 2009: 13).

The following sections of this chapter outline the various taphonomic processes that may affect the pattern of skeletal elements that are recovered. Beginning with the decomposition of the soft tissues and the skeletonisation of the body, I then describe the differential preservation of skeletal elements and the ways in which other agents may modify an assemblage. They are described here in a sequence but will not necessarily progress in a linear manner, as parts of same body may be skeletonised whilst other parts are still decomposing and scavenged by animals, for example.

2.1.1.1 Death and decomposition of the soft tissues

To understand the post-depositional movement of skeletal remains we must remember that skeletons were once corpses and therefore understanding the consequences of the initial decomposition and disarticulation of the body is essential. The decomposition of the soft tissues of a body decomposing in an open space follows a known sequence. There may be variation in the timing and duration of each stage in this sequence, influenced by factors such as the local environmental conditions and the size and weight of the person, or position of the corpse, for example. Obviously, observation or knowledge of these changes in the past, depends on if, and when in the sequence, a body is buried or disposed of in another way.

Death (for us at least) is determined by the absence of a heartbeat, felt in the chest or as a pulse in the neck or wrists, and the cessation of breathing, observed by noting a lack of chest movement or listening to the airway (Clark *et al.*, 1997). It is frequently the absence of the usual material properties of the body (lack of warmth, muscle tone, facial expression, speech) that are important in categorising whether someone is alive or dead (Hallam *et al.*, 1999: 61). There may of course have been other ways of determining when the 'death' of a person occurs, which may or may not have corresponded with the biological death of their body, and may not always necessarily mark the end of their social being or influence (*ibid.*).

Within the first two hours of death early changes to the body include the loss of usual skin colour (pallor), the relaxation of the muscles (including the sphincters, resulting in faecal soiling and, if the body is moved, the regurgitation of the stomach contents may occur). A dark band develops across the eyeballs (due to drying), and the blood coagulates and clots (Clark *et al.*, 1997).

Rigor mortis (the post-mortem stiffening of the muscles) actually begins shortly after death but is first noticeable within 2-3 hours, and by 24 hours after death the entire body will be rigid. Occurring at the same time as the development of rigor mortis are algor mortis, the normal cooling of the body as it equilibrates with the surrounding environment, and livor mortis, or lividity, which is the pooling of the blood in the body due to gravity. This is evident from about 2 hours post-mortem as red, darkening to purple, discolouration of the skin on the underside of the body, and becomes fixed after 4-6 hours (*ibid.*).

After around 48 hours rigor disappears and blood in the body re-liquefies and it is at this point that changes occur in the tissues which will eventually lead to skeletonisation, that is, the process referred to as decomposition (*ibid.*). It consists of two concurrent processes, autolysis (involving intrinsic enzymes) and putrefaction (involving intrinsic and/or extrinsic bacteria). Decomposition is divided into four chronological stages: putrid, bloating, destruction and skeleton (*ibid.*: 161). After around 2-4 days gases produced by bacterial action and the breakdown of the tissues cause the body to swell (bloating) and the head, followed by the body, to discolour. The body will also emit a putrid odour which may attract insects and animals, which will augment the removal of soft tissue further. During this time a phenomenon called skin slippage occurs, hair and nails may be lost and there may be drying of the nose, lips and fingers. The destruction stage occurs after the swelling of the body has reached its maximum and the built-up gases along with the putrefied internal organs are released. This may occur within days or months from death and as the gradual loss of soft tissues continues the body becomes skeletonised. Small amounts of ligamentous tissue, articular cartilage and other cartilage may persist even when the body is largely skeletonised.

The duration of each stage of decomposition will depend on such factors as the ambient temperature, the depositional environment, and the condition of the body at death. Bacterial action requires moisture and a moderate temperature, consequently putrefaction is rapid in temperatures of 15-37°C, but will be inhibited by desiccation or low or freezing temperatures (Micozzi, 1991: 41, Lyman, 1994: 140). In warm environments the bloating stage will be brief, 2-5 days, but longer in cool conditions, perhaps up to several weeks. Bodies subject to violent deaths may decompose more quickly due to soft tissue injuries which provide increased access points for carrion insects and/or animals (Rodriguez, 1997: 462). Lyman (1994: 141) has also observed, in the case of animal carcasses, that emaciated bodies will decompose faster than healthy bodies. In cool, moist environments saponification of the body fats may occur, producing a substance called adipocere, which may also act to inhibit decomposition (Lyman, 1994: 141).

It has been observed that decomposition occurs most quickly in bodies placed on the ground surface, in shallow burials or in the air, and may be reduced when they are deposited in water, and slowest when subject to burial (Lyman, 1994: 141). Burial of a body acts to slow decomposition, occurring as much as eight times more slowly than above ground, due to lower sub-surface temperatures and by restricting or totally preventing the access of carrion insects and animals (Micozzi, 1991: 37, Rodriguez, 1997: 459).

Shallow burial, at a depth of less than a foot, however, does not slow decomposition, and may expose the body to increased degradation by plants and soil organisms present in the rich upper soil. Temperatures are approximately similar to those above ground and decompositional odours easily penetrate the soil, attracting insects and other animals (mainly carnivores) which will respectively burrow down to, or dig up, the corpse (Rodriguez, 1997: 459). Additionally, plant roots will grow towards the nutrient-rich decompositional products, degrading clothing, skin and eventually bone, which when recovered from shallow burials often display root damage (*ibid.*: 460).

Mummification, where the soft tissues are conserved through dehydration, is not restricted to deserts and can occur in any dry, ventilated environment (closed rooms, barns), or icy environments. The persistence of soft tissues can result in skeletons in unusually contorted positions. The shrinkage of the tissues may leave elements in different positions in contrast to the 'passive' position where the positions of parts are relative to one another as they would be in life. The fragile and brittle soft tissue may eventually be destroyed, especially if accessed by scavengers.

Bodies submerged in water decompose at roughly half the rate of those in the open air, and as with burial, this is due to cooler temperatures and reduction of insect activity (*ibid.*: 461). After initially sinking, the decompositional gases eventually cause the corpse to float, allowing access by carrion insects. The head and limbs will hang down beneath the surface, resulting in differential rates of decay and disarticulation between the submerged and exposed areas. It is clear that deposition in water will have a significant effect on the preservation and dispersal of human remains, as the whole body, disarticulated limbs or skeletonised elements may all be transported by water at different stages. The disarticulation sequence of human bodies in an aquatic environment roughly parallels that on land, but because the body can move in three dimensions, soft tissue connections tend to disarticulate rapidly (Nawrocki *et al.*, 1997: 532). Joints with weak ligament attachments and little overlying tissue, such as the shoulder joint, will separate early in the sequence, exacerbated by water action (*ibid.*). The mandible, cranium and hands are the first to disarticulate, followed by the arms, neck, feet and lower legs, with the trunk, pelvis and thighs remaining articulated (*ibid.*). Potentially these elements may be spread over a large area resulting in rather unusual element orientation, degrees of skeletal completeness and states of articulation (Lyman, 1994: 140).

2.1.1.2 Skeletonisation

As for soft tissue decomposition, the skeletonisation and consequent disarticulation of the body also follow a known sequence, generally thought to proceed from the head downwards and from the mid-line of the body to the periphery. Dirkmaat and Sienickis (1998, cited in Pinheiro 2006) proposed the following sequence for disarticulation of bodies in the open. The cranium tends to skeletonise early in the process, primarily due to the accessibility of the facial cavities to birds and insects, and it may also become separated from the neck at this early stage, usually as a result of the disarticulation of the first and second cervical vertebrae. This is closely followed by the skeletonisation of the sternum and clavicle, both relatively superficial elements. The hands and feet may also disarticulate early on, sometimes before the head separates, though if they are protected in some way, such as by footwear, they will be amongst the last areas to disarticulate. Generally the upper limbs decompose, and therefore skeletonise, faster than the lower limbs. Skeletonisation proceeds with the thoracic and abdominal region, the ribs skeletonise to varying degrees and, whilst the vertebral column may be exposed, it is one of the latest parts to disarticulate due to the strong connecting ligaments and interlocking nature of the individual bones. The pelvis is also late to separate and the legs preserve the longest, which is only further emphasised if they are clothed. Clothing in general appears to significantly delay decomposition.

A single body can also show varying degrees of decomposition and skeletonisation. Pinheiro (2006: 87) provides an example of a cadaver with some parts of the body showing adipocere, other parts mummified and others still only putrefied, as a result of the different ‘microenvironments’ that may develop around a decaying body.

The timing of skeletonisation will also be environment specific. Under temperate climatic conditions skeletonisation may take 12-18 months and to achieve completely ‘clean’ bones, with no tendons or ligaments surviving, may take as long as three years (Knight 1996 cited in (Pinheiro, 2006: 111). Significantly shorter periods for skeletonisation have been reported however, where it has occurred in 1-2 weeks in a warm, damp, environment (Galloway, 1997, Pinheiro, 2006) and in as little as three days in a very humid environment where there was extensive insect activity (Clark *et al.*, 1997). Experimental studies have shown that skeletonisation of a body buried at a depth of c. 4 feet may take around 2-3 years whereas those at shallow depths of c. 1 foot may take 6-12 months or more (Rodriguez, 1997: 460). Whilst skeletal remains up to hundreds and thousands of years old are recovered archaeologically, bones may be degraded or destroyed completely over time. The most significant factors in their degradation are soil ph and moisture. Skeletal remains will degrade rapidly and may be completely destroyed by soils that are very alkaline or very acidic, or in very wet depositional environments (Rodriguez, 1997: 461).

Should they survive however, it is these skeletal remains that we eventually recover from archaeological sites, and as the preceding section has shown, various factors will contribute to the completeness and distribution of the bodies that are recovered, such as whether the body was deposited into water, on the surface or buried. In addition to this, the properties of the different bones of the skeleton make them more or less likely to survive the post-depositional environment and the actions of other agents, such as humans and animals, may also modify the remains at any time from death onwards. The following sections, however, describe how we may be able to identify these influences on the skeletal record.

2.1.1.3 Bone preservation

Even in the absence of any other factors or modifying agents we can expect there to be differential preservation of elements of the skeleton due to the specific properties (shape, size and density) of different bones. Bello and Andrews' (2006) study defined the intrinsic pattern of preservation of the skeleton by excluding human modifications and the influence of many taphonomic processes. Using data from undisturbed burials of complete bodies buried not long after death, they were able to provide skeletal bone frequencies that reflect a preservation pattern that they consider to be solely the result of the inherent structural properties of bone. This is characterised by higher frequencies for more robust and dense bones and lower frequencies for smaller and more cancellous elements. They found that the cranium, mandible, vertebrae, pelvis and long bones will be well-represented, but that the sternum, sacrum, patellae, and hands and feet, will naturally be under-represented. Elements such as the clavicle and scapula were found to be somewhere in-between, being reasonably abundant. There was however some variation within these categories, such as between different types of long bones and between different types of vertebrae.

Although the cranium as a whole can be expected to be well-represented, there were differences in the survival of the elements that make up the cranium: the facial and frontal bones, in particular, may be under-represented.

Furthermore, whilst the long bones were well represented there were some differences in their preservation relating to their size and their position, so that the larger bones were more abundant (e.g. the femur) and the proximal part of the limb was better preserved than the distal part (e.g. more humeri represented than ulnae and radii), though this difference also correlates with size. The relative preservation of bones of the extremities also appears to be directly related to their size: metatarsals and metacarpals were more abundant than tarsals and carpals, proximal phalanges were more abundant than intermediate phalanges, which in turn were more abundant than the distal phalanges. As a whole, the hand and foot bones were under-represented, and in Bello and Andrews' samples, hand bones were generally more abundant than foot bones (2006: 5), though a reason for this difference was not given. Vertebrae were also generally well-represented but there were some differences between vertebral types. Cervical vertebrae (especially C1 and C2) and lumbar vertebrae were better represented than thoracic vertebrae, which is thought to be the result of the relatively low density of thoracic vertebrae.

Bello and Andrews also observed that age and sex had an influence upon the preservation of the skeleton. As has already been noted in the osteological literature they found that sub-adult skeletons were less well preserved, and their elements less well represented, than those of adults (2006: 10). Using material of known age and sex, they were also able to suggest that preservation increases proportionally with increasing age and that the skeletons of female sub-adults would be less well preserved and less well represented than those of male sub-adults, particularly affecting individuals of 0-4 years of age (*ibid.*). Galloway *et al*. (1997) also considered that bone mineral density was the single most important intrinsic variable for bone survival and found differences between male and female bone density which indicated that female bones would be particularly susceptible to poor preservation.

2.1.1.4 Agents of modification

As well as the intrinsic pattern of bone survival described above there are of course other agents that may affect the relative survival and dispersal of elements of the skeleton (and our subsequent interpretation of them). So far, the decomposition, skeletonisation and preservation of the body has been described mostly without acknowledging how these other agents, such as animals and humans, can modify these processes.

Canids and large mammals, such as bears, can be responsible for the disarticulation of bodies and the movement of parts of them across the landscape. The timing and patterns of movement specific to different species have been identified by several studies (e.g. Haglund, 1997a: for canid scavenging), mainly for the purposes of forensic investigations but are equally applicable to archaeological remains.

2.1.1.4.1 Scavenging animals - Canids

If a body is left to decay in the open, or shallowly buried, than the most influential modifying agent will be scavenging animals, such as canids (e.g. dogs, wolves). The degree to which scavengers may disturb a body will depend on whether their access is restricted by clothing or the position of the body, or interrupted by collection or burial of the body at some point during the sequence of decay and skeletonisation.

Their scavenging can cause the modification and reduction of soft tissues (through consumption), disarticulation and modification of bone, and the dispersal of skeletal elements (Haglund, 1997a: 367). For these reasons forensic studies have been particularly concerned with the effects of scavenging, and Haglund, amongst others, has suggested that canid disarticulation and dismemberment of human remains occurs in a relatively consistent sequence, especially when it occurs early in the decomposition of the body (*ibid*.).

Initially, from 4 hours to 14 days since death, canid activity is confined to the soft tissues, usually focused around the face and neck, causing minor damage (punctures) to the facial cavities and possibly consuming the hyoid bone along with the neck tissue (*ibid*.). Between 22 days and 2½ months, feeding proceeds into the thorax and includes the destruction of the sternum, the adjacent proximal clavicles, and the sternal ends of the ribs. Around the same time, one or both of the upper limbs may be removed, and are usually transported elsewhere as a whole unit. Since the clavicles have been detached from the sternum this unit often includes the still articulated bones of the pectoral girdle (shoulder), the scapula, clavicle and first rib, as well as the humerus, radius, ulna and hand. By the end of this stage, most of the major muscle masses, from the thorax, pelvis and thighs, have also been consumed. Disarticulation continues (from 2 to 4½ months) with the removal of the lower limbs, either the lower leg only, by gnawing through the knee joint (at which point the patella (kneecap) may also be consumed or detached), or removal of the whole lower limb/s, possibly with the pelvis and varying amounts of the lumbar and thoracic vertebrae attached. By this stage then (from 2 to 11 months), the majority of skeletal elements will be disarticulated and damaged, leaving only segments of the vertebral column still articulated in the original place of deposition. In one case the skeletal remains were scattered over an area of around 180 m (*ibid*.: 372). Eventually all bones from the skeleton will be disarticulated, extensively gnawed and scattered (*ibid*.)

Carnivore access will also affect the surface of the bones as a result of chewing or gnawing of the overlying flesh, and/or the bones themselves for the fat and marrow within. Canids tend to target the marrow-rich trabecular bone at the ends of long bones, and leave a distinctive pattern of tooth marks and destruction, as described by Binford (1981). These include puncturing, furrowing and pitting of the bone surface and crenulated margins are created at the ends of chewed bones. Canids can also splinter the shaft of long bones (White and Folkens, 2000: 413). In his study of wolves and Inuit dog packs Binford demonstrated a difference between the pattern of destruction on bones which dogs or wolves had continuous access to, which had been subject to 'boredom' chewing, and those from a kill site where the consumption of meat was the main activity. Activity at wolf kill sites "predominantly yielded some furrowing, relatively common puncture marks, and some crenulated edges; pitting and scoring were much less common", whilst dog yard and wolf den assemblages "yielded extensive pitting, scoring and more extreme furrowing" (Binford, 1981: 49).

To conclude, as well as displaying evidence of characteristic canid puncture and gnawing marks, the remains of a skeleton subject to canid scavenging will have a distinctive pattern of element representation. Recovered elements may consist of articulated sections of the vertebral column including the pelvis and possibly the upper legs, along with a disarticulated cranium and mandible. Typically the patella, hyoid and sternum may be completely absent, and so may the hands and feet. The upper limbs, including the bones surrounding the shoulder joint, and all or part of the lower limbs may also be absent. Alternatively, the recovery of an isolated upper limb and shoulder girdle would be indicative of canid scavenging.

2.1.1.4.2 Other scavenging animals

Herbivores can also modify bones. Ungulates have been observed to chew bones and antler, grasping them in their cheek teeth and chewing them in the side to side movement normal to ungulates, planing off the top and bottom of the shaft leaving only the sides intact and a fork-like remnant of the bone (Lyman, 1994: 395).

2.1.1.4.3 Gnawing by rodents

Rodents also produce a very characteristic, and equally destructive, pattern on the surface of bone as a result of gnawing, usually focused on bony protuberances. Using the chisel-edge of their incisors they shave away the surface of the bone producing a fan-shaped pattern of regular, shallow, semi-parallel, flat-bottomed grooves (White and Folkens, 2000: 413). In juvenile remains they tend to target the epiphyseal cartilage, the area between the end of the shaft of the long bone and the joint surface, leaving the joint surface on a distinctive thin pedestal of gnawed shaft (Haglund, 1997b: 405). Whilst thought to favour dry bone they have been known to target fresh and mummified soft tissue as well as dry and fresh bone (Haglund, 1997b: 411). Cited gnawers of bone include squirrels, rats, mice, gerbils and porcupines (*ibid*.: 405) but may also include other rodents such as voles, marmots and beavers. They may also be responsible for the *dispersal* of skeletal elements, transporting small bones of the hands and feet to their burrows or occasionally larger elements, in one case, transporting two lumbar vertebrae into a length of pipe. They have also been known to utilize human bodies for nesting purposes (*ibid*.: 409).

2.1.1.4.4 Water

Environmental processes may also affect the preservation and dispersal of the body. In particular, bodies deposited in water (e.g. lakes, rivers) or affected by flooding, will have a unique pattern of dispersal. At first the whole body may be transported by water (potentially over vast distances) and then, as decay progresses, disarticulated body parts (head, trunk or limbs) may be moved and dispersed and finally isolated bones may be transported (Nawrocki *et al.*, 1997: 530). Flowing water may have the effect of spatially dispersing elements or, conversely, concentrating them in one area along with sorting them by size or morphology (*ibid*.) Fast flowing water (e.g. fast currents in rivers) is more likely to move elements than slow moving water (e.g. at lake margins), and fast flow will remove both small and large elements, whereas slow flow tends to remove small and light objects.

Water transport of skeletonised remains, in particular, results in a specific pattern of element dispersal, and experiments have categorised elements into those that are immediately carried by a current (the "transport" group), those that sink and resist transport (the "lag" group), and an intermediate group that move only gradually (after Voorhies, 1969 cited in Nawrocki *et al.*, 1997: 534). Intact crania, ribs, vertebrae, sacrum and the sternum are generally transported away from the point of origin, whereas cranial fragments and the mandible are not (*ibid*.). The long bones, hand and foot bones, the pelvis and scapulae all fall into the intermediate group (*ibid*.). Complete crania, when separated from the body, can travel considerable distances, probably further than other elements from the same body, and as a consequence will generally show a pattern of abrasion and damage (*ibid*.). This includes destruction of the facial bones, perforation of thin areas of bone, abrasion/breakage of bone edges/processes, pitting and scratching of the surface, chipped enamel on anterior teeth (*ibid*.: 538). They will also have lost any articulating bones (such as the mandible) and the single-rooted teeth, and be affected by staining, silting and retain water-borne deposits in the cranial cavities (*ibid*.).

2.1.1.4.5 Weathering

Weathering occurs when a bone lying above the ground is exposed to the elements, usually as a result of the decomposition of the surrounding tissues, and can therefore be indicative of the post-mortem treatment of the body (i.e. exposed on the surface). Behrensmeyer's

(1978) work on mammal bone described a fairly predictable pattern of surface cracking and flaking which could be related to the time since death (i.e. the length of time exposed). This appears to be the result of the repeated heating and cooling and wetting and drying that the bone is subject to at the soil surface (*ibid*.: 154) but was also observed on remains left fully exposed on a roof several metres above the ground (*ibid*.: 161). Burial, on the other hand, appears to protect the bone, as buried bones often show no sign of weathering even when exposed parts (of the same bone) are at advanced stages of disintegration (*ibid*.: 154). Variable degrees of weathering on a single bone can also be important indicators of process; Behrensmeyer found that bones were usually more weathered on upper (exposed) than on lower (ground contact) surfaces (*ibid*.: 153), which potentially provides information regarding bone orientation and depositional history.

2.1.1.4.6 Erosion and abrasion

Erosion and abrasion can also affect the surface of the bone and recording these changes provides further evidence for the post-depositional environment and the sequence of post-mortem processes. Erosion is commonly observed in assemblages such as these but cannot be recorded using the system set out by Behrensmeyer.

Erosion can be caused by root and fungal action; either roots themselves, or fungi associated with decomposing roots, excrete acid which etch the pattern of roots into the surface of the bone (Lyman, 1994: 375). They have been described as wavy, dendritic, sinuous, or spaghetti-like patterns etched into the bone surface. They vary greatly in that they can be stained a different colour, or they can be lighter than, or the same colour as, the surrounding un-etched bone (*ibid.*: 376), presumably depending upon sediment types, the type of root and the length of time it remained *in situ*. Microscopically they are smooth, U-shaped grooves in cross section and so can be easily distinguished from human-created butchery marks (which are V-shaped in cross section, see below) (*ibid*.: 376). This etching can occur after bones have been buried but, as certain mosses and lichens grow on bones prior to burial, it is also thought that some root etching can occur pre-burial (*ibid*.: 375). Cook suggests that root etching, "in the case of lichen, indicates a period of at least partial exposure without much disturbance" (Cook, 1986 cited in Lyman, 1994). Unfortunately, much about the circumstances and timing of root etching is unknown. We do not yet know which kinds of plant roots cause root etching, or even whether it is the roots or the associated fungi that cause the etching, and consequently, it is not possible to specify the depth of burial required, if any, or the length of time it takes for root etching to form (*ibid*.:

376). The only certainty is that the bone existed in a plant-supporting sedimentary environment for at least part of its taphonomic history (*ibid*.)

Nevertheless, root etching can be useful as an indicator of the *relative* timing of processes, such as bone fracture. If bone fracture surfaces, or the exposed internal surfaces of bones, are marked by root-etching then bone fracture must have occurred prior to the root-etching, and therefore perhaps prior to deposition (Lyman, 1994: 377).

Erosion of the bone surface may also be caused by burial in overly acidic or alkaline soil conditions (McKinley, 2003: 14) and, though this can resemble root etching, the two processes can be distinguished from each other by recognition of the individual grooves and dendritic pattern of root etching. Conversely, very extensive root-etching may resemble these types of sedimentary corrosion (Lyman, 1994: 377), and may not be distinguishable. This type of extensive erosion, whatever the cause, also decreases the prospect of observing butchery marks or other features which may have occurred prior to deposition and is therefore an important taphonomic variable.

Abrasion of the bone surface may also be present as a result of bone exposure, repeated deposition, reworking in occupation deposits and/or trampling. Abrasion from trampling can take the form of scratches on the surface of the bone, and can be mistaken for cut marks (see discussion below).

2.1.1.4.7 Human action

The actions of humans, whether through deliberate mortuary practice or through restricting the access of other animals, for example, will also affect the pattern of remains recovered.

Excarnation by exposure involves the exposure of a corpse to facilitate the decomposition of the flesh and to uncover the skeleton, and is often followed by a secondary rite to collect the remains. Here, the disarticulation and skeletonisation of the body follow that for open spaces (as described above), and as such, may be subject to weathering and scavenging. If the body is suspended above the ground, however, on a structure or by utilising naturally elevated places such as trees, this may, intentionally or not, prevent the access of scavenging animals. Rodents and birds, may still be able to gain access to the remains. There may be some dispersal of the remains, especially those that disarticulate early in the sequence, such as the head, the sternum and clavicle, and the hand and foot bones. We might expect to see these elements as disarticulated elements, or possibly as elements missing from secondary burials.

Indicators of exposed bodies may therefore include 1) animal gnawing on bones; 2) scattered, isolated, fragmentary, weathered or splintered bones; 3) disarticulated skeletons; and 4) incomplete skeletons lacking phalanges, a limb or other parts (Carr and Knüsel, 1997: 170). Research by Beckett and Robb (2006: 69), however, has shown that the skeletal part representation of primary burials may actually be similar to that of secondary burials, displaying classic under-representation of vertebrae, flat-bones and hands/feet compared to crania and long bones, and therefore part-representation is not a reliable indicator of exposure/secondary burial on its own.

Excarnation may also involve some manual defleshing of the corpse, either as the main method of defleshing or to remove final remnants of tissues which still remain following a period of exposure. In this case cut marks may be observed on the bones in addition to the above pattern.

Secondary burial of excarnated remains is a rite which lacks a specific definition within archaeology. In this study, Schroeder's (Schroeder, 2001: 82) definition was employed: 'The initial sequence of treatment commences with the death or imminent death of an individual and terminates with the initial disposal. The second sequence... involves the removal of the deceased from the location of initial disposal followed by: a. replacement in the initial disposal facility or b. removal to a place of secondary disposal.' This may be indicated by a lack of anatomical connections in the skeleton (though some *can* be maintained), and a lack of certain skeletal elements when specific bones have been selected for secondary burial.

Criteria outlined by Roksandic (2002: 109) were employed to distinguish between primary and secondary burial. In secondary burials the small hand and foot bones will be absent, normally well-preserved elements will be under-represented, elements may be fragmented with a lack of complete elements, and if the cranium is the object of retrieval, the number of teeth will be smaller than expected. Further indicators to distinguish secondary burial from disturbance are provided by Andrews and Bello (2006, 17), who emphasise the intention behind the event/s. They stress that disturbance relating to later activity (human and/or animal) will be incidental to the interred individual, whereas secondary burial practices target a specific individual/grave within a culturally established programme. The retrieval of specific elements may also involve the cutting/chopping of soft-tissues, dependent upon the time allowed for decomposition.

Practices of cremation obviously cause very distinctive changes to the human remain, not least fragmentation and calcination of the material. Cremations are often most clearly identifiable as secondary burials when they are found as discrete deposits of bone, within containers or pits, having been sorted from the remains of the cremation fire or pyre. This sorting may involve raking of remains, fragmenting them further, or the differential collection of remains, leading to under-representation of some portions of the skeleton.

Criteria for recognising practices of cannibalism in human remains are mainly based around identifying the similar treatment of humans and animals that have been butchered for food. Potential indicators may include: deposition within the same context as animals, similar element representation and similar patterns of bone modification (such as the frequency and anatomical location of cut/chop marks, percussion marks, anvil abrasions, peeling of bone and crushing of cancellous bone), similar peri-mortem fractures indicating similar processing of fresh bone, and evidence for cooking of whole or fractured elements, and evidence for consumption (human tooth impressions) (Knüsel and Outram, 2006: 258).

Turner and Turner's (1999) controversial publication regarding cannibalism in the American south-west focused on the presence of six key features for the identification of cannibalism: breakage, cut-marks, anvil abrasions, burning, 'many' missing vertebrae and pot polishing. Their approach has been heavily criticised, however. Firstly for the circularity of their argument – that the six criteria can result *only* from cannibalism because with cannibalism one would get these criteria, and secondly that they fail to consider the condition and context of different assemblages and alternative explanations for the six criteria, which range from extreme violence, corpse mutilation, witch executions (demonstrated in the south-west), secondary burial, domestic and social violence and various post-depositional processes (McGuire and Van Dyke, 2008: 22). This highlights the importance of using "broad and integrated taphonomic studies rather than relying on one or two methods" and, particularly, the importance of attention to contextual archaeological detail, as utilised in this study (Beckett and Robb, 2006: 69).

2.1.1.4.8 Cut marks and evidence of processing

Cut marks can be made on the surface of bone as a result of different practices: defleshing, disarticulation, scalping and/or peri-mortem trauma. Their location and orientation can, however, be helpful in distinguishing between these practices, for example, those associated with disarticulation tend to be focused around the joints and/or ligament attachment sites. It should be noted, however, that an experienced butcher "with a working knowledge of the anatomy of the animal they were butchering and with some concern of preserving a sharp tool edge" will not leave cut marks on bone (Lyman, 1994: 297), and therefore the presence of tool marks on bone are a rare but an important indicator of burial practices.

Cut mark-like scratches of the bone surface may also be caused by post-depositional movement within sediment, trampling or during excavation. A number of studies (e.g. Behrensmeyer *et al.*, 1986, Fiorillo, 1989) have investigated the issue that trampling of bone, by animals or humans, can result in pseudo cut marks. Scratch marks from trampling were demonstrated to be morphologically similar (microscopically) to those made by stone tools. However, as Lyman notes, trampling marks tend to be more randomly orientated, and multi-directional, compared to those resulting from butchery and they are also more shallow and more often located on bone shafts rather than the ends of long bones (1994: 381).

These factors are also helpful in distinguishing the effects of post-depositional movement or excavation damage, as these would also tend to be randomly orientated and located, and damage caused during excavation would expose bone that was lighter in colour than the surrounding bone surface.

2.1.1.4.9 Burning

Evidence for burning of bones was also recorded. Exposure to heat causes systematic colour changes which are a reflection of the temperature that a bone was subject to. Scorching of bone occurs at relatively low temperatures (less than 400°C) whereas carbonisation of the organic component occurs between about 360°C and 525°C, and total incineration, which chemically alters the bone mineral, occurs from about 645°C (Lyman, 1994: 386). As a point of comparison grass fires can reach temperatures of between 65-700°C, camp fires 400-700°C, and cremation pyres (and oak fire coals, open forest) more than 800°C (*ibid*.). So a consideration of the degree of burning of an element may give an indication of the circumstances under which it was burnt.

We must also consider that material may be affected by heat at different points in its depositional history, and that this may affect our interpretation of the burning. Whilst it may be more common that bones are burned prior to their deposition and burial, or between deposition and burial, it is also possible that they were burned after burial. This is especially worth considering for material buried in occupational deposits, such as middens perhaps, which may then be unintentionally burned due to the proximity of anthropogenic fires. Bones may also be accidentally burned by natural fires such as grass or forest fires. With this in mind, several researchers have tried to determine the timing (and agent) of burning, investigating differences between bones burnt whilst fleshed, defleshed but still fresh (green), and those burnt once dry and skeletonised. Buikstra and Swegle's (1989) experiments found that it was possible to distinguish between bone that was burned dry from bone burned whilst fleshed or green, but that it was much harder to distinguish between the latter two types, that is, between fleshed or defleshed green bone.

They found that at the carbonised stage only defleshed (green) bone was uniformly blackened. Dry bone did not become blackened and fleshed bone only became blackened on exposed surfaces. When completely calcined, both fleshed and defleshed green bone was white, blue or grey whereas dry bone retained an apparently unmodified tan-colour on the surface but was grey/white underneath. Both types of fresh bone had similar patterns of surface cracking (a checked pattern caused by longitudinal and transverse splitting) but dry bone displayed shallow longitudinal fissures, less frequently accompanied by transverse cracking.

2.1.1.4.10 Fragmentation of bones

Fragmentation of bones and bone assemblages can occur prior to deposition, as a result of peri-mortem[1] trauma or deliberate fracturing of bones, or after deposition, as a result of several possible processes including trampling, sedimentary pressure, bioturbation, and excavation methods. Identification of the *type* of bone fracture, peri- or post-mortem, can help to distinguish the timing and agent of fragmentation. Antemortem trauma (fractures that occurred during life) can be distinguished based on the fact they will display some degree of bone healing (visible as bone formation). These were not recorded under fragmentation but noted under pathology.

The difference between peri- and post-mortem fractures is based on the principle that bone that has an intact organic matrix ('green bone') will respond differently to bone that has a partial organic matrix ('dry bone') (Loe, 2009: 267). Defining characteristics for the cranium and long bones include the shape of the fracture outline, the fracture angle and the texture of the fracture surface (specific criteria have long been established, as described by (Morlan, 1984, Marshall, 1989, Villa and Mahieu, 1991, Outram, 2002)).

[1] occurring at, or shortly after, death

Peri-mortem fractures of fresh or 'green' bone have a smooth fracture surface at an obtuse or acute angle to the bone surface and a helical or curved outline with sharp margins. Post-mortem fractures of 'dry' bone (also variously referred to as mineralised, sub-fossil or desiccated bone) have a rough fracture surface at right angles to the bone surface and are transverse in outline with jagged margins.

Knüsel and Outram (2006) further divide fractures of 'dry' bone into those that still maintain some of the characteristics of green bone fractures and those that are fractures of truly mineralised bone. A 'dry' fracture, as termed by Knüsel and Outram, is one that occurs in bone that is not mineralised but is not 'green' either; the collagen content is reduced but not entirely absent. Dry fracture morphology may resemble that of green bone, but loss of water and collagen causes micro-cracks which result in distinguishing features such as roughened, corrugated fracture surfaces and steps in the fracture outline (Knüsel and Outram, 2006: 262, fig. 17.5). With decreasing freshness, fracture outlines become rougher and straighter, rather than spiral, and straight diagonal breaks of dry bone are most easily confused with true helical (i.e. peri-mortem) fractures (*ibid*.). Dry fractures are interpreted as evidence for disturbance or manipulation of remains in the past, and as such, have been viewed, along with other factors, as an indicator of secondary burial (see Valentin and Le Goff, 1998, Outram, 2002, Redfern, 2008).

Surface colour can also be a good indicator of the timing of bone fracture. Peri-mortem and dry fracture surfaces will usually be the same colour as the surrounding bone, as they occur relatively close to the beginning of the bones' depositional history. Bones fractured later in their depositional history, however, will have fracture surfaces which are lighter than the surrounding bone. Other evidence of deliberate fragmentation or processing of bone may include percussion notches and flake scars.

2.1.2 Identifying the deceased

Having identified the different practices that were taking place, a secondary objective of the project is to explore whether these may have related to differences in the identities of those whose remains were treated. Whilst the physical body does not equate to the totality of a person's identity, biological sex and chronological age can provide a starting point for these discussions. There are, however, two important factors to consider, age and sexing methods and the nature of the assemblages.

Ageing and sexing methods for skeletal remains were mostly developed on modern populations and their applicability to prehistoric populations is not fully known. Very few large collections of prehistoric material, especially from the Mesolithic, are available to assess the range of skeletal variation expected between the sexes, for example. Ageing and sexing of individuals in this material was also limited by the fragmentary nature of the assemblages. Both suites of methods require the presence of specific elements or portions of them, primarily the cranium and pelvis, and if these are not preserved then age and/or sex cannot be reliably determined. Also, having assigned age categories to this material we must exercise some caution in their use. The descriptors attached to age categories, such as child, adolescent and adult, are culturally loaded labels which inevitably reflect our own attitudes to age. As such, they do not necessarily reflect age distinctions in the past. For example, what we may define as the transition from childhood to adulthood may have occurred at a different time in a person's life and may also have been marked by factors other than chronological age.

2.2 Osteological methodology – recording

2.2.1 Selection of case studies for osteological analysis

Initial research identified 103 sites with evidence for Mesolithic mortuary activity (see Figure 2.3, Table 2.4 and section 9 for a full catalogue. Sites referred to in the text will be followed by the corresponding site number in brackets, e.g. River Bann (2)). In order to understand the nature of Mesolithic mortuary practice detailed osteological analysis was undertaken on skeletal assemblages from three of these sites. As was discussed earlier, the principal aim of the analysis was to identify and characterise the osteological evidence for different forms of mortuary treatment. This would then be used to interpret other assemblages and, more importantly isolated elements, from across the study area. To achieve this aim the case study sites had to constitute a relatively large assemblage (rather than single elements) with detailed contextual data relating to their deposition. It was also important that they represented a range of funerary or mortuary contexts and spanned different points within the Mesolithic.

Based on these criteria the following sites were selected:

Hardinxveld-Polderweg (Netherlands) (Site number (64)). This site represented a scatter of skeletal material similar in character to the so called 'loose' human bone assemblages discussed in chapter 1 and a number of inhumations. The site dates to the late Mesolithic (c. 5500-4500 cal BC).

Petit Marais, La Chaussée Tirancourt (France) (48). This site has evidence for three episodes of funerary activity, characterising different forms of mortuary practice. These consist of a secondary burial, multiple cremation (though not available for analysis as part of this study), and scattered fragmentary human bone. Activity at the site ranges from 8533-7833 cal BC to 7029-6360 cal BC.

Les Varennes, Val-de-Reuil (France) (45). Two forms of practice were recorded at this site, a multiple burial and a later inhumation. The earlier burials have been dated to 8635-7066 cal BC.

It was hoped to include several other assemblages, particularly Ferriter's Cove, Ireland (1), and Noyen-sur-Seine, France (39), but unfortunately this material could not be located, and was therefore not available for re-analysis.

2.2.2 Data recording

From the outset it was clear that standard approaches to the recording and analysis of human remains (such as Buikstra and Ubelaker, 1994) were not suitable for the recording of the disarticulated, fragmented, and/or commingled assemblages that are the subject of this thesis. As Outram and colleagues (2005: 1700) have stated, standard methodologies were developed upon the expectation of relatively complete individuals from isolated contexts, and they suggest that techniques more common to zooarchaeology may be more applicable to the types of assemblages which are the focus of this thesis. Consisting not only of partial skeletons, but also of fragmented bones from different individuals mixed with other materials, they are closer to the mixed species assemblages that faunal analysts are familiar with. Outram argues that whilst human osteologists are aware of the variables, zooarchaeological methods are better placed to handle the evidence for peri-mortem, post-mortem and post-depositional factors that result in fragmented, disarticulated and commingled deposits. He suggests that zooarchaeological quantification methods for establishing maximum and minimum numbers of elements and individuals, for example, be used alongside those of human osteologists.

For mixed assemblages he goes further to suggest that the analyses of human and animal bone should be completely integrated, using identical recording systems and with human and animal osteologists working together during the analysis. This would facilitate direct comparison between human and animal bone, something he notes is distinctly lacking even when similarities in their treatment have been claimed (Outram *et al.*, 2005). As Outram notes, the benefits of this approach "were first identified by analysts attempting to distinguish cannibalism from other unusual treatments of human remains" (*ibid*.: 1700).

Unfortunately, due to time constraints, it was not possible to re-analyse the animal bone assemblages from the sites selected for the case studies, but where animal bone was present (e.g. at Hardinxveld) an attempt was made to compare the existing animal bone data (usually recorded in a similar way, though not using Outram's method) directly with the human bone. Outram's approach still brings significant benefits to the understanding of the human bone assemblage without re-recording the animal bone. The re-analysis of the animal bone assemblages, using Outram's methodology, from the sites studied here (such as Hardinxveld and Noyen-sur-Seine), and comparison with the human bone analysis, remains a potentially fruitful area for further research.

The first objective of the osteological analysis was achieved by following the approach outlined by Outram and colleagues (2005) (as described in detail in below). The basic level of analysis was the individual fragment and each identifiable specimen was assigned a unique number and a single record in a Microsoft Access (2007) database which, following Outram, recorded information on the following: context, anatomical element, bone zone, fusion state (for ageing), side, butchery/trauma (e.g. cut marks), other surface modifications (e.g. root etching, animal gnawing etc.), level of burning, fracture type and other notes (e.g. degree of preservation, pathology, age and sex, if such information was available). In addition I gave each site a unique site ID code, recorded the original find number of each fragment (to maintain a link with the site archive and any previous analysis) and included any additional information regarding context, location and/or phasing.

Following Outram (2001), specimens that were indeterminate to element (and/or species) were also recorded by number and size and fracture type was recorded. It was usually possible to record the bone 'type' for these unidentified fragments and determine whether they were from the appendicular skeleton (bones of the limbs, including the shoulder and pelvic girdles), the axial skeleton (bones of the trunk, including the vertebrae, ribs and sternum) or skull (the bones of the head; the cranium and mandible). This is based on whether the fragment was spongy, cancellous trabecular bone or dense, cortical bone. It was usually possible to distinguish between cancellous bone from the axial (vertebrae) or appendicular skeleton (from the epiphyses of the long bones) and between cortical bone from the appendicular skeleton (the diaphyses of the long bones) or skull.

Outram (2001) has stressed the importance of including these unidentifiable (and by their nature, usually very fragmented) bone fragments for studying within-bone nutrient exploitation (e.g. bone marrow). The exploitation of bone fats by hunting peoples is virtually ubiquitous in vastly different areas of the world (Outram, 2001: 401). The fragmentation pattern of the different bone types, even when they cannot be identified to element or taxon, alongside that of the rest of the assemblage, can reveal information about the type of bone fat exploitation: "diaphysis bone encloses marrow, epiphysial cancellous bone contains one type of bone grease and axial cancellous bone contains another type of grease" (Outram, 2001: 403).

2.2.3 Data collection

The material from each site was laid out and each fragment was examined individually. Observations were entered directly into the database to avoid the need for a second stage of data entry after recording. Each fragment was photographed and, when required, supplementary photographs and annotated line-drawings were made to record the nature and location of modifications such as cut marks and burning, or to record pathological changes. Once examined and recorded, re-fitting of fragments from the same element was attempted for all fragments, within and between different contexts. Bone surfaces were examined by eye, with the aid of a hand lens and, when necessary (such as for examining potential cut marks), with a light microscope.

2.2.4 Identification and quantification - Zonation, refitting, MNE, MNI and BRI

Each specimen (fragment) was identified to a skeletal element and side. Human osteologists generally also indicate which part of the bone is present, commonly dividing the bone into proximal and distal portions, and/or joint surfaces, and the diaphysis (shaft), recorded either visually or using a simple coding system. This is adequate under most circumstances but for assemblages such as those considered here, which may be highly fragmented, better resolution is gained through dividing the bone into smaller segments, or 'zones', a system which has long been used in the analysis of animal bone. The system developed by Dobney and Rielly (1988), separated bones into recognisable zones based on their natural tendency to fragment in certain places, and this has recently been adapted for the human skeleton by Knüsel and Outram (2004) (see example in Figure 2.2). A 'zone' was only recorded if more than 50% of it was present. The benefits of using this system were threefold; the coded system facilitated rapid recording of fragments into the database, representation was readily comparable to animal bone, and the improved resolution contributed to a more accurate calculation of the number of elements and the number of individuals (as discussed below).

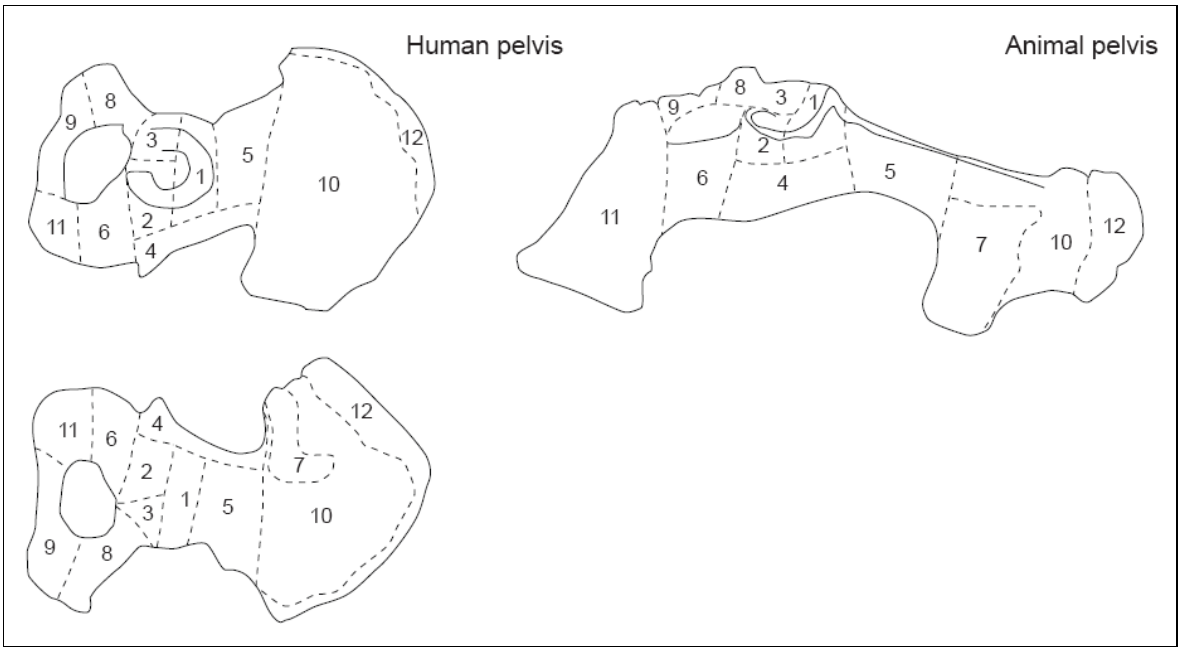

Figure 2.2 An example of the translation of Dobney and Reilly's (1988) animal bone zonation system to human bones, from Outram et al. (2005).

Quantification of the assemblages was based on the identification and zonation of the fragments and was achieved by using NISP, MNE and MNI. The number of identified specimens (NISP) represents the raw data; each fragment was either identified to an element or unidentified. The number of identified specimens is, however, an inflated representation of the actual number of elements present, as one element may be broken into many fragments. This distortion is avoided by calculating the minimum number of elements (MNE), which accounts for fragments that could be from the same bone. The use of zones makes this calculation more accurate; any overlapping zones indicate the presence of another element and, as the zonation method divides each element into relatively small zones, it provides greater resolution than other methods. The process of re-fitting fragments also served to refine the MNE. A visual check could confirm whether it was likely that two or more fragments were indeed from the same element, using observed differences in size and robusticity, for instance. This also made it possible to exclude some associations, that two paired or contiguous elements are so dissimilar that they could not belong to the same skeleton. This also applied to the pairing of left- and right-sided elements; the presence of a left and right femur, for example, would not usually be an indication of more than one individual, but by visually comparing morphology and robusticity it was occasionally possible to determine that they represented two different people. Caution is necessary, however, as the skeleton may display natural asymmetry (a product of laterality) and pathological changes may affect the size and robusticity of paired or contiguous elements.

The minimum number of individuals (MNI) was also calculated using the same principle as the MNE; any repetition of an element represents another individual. Therefore the most frequently occurring element in the assemblage indicates the MNI. Both minimum numbers' methods take into account side (for example, a single individual may have two femurs, left and right sides), and age and sex determinations.

To account for the fact that some elements of the skeleton are more numerous than others, the bone representation index was calculated (BRI) (as described by Bello and Andrews, 2006). This expresses the number of elements (MNE) as a percentage of the number of each element expected for the number of individuals (MNI) represented.

2.2.5 Recording surface condition /modification

Any modification of the bone surface was recorded, such as that caused by weathering, erosion and abrasion, other humans (for example as a result of body processing), animals, and burning,

2.2.5.1 Weathering

The 'Bone Weathering Stages' that Behrensmeyer defined remain the standard method for recording these changes (Behrensmeyer, 1978). There are some limitations to the method, however. The bones of the hands and feet are not a reliable indicator of weathering. Behrensmeyer found that these small compact bones weathered more slowly than other elements of the same skeleton and did not show the full range of weathering characteristics (*ibid.*: 152). Size also appears to affect the degree of bone weathering. The bodies of relatively small animals (<100kg), such as small adults and juveniles of larger species, were shown to weather more rapidly, resulting in preferential destruction of their bones compared to larger animals (*ibid.*: 160). Behrensmeyer was not able to distinguish whether this was a factor of low body mass alone or whether it was influenced by the differing properties of the juvenile skeleton (such as relatively low bone density), but other factors did indicate that immature bones weather more rapidly than adult bones, possible resulting in their complete destruction.

All bone surfaces were assessed and a weathering stage was assigned to each fragment. Where possible, flat surfaces, such as the shafts of long bones, were assessed, avoiding the edges/ends of bones or any areas with obvious physical damage (e.g. gnawing). If a single fragment displayed differing weathering stages, the maximum and minimum stages were recorded and the distribution of the weathering was noted. Weathering of bones at each site was summarised by calculating the percentage frequency of bone fragments exhibiting each weathering stage.

2.2.5.2 Erosion and abrasion

Both abrasion and erosion of the bone surface were recorded using the system set out by McKinley (2003: 14-15) which records the changes on a scale of 0-5, ranging from no changes to the surface of the bone to complete obscuring of the cortical surface, summarised in Table 2.1. As with the recording of weathering, all bone surfaces were assessed and a grade was assigned to each fragment. If a single fragment displayed differing grades of erosion/abrasion then the different grades and their distribution and location were noted. The surface preservation of bones at each site was summarised by calculating the percentage frequency of bone fragments exhibiting each grade.

Surface preservation score	
0	No modifications, surface morphology clearly visible with fresh appearance to bone
1	Slight and patchy surface erosion
2	More extensive surface erosion, than grade 1, with deeper surface penetration
3	Most of bone surface affected by some degree of erosion, general morphology maintained, but completely masking surface detail in some areas
4	Extensive erosion; all of bone surface affected, but at varying depths and general bone profile maintained
5	Heavy erosion across whole surface, completely masking normal surface morphology with some modification of the bone profile
5+	As grade 5 but with extensive penetrating erosion resulting in modification of profile

Table 2.1 Surface preservation of fragments – grades for recording abrasion/erosion of bone (following McKinley, 2003).

Uniform weathering/erosion may indicate that the bone was subject to post-burial movement. A bone which “displays a broad range of weathering stages may have undergone slow burial, or possibly multiple burials and partial re-exposure" (Lyman and Fox, 1997: 243).

2.2.5.3 Cut marks and evidence of processing

All bone surfaces were examined for cut marks macroscopically and with the aid of a hand lens and a light microscope. For potential cut marks, detailed records of their location, orientation, coloration, morphology, number and length were made with the help of line drawings and photographs. Positive identification of cut marks, including the type of cut (light defleshing mark, cut, or chop), was made with reference to examples and established criteria described by Binford (1981) and (Olsen and Shipman, 1994). SEM analysis of potential cut-marks was not used. Where possible, the type and distribution of cut marks in the human and animal bone assemblages were compared.

2.2.5.4 Animal gnawing (action)

If gnaw marks were present the type (rodent or canid) was recorded in the database and their location and the extent of the area affected was recorded with line drawings (on pre-printed element outlines) and photographs where necessary.

2.2.5.5 Burning

Evidence for burning of bones was recorded. Three grades were used to score the degree of burning, following Outram *et al*. (2005: 1704);

1) "scorching"; yellow/brown superficial colouration of the bone surface
2) "carbonised"; blackening of the bone, or charcoal-like
3) "calcined"; grey/white bone

In the light of these differences, which may indicate the condition of the body/element when burnt, the location, distribution, and pattern of changes caused by burning were recorded using drawings and photographs.

2.2.6 Recording fracture type

The shape of the fracture outline (helical, transverse, stepped or intermediate), the fracture angle (oblique or right-angle), the texture of the fracture surface (rough or smooth), and the colour of the fracture surface (same colour or lighter) were recorded for identification of bone fracture type. These were compared with established criteria for the classification of fresh, 'dry' and post-depositional fractures.

2.2.7 Anthropological data

2.2.7.1 Estimation of biological age at death

Estimation of skeletal age is, until the age of around 25 years, based on the growth and development of the skeleton and the dentition, and thereafter on the degeneration of specific joint surfaces as adult skeletons increase in maturity. Differentiation between young and mature adults is generally accepted to be relatively straightforward, but as rates of degeneration are variable within and between populations, division of adults into anything other than broad age categories is not advocated. This also mitigates for the fact that maturational processes will vary between the sexes and between ethnic groups, and will be influenced by genetic, hormonal, environmental, nutritional and social factors (O'Connell, 2003: 17). For the purposes of this study adult skeletal material was divided into three categories of young, middle and older adult individuals (see Table 2.2 below). Ageing of juvenile skeletons is, however, more accurate, as the timing of the development of the dentition and juvenile skeleton follows a reasonably predictable order, and juvenile skeletons can be placed into smaller age categories (see Table 2.2).

Estimates of age at death in sub-adults were made using dental development (Moorees *et al.*, 1963a, 1963b), dental eruption stages (Gustafson and Koch, 1974), and epiphyseal fusion (Scheuer and Black, 2000). Foetal and neonatal remains were aged using linear regression equations for diaphyseal length as cited in Scheuer and Black (2000).

Adult age at death was estimated using standard macroscopic techniques as outlined in (Buikstra and Ubelaker, 1994), specifically using the characteristics of the pubic symphysis and auricular surface. Whilst dental attrition can provide a broad indicator of age, it was not used in this study as it is largely influenced by diet and its applicability to hunter-gatherer populations has not been demonstrated.

Multiple techniques were applied where possible, but as the remains were generally disarticulated elements, age assessment could only be made for elements where the relevant indicators were present (e.g. the pelvis, for adults). The majority of elements could only be broadly categorised as adult or sub-adult with most elements or fragments only allowing classification as fused or unfused.

Estimate of biological age	
Description	**Age range**
Inter-uterine/Neonate	<4 weeks
Early post-natal infant	1-6 months
Later post-natal infant	7-11 months
Early child	1-5 years
Later child	6-11 years
Adolescent	12-17 years
Young adult	18-25 years
Middle adult	26-45 years
Older adult	>46
Sub-adult	**<18 years**
Adult	**>18 years**
Unobservable	*Unknown*

Table 2.2 Categories for estimation of biological age

2.2.7.2 Estimation of biological sex

Estimation of skeletal sex is based on the secondary sexual characteristics which begin to appear during puberty, resulting in observable differences between the sexes in the morphology of the adult pelvis and the size and robusticity of the skeleton, particularly the cranium. Standard physical anthropology techniques, as outlined by Buikstra and Ubelaker (1994), were used to record the sexually dimorphic traits of the pelvis and cranium, where these were present. When observable, each trait was graded on a scale of 1 to 5 (see Table 2.3) and an overall estimate of sex was based on the predominant score. If both sets of traits could be recorded for a single individual then more weight was given to those of the pelvis as they are considered the most reliable indicator of sex.

In the absence of morphological traits, metrical data provide reasonable sex discrimination and, where possible, measurements of bones or joint surfaces were taken and compared to data provided by Bass (1995) for each element. Significant overlap in measurements between the sexes can be expected and, in the absence of a large collection of remains in which to observe the population variability, they only provide a tentative indication of sex. In fact, Mays and Cox (2000: 119) recommend that only metrics derived from sexed individuals from the same assemblage should be used to ensure that the ancestry of the reference sample is the same as the population under study. If sex was determined on the basis of metrical data alone the estimation was recorded as possible male (M?) or possible female (F?). Sex estimation was always based on morphological characteristics where these were available, and whether sexing was based on pelvic morphology, cranial morphology or metrics was indicated in the database (in the field 'Sex_method'). In the light of these limitations, sex estimation was made more as a record than for use as an interpretive tool. The fragmentary nature of the assemblage also meant that only a small number of elements could be sexed, further limiting its use.

Grade *(for pelvic/ cranial traits)*	**Database code**	**Sex estimate**
1	M	**Male**
2	M?	**Possible male**
3	?	**Intermediate sex**
4	F?	**Possible female**
5	F	**Female**
9	U	**Element not observable / Sex undetermined**

Table 2.3 Estimation of adult sex

As discussed for skeletal age, caution must also be taken in our consideration of the sex of human remains. Whilst biological sex may be determined from human remains this is not an indication of gender. Recognised as a cultural construct, gender is not necessarily directly linked to biological sex nor limited to a binary division of only male and female categories.

2.2.7.3 Stature

Stature is an inherent characteristic influenced by both genetic predisposition and childhood health and nutrition and can therefore be an informative area of study (Brothwell and Zakrzewski, 2003: 30). It is also affected by age, sex, posture and to some degree, occupation and is best studied in terms of samples rather than individual cases. Adult stature estimates were recorded for the purpose of examining intra-site variation and for comparison with other Mesolithic sites. Where possible measurements of intact long bones were taken and the prediction equations of Trotter (1970) used to estimate stature. Whilst Trotter's equations are those usually employed to estimate stature it must be noted that they were derived from modern American samples and so they may not be suitable for European and/or prehistoric material. Prediction equations are available for the upper and lower limb bones, but the latter provide estimates with smaller error ranges. Trotter provides equations for males and females and where the sex of a measured long bone was unknown both results are given.

2.2.7.4 Other observations

All bone surfaces were examined and if pathological changes or evidence of trauma were present these were described, and drawn and photographed as necessary, and details given in the comments field. Vertebral degenerative joint disease (such as Schmorl's nodes, osteophytes etc.) and dental disease were not systematically recorded.

2.3 Conclusions

This chapter has discussed the criteria for the selection of individual case studies, as well as emphasising the need for a consideration of taphonomy. This is particularly key given that the disarticulated human remains found on Mesolithic sites have so frequently been considered to be the product of taphonomic factors alone, rather than intentional human practices. The second part of the chapter outlined the methods employed to elucidate mortuary practices focused on the disarticulation of the body, and means of identifying the identity of the deceased. The following three chapters will focus on the individual case study sites.

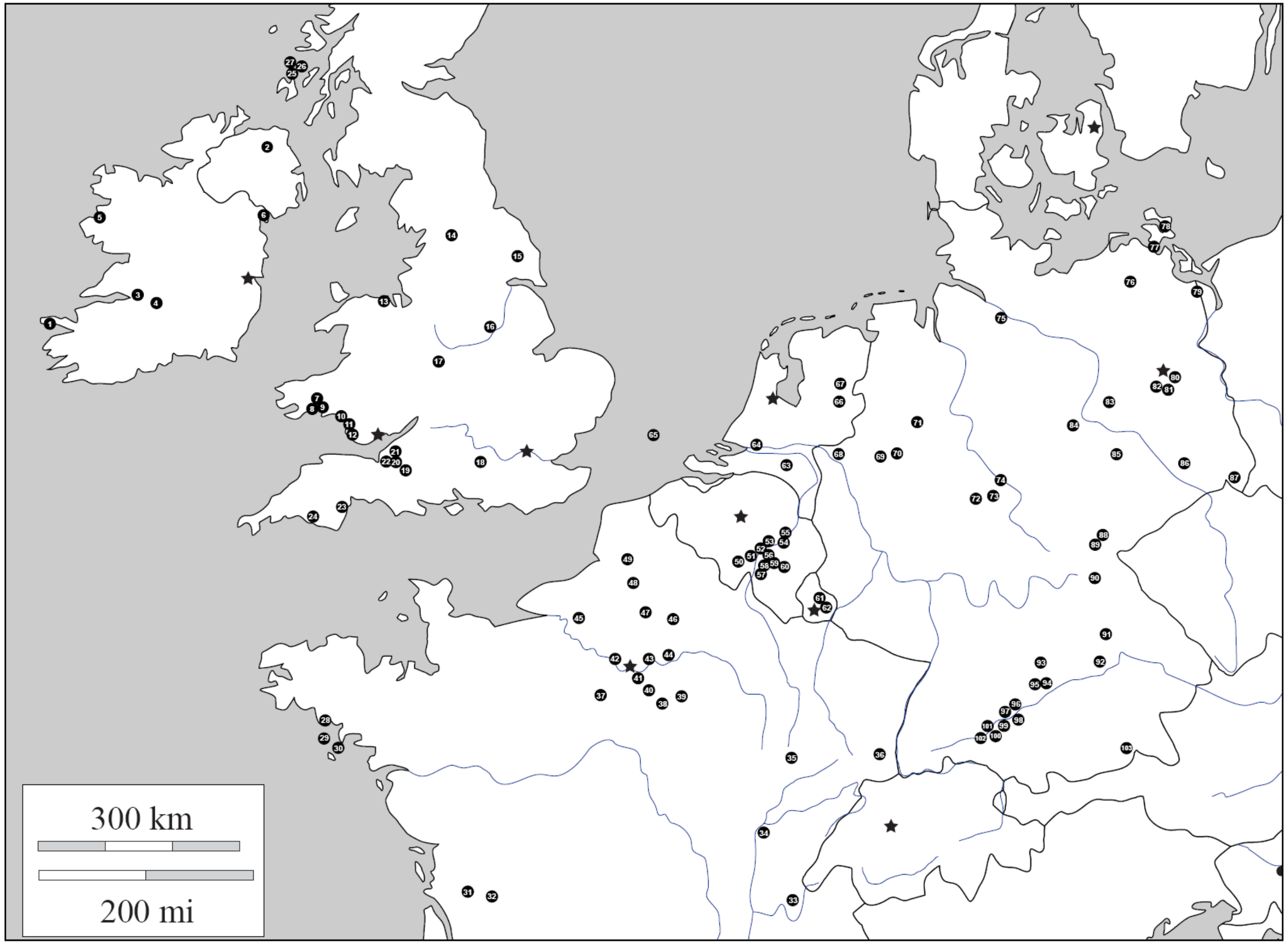

Figure 2.3 Distribution of sites in the study area (see Table 2.4 for key to site names)

Table 2.4 Key to sites in the study area, as shown on Figure 2.3

Site No:	Name:	Type:	Period:	Condition:
1	Ferriter's Cove, Co.Kerry	Open	LM	Disarticulated
2	River Bann	Open	M	Artefact
3	Hermitage, Castleconnell, Co.Limerick	Open	EM/LM	Cremation
4	Killuragh Cave, Co.Limerick	Cave	LM	Disarticulated
5	Sramore Cave, Leitrim	Cave	LM	Disarticulated
6	Rockmarshall, Co.Louth	Midden	LM	Disarticulated
7	Ogof yr ychen, Caldey, Dyfed	Cave	LM	Disarticulated
8	Potter's Cave, Caldey, Dyfed	Cave	LM	Disarticulated
9	Daylight Rock, Caldey, Dyfed	Cave	EM/LM	
10	Foxhole cave, Glamorgan	Cave	LM	Disarticulated
11	Worm's Head, Gower, W. Glamorgan	Cave	EM	Disarticulated
12	Paviland, Gower, W. Glamorgan	Cave	LM	Disarticulated
13	Pontnewydd, St. Asaph, Clwyd	Cave	LM	Disarticulated
14	Chapel Cave, Yorkshire	Cave	LM	Disarticulated
15	Kilham long barrow, Yorks.	Open	M	In features
16	Staythorpe, Notts.	Open	LM	Disarticulated
17	Bower Farm, Rugely, Staffordshire	Cave	LM	Disarticulated
18	Thatcham, Berks.	Open	EM	Disarticulated
19	Badger Hole, Wookey, Somerset	Cave	EM	Disarticulated
20	Totty Pot, Cheddar, Somerset	Cave	LM	Disarticulated
21	Aveline's Hole, Burrington Combe, Somerset	Cave	EM	Disarticulated
22	Goughs Cave, Cheddar, Somerset	Cave	EM	Inhumation
23	Kent's Cavern, nr Torbay, Devon	Cave	LM	Disarticulated
24	Oreston (third bone cave), Plymouth, Devon	Cave	EM	Disarticulated
25	Priory Midden, Oronsay	Midden	LM	Disarticulated
26	Caisteal nan Gillian II, Oronsay	Midden	LM	Disarticulated
27	Cnoc Coig, Oronsay	Midden	LM	Disarticulated
28	Beg-er-Vil, Morbihan	Midden	LM	Disarticulated
29	Téviec, Morbihan	Midden	LM	Multiple Inhumation, Secondary burial
30	Hoëdic, Morbihan	Midden	LM	Multiple Inhumation
31	La Vergne, Charente-Maritime	Open	EM	Multiple Inhumation Cremation, Disarticulated
32	Grotte des Perrats, Agris, Charente	Cave	MM/LM	Disarticulated
33	Culoz sous Balme, Ain	Cave	MM	Inhumation, Disarticulated
34	Ruffey-sur-Seill, À Daupharde, Jura	Open	MM	Cremation

Site No:	Name:	Type:	Period:	Condition:
35	L'abri des Cabones a Ranchot, Jura	Cave	LM	Disarticulated, Artefact
36	Mannlefelsen I, Haut-Rhin	Cave	MM	Head/Skull burial
37	Parc du Chateau à Auneau, Eure-et-Loir	Open	MM and LM	Inhumation
38	Villeneuve-la-Guyard, Falaises de Prépoux, Yonne	Open	LM	Multiple Inhumation
39	Noyen-sur-Seine, Seine-et-Marne	Open	MM/LM	Disarticulated
40	Melun, Seine-et-Marne	Open	MM	Inhumation
41	Maisons-Alfort, Val-de-Marne	Open	MM	Inhumation
42	Rueil-Malmaison 'Les Closeaux' , Hauts-de-Seine, Paris	Open	MM	Inhumation, Cremation
43	Neuilly-sur-Marne, Seine-Saint-Denis	Open	LM	Inhumation
44	Mareuil-lès-Meaux, Seine-et-Marne	Open	MM	Inhumation
45	Les Varennes, Val de Reuil, Eure	Open	MM?	Inhumation, Multiple Inhumation, Disarticulated
46	Concevreux, Aisne	Open	LM	Cremation
47	Verberie, Le Buisson Campin, Oise	Open	MM	Inhumation
48	Petit Marais, La Chaussée-Tirancourt,	Open	MM	Cremation, Disarticulated
49	Saleux, Les Baquets, Somme	Open	MM	
50	Grotte Lombeau at Mont-sur-Marchienne, Charleroi, Hainault	Cave	EM	Disarticulated
51	Loverval / Grotte des Sarrasins, Hainaut	Cave	EM	Multiple Inhumation
52	Grotte de Claminforge at Sambreville, Namur	Cave	EM	Disarticulated
53	Petit Ri at Malonne, Namur	?	EM	Disarticulated
54	Faille du Burin at Thon, Andenne, Namur	Cave	EM	Disarticulated
55	Trou Al'Wesse, Modave	Cave	LM	Disarticulated
56	Bois Laiterie, Namur	Cave	EM	Disarticulated
57	Abri des Autours, Namur	Cave	EM	Inhumation, Disarticulated
58	Grotte Margaux, Namur	Cave	EM	Disarticulated
59	Trou Magrite, Namur	Cave	EM	Disarticulated
60	Trou de Chaleux, Namur	Cave	EM	Disarticulated
61	Abri Astebach, Reuland	Cave	LM/EN	Disarticulated
62	Abri du Loschbour,	Cave	LM	Inhumation, Cremation
63	Oirschot V (site 21), North Brabant	?	MM	Cremation
64	Hardinxveld, Giessendam	Open	LM	Inhumation, Disarticulated
65	North Hinder Bank, North Sea Basin	Sea	EM	Disarticulated
66	Marienberg, Overijssel	Open?	M	Inhumation

Site No:	Name:	Type:	Period:	Condition:
67	Dalfsen (Welsumer Maan), Overijssel	?	LM	Cremation
68	Rees, Nordrhein-	Unknown	LM/N	Disarticulated
69	Blätterhöhle bei Hagen, Nordrhein-Westphalen	Cave	EM	Disarticulated
70	Balver Hohle, Nordrhein-Westfalen	Cave	EM	Disarticulated
71	Steinhagen, Mecklenburg-Vorpommern	?	LM	Disarticulated
72	Bottendorf Sachsen-	?	LM	Multiple Inhumation
73	Rhünda, Hessen	?	EM	Disarticulated
74	Abri Bettenroder Berg IX, Gottingen	?	EM	Inhumation, Disarticulated
75	Hahnöfersand, Niedersachsen	?	LM	Disarticulated
76	Plau, Mecklenburg-Vorpommern	?	LM	Inhumation
77	Drigge, Wiek, Rügen	?	LM	Disarticulated
78	Ralswiek-Augustenhof, Mecklenberg	Open	LM?	Disarticulated
79	Rothenklempenow, Mecklenburg-Vorpommern	?	LM	Inhumation
80	Berlin (Scmöckwitz)	Open	LM	Inhumation
81	Grosse Fredenwalde, Brandenburg	?	LM	Multiple Inhumation
82	Kolberg, Brandenburg	?	LM	Inhumation
83	Schopsdorf (Fundstelle 14 & 2), Sachsen-Anhalt	?	LM	Multiple Inhumation
84	Unseburg, Sachsen-	?	LM	Inhumation
85	Bad Dürrenburg, Sachsen-Anhalt	Open	LM	Multiple Inhumation
86	Coswig, Sachsen-Anhalt	?	LM	Cremation
87	Niederkaina, Ostsachsen	?	M	Inhumation
88	Ranis, Ilsenhöhle, Thüringen	?	LM	Disarticulated
89	Urdhöhle, Döbritz, Thuringen	?	EM/LM	Disarticulated
90	Büttnerloch, Thuisbrunn, Bayern	Cave?	EM/LM	?
91	Ensdorf, Steinbergwand, Bayern	Cave	M	Disarticulated
92	Schellnecker Wänd, Bayern	Cave	LM-N	Multiple Inhumation
93	Nassenfells, Bayern	?	EM	Disarticulated
94	Hexenküche by Kaufertsberg, Bayern	Cave	M?	Head/Skull burial
95	Grosse Ofnet-Höhle, Bayern	Cave	LM	Head/Skull burial
96	Höhlesbuckel, Blaubeuren-Altental,	?	EM	?
97	Hohler Fels, Happurg, Bayern	Cave	EM/LM	Disarticulated
98	Hohlenstein or Hohlenstein-Stadel, Baden-Württemberg	Cave	LM	Head/Skull burial
99	Felsställe-Mühlen, Baden-Württemberg	Cave	M	Inhumation

Site No:	Name:	Type:	Period:	Condition:
100	Felsdach Inzigkofen, Baden-Württemberg	?	LM	Disarticulated
101	Falkensteinhöhle, Baden-Württemberg	Cave	LM	Disarticulated
102	Jagerhaus Höhle	Cave	LM	Disarticulated
103	Bockstein Höhle, Baden-Württemberg	Cave	LM	Multiple Inhumation

Period: M = Mesolithic

EM = Early Mesolithic

MM = Middle Mesolithic

LM = Late Mesolithic

N = Neolithic

3 Case study 1: Mortuary practice at the late Mesolithic site of Hardinxveld-Polderweg, Netherlands

3.1 Introduction

As a case study to explore specific mortuary practices I undertook osteological analysis of an assemblage of human remains from the later Mesolithic site of Hardinxveld (64), in the Netherlands. The remains were recovered from two islands within a wetland landscape and included three inhumations, a concentration of disarticulated human remains and a scatter of disarticulated elements. These had been deposited over the occupation surface and in the surrounding wetlands. The skeletal material had been recognised as evidence for a "different and complex body treatment" (Louwe Kooijmans, 2003: 613) but aside from the recognition of some cut marks this had not been explored further. This chapter outlines my reanalysis of the assemblage which revealed evidence for body processing including additional cut marks, freshly fractured bones and burning of some elements.

3.2 Site background

3.2.1 Circumstances of excavation

Palaeoenvironmental survey carried out in 1994 in advance of the construction of a new railway line revealed late Mesolithic occupation on the tops of two Late Glacial river dunes, or *donken*, in a Late Glacial river valley of the Rhine/Meuse delta in the municipality of Hardinxveld-Giesendam. The two sites are around one kilometre apart and were named De Bruin (dated to 5500-4500 cal BC) and Polderweg (dated to 5500-5000 cal BC) (Louwe Kooijmans, 2003). The islands are now covered by Holocene clay and peat deposits and their tops lay *c*. 4-5 m below present sea level with surrounding marsh deposits up to 10 m below sea level (the depth being due to the former low water table and later compaction of deposits). A programme of hand coring defined the palaeogeography and indicated the extent of the archaeological activity at the two sites, at Polderweg (phase 1) as *c*. 20 x 80 m and at De Bruin (phase 3) as *c*. 25 x 25 m, representing palimpsests of *c*. 200-300 years of activity. The authors estimate that around 20% of each site was excavated. Full reports of the excavations are available in Dutch with English summaries (see Louwe Kooijmans, 2001a, 2001b) and a brief account was published in English in the proceedings of the Sixth International Conference on the Mesolithic in Europe (see Louwe Kooijmans, 2003). This background and analysis are based on both the English and Dutch publications and clarifications and further information were kindly provided by Prof. Louwe Kooijmans and Dr. Liesbeth Smits during my visit to study the material.

3.2.2 Archaeological context

In the past, the two sites would have been dry islands in a dense wetland environment. The dune tops were dry and covered by trees (oak, elm, ash, and lime with shrubs at their edges) and the surrounding marsh deposits were dominated by willow and alder carr and contained lakes and flowing rivers which were fringed by reeds.

The sites were occupied at roughly the same time and were both abandoned when the dunes became submerged by wetland deposits moving up slope and encroaching on the dry land, as the water levels gradually rose. This occurred earlier at the lower lying site of Polderweg. The site is described in terms of three depositional zones; the flat top of the dune, the dune slope, and the surrounding marsh deposits, which gradually moved up slope throughout the occupation, as the marsh encroached on the drier land.

The dune top is considered as the occupation surface and contained a dense concentration of features; large and shallow pits, tree throws, post holes, and burials, along with scarce and fragmentary finds. The dune slope is covered by slope-wash from the top of the dune (colluvium) and contained a large number of small and fragmentary finds, including bone fragments (especially fish remains), flint and charcoal. The authors consider that the distinct concentrations of material in this zone at both sites indicate that these were 'primary activity' areas situated on the marsh margins. Despite acknowledging that this material is redeposited, even if only over a short distance, they do not seem to consider that the spatial distribution of these remains may not be representative of *in situ* activity. The last area, the surrounding marsh deposits, is considered as a 'toss and drop zone'. Large objects, worn and broken implements, production waste, and larger bones were deposited into the marsh over a distance of up to 10 m from the dune slope.

3.2.3 Dating and phasing

Based on radiocarbon dating the occupation at the sites has been divided into three phases, Phase 1 = 5500-5300 cal BC, Phase 2 = 5100-4800 cal BC, Phase 3 = 4700-4450 cal BC [2] during which the nature and extents of the activities taking place varies between the islands:

[2] This has been further refined by Bayesian analysis of the dating (Mol and Zijverden, 2007)

5500-5300 cal BC (Phase 1 (a)): The main focus of occupation is at Polderweg, with some parallel use of De Bruin.

5300-5100 cal BC (Phase 1 (b)): The focus of activity shifts to De Bruin, with less activity at Polderweg though the site is still visited up to c. 5000 cal BC (referred to as phase '1 or 2' c. 5150-5050 cal BC)

5100-4800 cal BC (Phase 2 at both sites): Both sites are occupied, but less so and for only short time, at Polderweg where occupation ceases around 5000 cal BC. Pottery was made and used from beginning of this phase (the ceramic Mesolithic).

4700-4450 cal BC (Phase 3): Occupation only took place at De Bruin. The remains of domestic animals do not appear until the end of phase 3 and only in low numbers, so the whole sequence is considered to be Mesolithic.

At Polderweg a single burial and a small assemblage of artefacts and animal bone predated phase 1, and are referred to in the site report as phase 0 (>5500 cal BC). The burial (grave 1) yielded a date of 5805-5629cal BC (6820 ± 50 BP (GrA-9804). The material from this phase represents the first activity on the site, and was considered by the excavators as part of phase 1 for the purposes of distribution diagrams.

3.2.4 Human remains and mortuary practice

Human remains were recovered on both sites from unfurnished burials (three) on the dune top and as isolated remains (c. 90 fragments) from the dunes and dune slope, where they were deposited along with large quantities of faunal remains and discarded artefacts.

3.2.4.1 Polderweg

3.2.4.1.1 Phase 0

An adult female (Grave 1), c. 40-60 years of age, was buried supine and extended in a simple grave cut within the sand of the dune top and dated to *c*. 5600 cal BC. The grave was intact and undisturbed, with hand and foot bones *in situ*, but the sandy context meant that preservation of thin and small elements was relatively poor. A single metatarsal (foot bone) was also recovered from this phase, and does not appear to derive from the individual in grave 1.

3.2.4.1.2 Phase 1

The majority of human remains were deposited within this phase. This included a concentration of skeletal material consisting of 17 disarticulated elements; lower leg bones, vertebrae, ribs, a scapula and lower arm bones, within a 2 m diameter in the colluvium (Smits and Louwe Kooijmans, 2001: 423). It was located on the dune top but not within an obvious feature and was only identified in post excavation analysis when it was referred to as Grave 2, see Figure 3.1.

Scattered across the dune top, dune slope and marsh deposits a further 76 disarticulated human bones were also identified. Amongst these a hand phalange with gnaw marks and a clavicle with cut marks were identified (Louwe Kooijmans, 2001b: 429).

As well as burials of humans there were also three dog burials (Graves 3, 4 and 5) within this phase. One was fully articulated and lay on its right side, a second was only partially preserved and a third was inferred from a concentration of unbroken bones (in a very similar way to the human grave 2). In fact the disarticulated remains of dogs were also found scattered over the whole area.

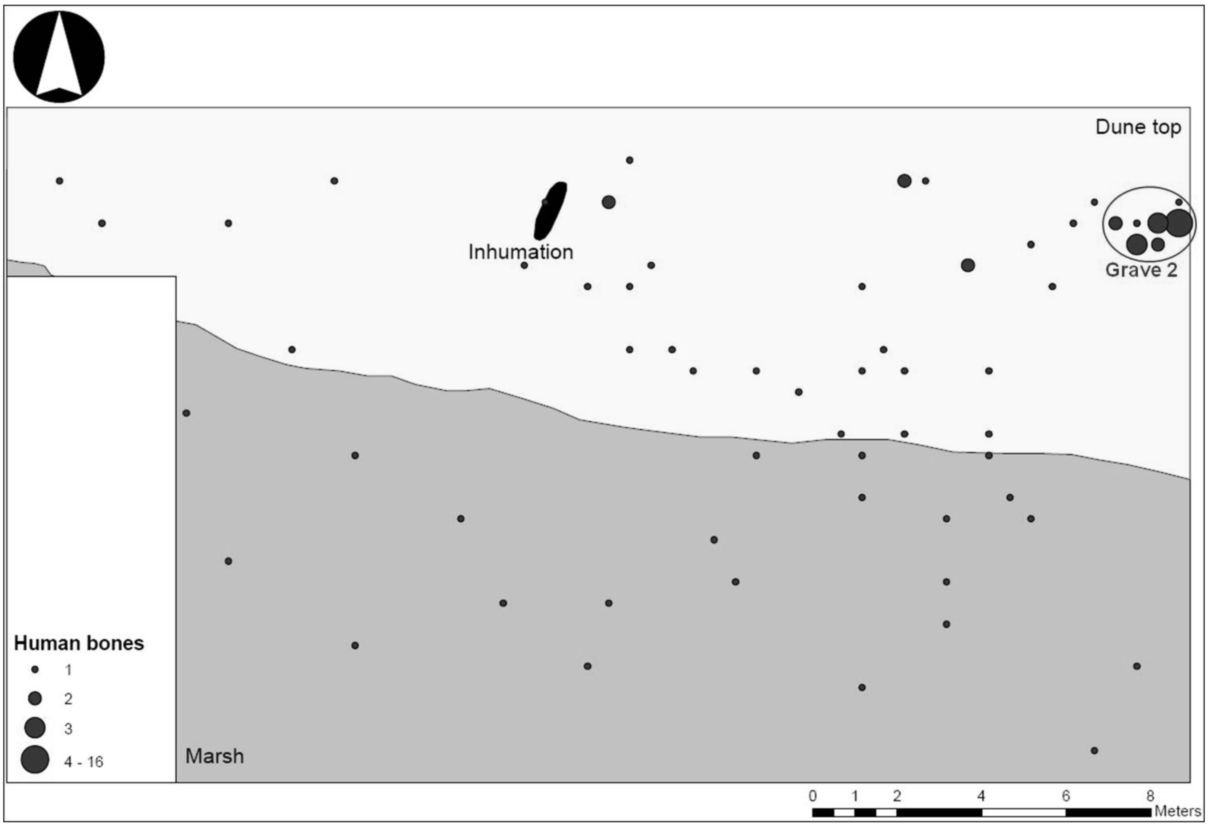

Figure 3.1 Site plan of Hardinxveld-Polderweg, phase 0 and 1

3.2.4.1.3 Phase 1/2 (c. 5150-5050 cal BC)

A single humerus (upper arm) was recovered from the dune top within this phase[3].

3.2.4.1.4 Phase 2

Two elements, a fragmentary but almost complete cranium (24038) and the head of a femur (25341), were recovered from deposits in this phase.

3.2.4.2 De Bruin

Human remains were sparser at the site of De Bruin and consisted of two graves, one of which had been disturbed by a later feature, and 10 scattered elements.

3.2.4.2.1 Phase 1

Grave 1 held the burial of an adult lying supine and probably extended, but disturbed from the waist down by a later pit. Grave 2 contained a second individual who is postulated to have been buried in a sitting posture within a pit. Four[4] disarticulated elements were also recovered.

3.2.4.2.2 Phase 2

Five disarticulated elements were recovered.

3.2.4.2.3 Phase 3

Three[5] disarticulated elements.

3.2.5 Current interpretation of burial practice at the site

The authors interpreted these remains as evidence for a "different and complex body treatment" (Louwe Kooijmans, 2003: 613). They suggested that remains may have been exposed on the surface of the sites, based on evidence of rat gnawing (on one bone) and some secondary burning (Smits and Louwe Kooijmans, 2001). However, as with the cut marks, this idea is not explored further in the interpretations of the site. More recently one of the original authors has considered that cultural traditions involving dismemberment and defleshing may be responsible for the scattered remains, tentatively suggesting that the cut-marked clavicle may be associated with cannibalism or decapitation (Smits and van der Plicht, 2009: 65).

---

[3] Distribution diagrams in the publications combine phases 1/2 and phase 2 into one figure

[4] Though the publication lists only 3; Louwe Kooijmans 2001a, p487 Table 13.1

[5] Though the publication lists 2 (as footnote 1), 20423, 10189

3.3 Osteological analysis of Hardinxveld-Polderweg

This section outlines the results of the osteological analysis of material from Hardinxveld-Polderweg. It begins by quantifying the individual fragments of bone, which form the basic unit of analysis, in terms of their preservation, identification to skeletal element, and any further information gained from their analysis, such as metrical and morphological observations that may be used to estimate sex, age and stature.

The identified fragments are then reduced to a minimum number of skeletal elements (MNE), by virtual 'refitting' of adjacent zones of the same element and counting overlapping or repeating zones (though it also includes refits identified during analysis) The number of skeletal elements is then used to calculate the minimum number of individuals (MNI) that can be represented by these elements. Any modifications to the bones, such as cut-marks, are also discussed.

3.3.1 Basic quantification of the assemblage

3.3.1.1 Introduction

In total 66 finds numbers were assigned to human bone during the original post-excavation analysis; this included one burial, (Grave 1, finds number 1004), and 65 finds numbers for the scattered material. In two cases (11159 and 15322) the bones themselves were missing from their bags and could not be examined which has led to a discrepancy between this study and the numbers of elements cited in the original analysis (Smits 2001). During my initial analysis of the material it became clear that a single finds number could relate to a single fragment, several fragments or a complete element. Where several unidentifiable fragments were bagged under one finds number they have been grouped by bone type (such as appendicular) with each 'group' representing a single fragment. For example, if a bag contained multiple unidentifiable appendicular fragments it has been counted as a single fragment but where it contained fragments of appendicular and axial bone it has been counted as two fragments. Therefore the number of unidentified fragments represents a minimum number of elements of each bone type for each finds number (see methodology). As the skeleton buried in Grave 1 was complete and undisturbed the individual bones were not included in the following analysis, which is concerned with characterising the nature of the scattered and disarticulated material, but it was counted as representing one individual for inclusion in the MNI. The 63 finds numbers for scattered material resulted in the recording of 89 fragments, which forms the most basic level of analysis.

3.3.1.2 Total number of identified specimens (NISP) and unidentified fragments (UF)

The assemblage of scattered material consisted of 76 (85%, 76/89) identifiable fragments (see Table 3.1) and a minimum of 13 (15%, 13/89) unidentified fragments (see Table 3.2). The majority of this material belongs to phase 1, which consisted of 85 fragments, 72 (85%, 72/85) identified specimens along with a minimum of 13 unidentified fragments (15%, 13/85). The unidentifiable fragments consisted of 122 separate pieces, 80% of which were 0-20 mm, 15% were 21-30 mm, and the remaining 5% between 31-70 mm in size. Phase 0 and 1/2 were each represented by a single identifiable bone and there were two identifiable fragments from phase 2. There were no unidentified fragments from these phases.

	Number of identified specimens			
Fragment ID	**Phase 0**	**Phase 1**	**Phase 1/2**	**Phase 2**
Cranial		4		1
Mandible		1		
Clavicle		1		
Manubrium		0		
Sternum		0		
Scapula		2		
Humerus		1	1	
Radius		4		
Ulna		2		
Hand		2		
Ribs		2		
Cervical vert		0		
Thoracic vert		7		
Lumbar vert		5		
Sacrum		1		
R os coxa		0		
L os coxa		0		
Femur		4		1
Tibia		3		
Fibula		1		
Feet	1	10		
Teeth		22		
Total	1	72	1	2

Table 3.1 NISP Total number of fragments recorded, by bone identification.

Unidentified fragment type	**Min. Number**
Cranial	1
Appendicular	7
Axial - rib	1
Axial - vert	2
Axial (flat not rib)	1
Unidentified (not assignable to element type)	1
Total	13

Table 3.2: Minimum number of unidentified fragments by element types (all Phase 1)

Of the identifiable fragments a high proportion, (22 fragments) were single teeth (see Table 3.3), and were a mixture of permanent and deciduous dentitions. Although this represents a large proportion of the assemblage it is a relatively small number considering that just one individual can account for 20 deciduous and 32 permanent teeth. Unlike other elements teeth can be lost during life (antemortem), due to dental disease, trauma or the natural shedding of the deciduous dentition, as well as after death (postmortem) due to the decay of their ligamentous attachments. It is, however, often not possible to differentiate postmortem and antemortem tooth loss from the teeth alone. The assemblages of deciduous and permanent teeth were both dominated by molar teeth which is unusual as it is the single-rooted teeth (canines, incisors and lower premolars) that most easily become separated from the bony sockets of the jaw postmortem. Of the permanent dentition there were also substantially more teeth from the maxillary dentition (upper jaw), which is probably related to the fact that four crania were recovered but only one left mandible (lower jaw). Within this mandible (13883) there were three teeth, the first, second and third permanent molars, remaining *in situ*, and these were not included in the count of loose teeth.

The positions for the left mandibular premolars, canine, incisors and first right incisor were also preserved indicating that these teeth were lost postmortem, though none of these teeth were recovered separately. The elements represented by the remainder of the identifiable fragments will not be discussed in detail in this section because as individual fragments they may be parts of the same element and therefore any quantification or discussion of skeletal part representation would be misleading. The minimum number of elements that these fragments represent will be presented and discussed below.

Teeth	No.
Deciduous dentition	8
maxillary	4
1st molar - right	1
2nd molar - unsided	1
2nd molar - right	2
mandibular	4
Canine - left	1
2nd molar - right	1
2nd molar - left	1
2nd molar - unsided	1
Permanent dentition	13
maxillary	10
Second incisor - left	1
Canine - left	1
1st premolar - left	1
1st molar - left	2
2nd molar - right	1
2nd molar - left	2
3rd molar - left	2
mandibular	2
2nd molar - unsided	1
2nd molar - left	1
molar (unclassified)	1
Unidentified tooth crown	1
Total	22

Table 3.3: Total number of teeth recovered, by dentition type

3.3.2 Surface preservation

Preservation of the surface of the remains was very variable but generally it was in good to moderate condition, enabling the observation of fine surface detail (see Table 2.1 and

Figure 3.2). Just over 50% of the material had only slight and patchy surface erosion or none at all, meaning that surface morphology was fresh and clearly visible. There were a few examples that were very poorly preserved (three scored as grade 5) where there was significant erosion and the normal surface of the bone had been completely lost. For example, fragments of tibia (6654) and femur (6655, pictured in Figure 3.3) showed extensive and uniform erosion and abrasion of the entire surface, suggesting that they had been subject to exposure on the surface and/or movement within the deposits. Grave 1 (not included in table) had patchy surface preservation with some areas of surface erosion (grade 2).

Surface preservation score (brief description)		N	%
0	No modifications	12	13.5
1	Slight/patchy surface erosion	36	40.4
2	More extensive surface erosion	6	6.7
3	Most of surface affected by erosion, completely masking surface detail in some areas	5	5.6
4	Extensive erosion; all of surface affected, but at varying depths and bone profile maintained	5	5.6
5	Heavy erosion across whole surface, completely masking surface morphology & modifying the bone profile	3	3.4
N/A	22 teeth	22	24.7
Total (all phases)		89	

Table 3.4: Surface preservation of fragments – abrasion and erosion recorded on a scale of 0-5 (ranging from no changes to the surface of the bone to complete obscuring of the cortical surface (following McKinley, 2003)).

Figure 3.2 Example of good surface preservation (Left mandible (13883)).

Figure 3.3 Femur (6655), surface preservation grade 5.

A small proportion of bone fragments (c. 11%, 10/89) displayed differential surface preservation (see Table 3.5). A left radius (7875) from Grave 2, for example, had good surface preservation of the anterior surface but significant erosion of the posterior surface (see Figure 3.4). This may be an indication that the bone was subject to very little post-depositional movement and lay exposed on the surface, as it has been noted that “bones are usually weathered more on the upper (exposed) than on the lower (ground contact) surfaces" (Behrensmeyer, 1978: 153). This indicates that it was the posterior aspect of this bone that was uppermost when it was deposited and that it lay exposed on the surface for some time. As no other bones in Grave 2 showed such distinct differences in preservation this may indicate that the assemblage was partially buried but leaving the ulna exposed.

Find ID	**Fragment ID**	**Con-text.**	**Surface pres'n**	**Comments**
11978	Clavicle	26	1	Longitudinal cracking along the diaphysis, exfoliation and surface flaking of the medial end, post-excavation flaking of the inferior aspect of the lateral end
24337	Cranial: left frontal, parietal, temporal, occipital	26	3	Endocranial (internal) surface = grade 1, ectocranial (external) = grade 3
23356	Humerus	28	0	A discrete area of patchy surface erosion/exfoliation on the posterior aspect of the mid-distal diaphysis (shaft).
24055	Femur	29	0	Good surface preservation but anterior aspect has significant (post-excavation) flaking of the outer cortex.
27385	Radius	29	0	Patches of surface flaking and exfoliation of the proximal end
10297	Cranial: left parietal, temporal, sphenoid, right parietal, occipital	29	0	Good preservation of endo- and ectocranial surfaces. Areas of the left parietal show surface cracking and exfoliation and patches of root erosion. This section is also damaged by the effects of burning, though this is considered separately.
17081	Carpal (c)	32	2	Cracking of articular surfaces
7875 /7881 (Gr. 2)	Radius	40	4	Anterior surface = grade 1, posterior surface = grade 4
13002	Cranial: fragment of occipital	40	5	Endocranial (internal) surface = grade 1, ectocranial (external) = grade 5
12703	1st proximal foot phalanx	40	4	Dorsal surface = grade 4, plantar surface = grade 0
8644	Ulna	50	1	Some longitudinal cracking and surface flaking of a well defined area of the posterior aspect

Table 3.5: Fragments displaying differential preservation (All phase 1)

A small fragment of the occipital bone (from the posterior cranium) (13002) also displayed this type of differential preservation – the endocranial (internal) surface of the fragment was well preserved but the ectocranial (external) surface was heavily eroded. Such differential preservation is likely to be a common feature of more complete crania, as the internal surface of a complete cranium is protected from exposure by the nature of its completeness where as cranial fragments would have become weathered/eroded evenly over all surfaces. This may indicate that this fragment was deposited as part of an intact cranium, rather than as a separate fragment. In addition the fracture surfaces around the edges of the fragment were much lighter in colour than the rest of the bone indicating that it had become broken after it had been deposited and weathered.

A

B

Figure 3.4: Differential preservation of a left radius (proximal 2/3rds (7875) and distal 1/3rd (7881)): A) posterior surface, grade 4, B) anterior surface, grade 1.

Other features indicative of weathering/exposure on the surface, such as superficial or deep longitudinal cracking, and flaking and exfoliation of the bone surface, were observed as discrete areas on five other fragments, mostly from the arm or shoulder. This indicates that these bones underwent slow burial, with some parts of them exposed, or perhaps a series of burial events with some re-exposure in between.

Surface preservation did not appear to differ significantly between the bone types (cranial, appendicular or axial) (see Table 3.6). All bone types had a higher proportion of fragments with well-preserved surfaces (grades 0 and 1) than those with more significant alteration of the surface, though the majority in every category had slight/patchy surface erosion. Axial fragments were the best preserved, with 95% of these fragments in grade 0 or 1, followed by cranial (72%) and appendicular (56%) fragments. The highest proportion of heavily eroded fragments (grade 5) was seen in the cranial fragments.

As there was such a small amount of material in the other phases it was difficult to compare preservation between them (see Table 3.7). However, there was no indication from the surviving elements that preservation differed significantly in the earlier or later phases as over half of the fragments had good surface preservation. Whilst predominantly the remains in Phase 1 had good surface preservation (52% at grade 0 and 1), the remainder covered the whole range of preservation grades, with several fragments suffering from extensive erosion and abrasion.

	Bone type							
	Cranial		Appendicular		Axial		UF/ teeth	Total
Surface preservation	N	%	N	%	N	%	N	N
0	2	28.6	5	13.5	5	22.7	0	12
1	3	42.9	16	43.2	16	72.7	1	36
2	0	0.0	6	16.2	0	0.0	0	6
3	1	14.3	3	8.1	1	4.5	0	5
4	0	0.0	5	13.5	0	0.0	0	5
5	1	14.3	2	5.4	0	0.0	0	3
n/a	0	0	0	0	0	0	22	22
Total	7	100.0	37	100.0	22	100.0	23	89

Table 3.6: Preservation by bone type (all phases) (UF = unidentified fragment)

	Phase 0		Phase 1		Phase 1/2		Phase 2		
Surface preservation	N	%	N	%	N	%	N	%	Total
0	0	0.0	11	12.9	0	0.0	1	50.0	12
1	1	100.0	34	40.0	0	0.0	1	50.0	36
2	0	0.0	6	7.1	0	0.0	0	0.0	6
3	0	0.0	4	4.7	1	100.0	0	0.0	5
4	0	0.0	5	5.9	0	0.0	0	0.0	5
5	0	0.0	3	3.5	0	0.0	0	0.0	3
n/a	0	0.0	22	25.9	0	0.0	0	0.0	22
total	1	100	85	100	1	100	2	100	89

Table 3.7: Preservation by phase

It was also possible to examine whether preservation was related to the location or context of deposition (see Table 3.8). All of the poorly preserved and highly eroded material (grades 4 and 5) was deposited within context 40, a highly humic coarse sand, directly overlying the substrate, on the donk-top and slope ((Louwe Kooijmans, 2001b: Table 3.1, Figure 3.6, 63)). The uniform weathering and/or erosion seen on these fragments indicates that they were probably subject to post-burial (or post-depositional) movement (Lyman and Fox, 1997: 243). However, this was not the case for all the material on the dune top, the majority of which was well preserved (grade 1). The remainder of the well preserved material derives from the marsh deposits. Whilst there was less material deposited in this area, the majority of it, 90% (10/11), was very well preserved, with grade 0 or 1 surface preservation, and there were no heavily eroded or abraded fragments. Interestingly, two paired elements, a right clavicle (11978) and a right scapula (23097), displayed different levels of preservation (see section 4.3.5). The scapula had very good surface preservation, but the clavicle was not as well preserved, showing some cracking and flaking of the surface, consistent with weathering (and possibly some exfoliation of the broken medial end suggesting it was broken before deposition). This difference in surface preservation may be related to their location. Whilst they were both recovered from the marsh deposits, the clavicle was located at what would have been the very edge of the marsh deposits in phase 1, where it met the edge of the donken and where the deposits were shallower and presumably more exposed to fluctuations in the water table. Alternatively, the clavicle may have lain exposed on the surface of the donken and later moved down slope into the edge of the nearby marsh deposits. The scapula, however, was deposited significantly further out into the marsh deposits, about 4m further from the donken edge. This element may have become buried more quickly, or even deposited under water, affording it better and uniform preservation.

In general it seems that whilst there is less material in the wet/marsh deposits, it is better preserved than the material on the top or slope of the donken. This would suggest that the material deposited on the top of the donken may have become buried more slowly and or was subject to post-depositional movement on the donken slope (colluvium), whereas the material in the marsh deposits was buried more quickly and was subject to less exposure or movement.

Phase 1	donk-top & donk-slope contexts						donk-edge contexts				wet/marsh sediment contexts							
Pres'n	30	40	50	1001	total	%	32	35	total	%	26	28	29	total	%	1002	1003	Total
0		1		2	3	4.9		1	1	11.1		2	5	7	63.6			11
1		15	3	9	27	44.3	1		1	11.1	1	1	1	3	27.3	1	2	34
2	1	2	1	1	5	8.2	1		1	11.1				0	0.0			6
3		3			3	4.9			0	0.0	1			1	9.1			4
4		5			5	8.2			0	0.0				0	0.0			5
5		3			3	4.9			0	0.0				0	0.0			3
n/a	3	12			15	24.6	3	3	6	66.7				0	0.0	1		22
total	4	41	4	12	61	72	5	4	9	11	2	3	6	11	13	2	2	85

Table 3.8: Preservation by context

3.3.3 Completeness; an assessment of the degree of fragmentation of the assemblage

As the number of zones present was recorded for every identifiable fragment it was possible to calculate the percentage completeness of each identified specimen. This was based on the number of zones present on a fragment of an element, divided by the total number of zones expected for that complete element. For example a complete femur consists of 11 zones, so if a fragment of femur consisted of five zones (for example, the distal portion of a femur, zones 7, 8, 9, 10 and 11) this was calculated as 45.5% (5/11) complete. The following table, Table 3.9, shows the average completeness (based on the average number of zones per fragment) for the main bones of the skeleton

	All phases	Phase 1 (incl. Gr.2)	Phase 2 (1/2 + 2)
Cranium	44.0	40.0	60.0
Mandible	50.0	100.0	0.0
Clavicle	66.7	66.7	0.0
Scapula	83.3	83.3	0.0
Humerus	63.6	81.8	45.5
Radius	36.4	36.4	0.0
Ulna	45.0	50.0	0.0
Femur	29.1	34.1	9.1
Tibia	53.0	53.0	0.0
Fibula	83.3	83.3	0.0

Table 3.9: Summary of average % completeness of identifiable fragments (by element type)

The femur and the radius were the least complete bones, as fragments of these were on average around 29% and 36% complete, respectively. It is worth noting that there is also evidence for deliberate fracturing of the femur and the radius, see section 3.3.9.3, below and this may be related to the greater degree of fragmentation of these elements. The fibula and the scapula, both 83% complete on average, were the most complete in the assemblage.

A comparison of the completeness of the same bones in Grave 2 and the rest of the Phase 1 assemblage shows that, more often than not, the bone in grave 2 was more complete (see Table 3.10).

	Phase 1 (excl. Gr.2)	Grave 2
Cranium	40.0	0.0
Mandible	50.0	0.0
Clavicle	66.7	0.0
Scapula	88.9	77.8
Humerus	81.8	0.0
Radius	18.2	42.5
Ulna	10.0	90.0
Femur	34.1	0.0
Tibia	30.0	100.0
Fibula	0.0	83.3

Table 3.10: Comparison of average % completeness of fragments in grave 2 and phase 1

3.3.4 Osteometric and morphological analysis

As a result of both the degree of fragmentation and the preservation of the material it was only possible to take measurements from five fragments (most osteometrics require complete bones and/or intact joint surfaces) (see Table 3.11). Where measurements could be taken they were, where relevant, also employed to estimate stature or sex (see Table 3.12 and Table 3.13).

Find ID	**Fragment ID**	**Side**	**Measurement**	**mm**
Grave 2				
7875	Radius	L	Head, maximum diameter (see methodology)	22
27939	Tibia	R	Length (#69 in Buikstra & Ubelaker 1994)	368
Phase 1				
23356	Humerus	L	Epicondylar breadth (#41 in Buikstra & Ubelaker 1994)	65
23097	Scapula	R	Glenoid - length (Bass 1995: 126)	32
"	"	"	Glenoid - maximum width	24
24055	Femur	L	Epicondylar breadth (#62 in Buikstra & Ubelaker 1994)	80

Table 3.11: Fragments from which measurements could be taken

3.3.4.1 Estimation of living stature

It was only possible to take one long bone measurement for the purpose of estimating stature. The length of the right tibia (lower leg) (27939) from the unsexed skeleton in Grave 2 (phase 1) suggested a stature of 168 ± 3-4 cm if the individual was female and 171 ± 3-4 cm if the individual was male (using equations for white females and white males from (Trotter, 1970)). Compared with stature estimates for individuals from other sites across western Europe (see Table 3.12) this individual was slightly taller than the average estimated for the western European Mesolithic of 151.3 ± 4.6 cm for females and 163.1 ± 5.8 cm for males (Formicola & Giannecchini, 1999, Tab. 5) and taller than the individual from Gough's Cave 1, estimated at 166.2 cm (Holliday & Churchill, 2003), and Aveline's Hole, 143 – 159 cm (Schulting, 2005). It does, however, fall within the range of stature estimated from the footprint-tracks of Mesolithic individuals from Goldcliff East (Scales, 2007).

Location	**Stature**	**Reference**
Hardinxveld-Polderweg	Grave 2: 168 ± 3-4 cm (female) or 171 ± 3-4 cm (male) Grave 1 (female): 158 ± 3-4 cm (Trotter, 1970)	(Smits and Louwe Kooijmans, 2001: 426, 439)
Western Europe (pooled data)	151.3 ± 4.6 cm (females) 163.1 ± 5.8 cm (males)	(Formicola and Giannecchini, 1999: Tab.5)
Aveline's Hole, Somerset	143 – 159 cm (female) (distal humerus)	(Schulting, 2005: 197)
Gough's Cave 1, Somerset ('Cheddar Man')	166.2 cm (male)	(Holliday and Churchill, 2003)
Goldcliff East, Severn Estuary (human footprint-tracks)	160 – 175 cm (adult females & sub-adult/adult males) (from footprint-size)	(Scales, 2007: 153)

Table 3.12: Calculations of stature (in cm) for Mesolithic populations in western Europe

3.3.4.2 Estimation of sex

An indication of sex could be determined for several fragments (see Table 3.13), showing that individuals of both sexes are represented. In phase 1 three fragments were assigned a sex based on osteometric data and six were assigned sex based on morphological characteristics, mostly those of the cranium, resulting in the identification of five male and four female fragments.

All of the sex estimations here are given only as tentative suggestions, as sexing based on metrical and morphological analysis, in the absence of a chronologically comparable control population or a larger series of individuals, are inherently unreliable. The most reliable indicator of sex in the skeleton is the morphology of the pelvic bones (os coxa), unfortunately absent from this assemblage. Whilst cranial morphology is the next best indicator, this is based on robusticity and may be unreliable in such a small assemblage where it is not possible to observe the full range of male-female characteristics.

Phase	Find ID	Fragment ID	Side	Sex	Method of sex estimation
0	1004 (G1)	Whole skeleton	-	Female	Cranial morphology
1	23097	Scapula	R	Female	Metric: Using figures for glenoid length in Dwight 1894 in Bass 1995: 125, 129.
1	23356	Humerus	L	Female	Metric: Based on epicondylar breadth (using Caucasoid regression formulae (France 1983 in Bass 1995: 157, 159)
1	24055	Femur	L	Male	Metric: Based on epicondylar breadth (Pearson 1917-1919 in Bass 1995: 229-230) (C17th London)
1	13022	Cranial	-	Male?	Cranial morphology
1	22639	Cranial	-	Male	Cranial morphology
1	27415	Femur	U	Female?	General size/morphology
1	11978	Clavicle	R	Female?	General size/morphology
1	13883	Mandible	L	Male?	Cranial morphology
1	24337	Cranial	-	Male?	Cranial morphology
2	24038	Cranial	-	Female?	Cranial morphology

Table 3.13: Fragments for which sex could be estimated

3.3.4.3 Estimation of age

The majority of the material (93%, 86/92) could be assigned to a broad age category, such as sub-adult or adult (see Table 3.14). In Phase 1 both adults and sub-adults were represented though the assemblage was dominated by fragments of adult bone. There were two fragments where a more precise age range could be inferred; an un-fused proximal foot phalanx (19632) from an individual less than 16-18 years old, and a developing mandibular molar tooth crown (6530), which would have been un-erupted within the mandible (not recovered) of an individual c. 7 years old (MFH stage 7). The other eight sub-adult fragments were all deciduous ('milk') teeth.

3.3.5 Results of refitting exercise

Unfortunately there were very few fragments that could be refitted with confidence. One positive match was made between the distal portion of a left radius (7881) and a left radial shaft (7875) (as can be seen in Figure 3.5 note the conjoining fracture surface and matching differential preservation). These elements were both found in the area considered as 'Grave 2'. Also the shaft of radius (7881) recovered with the distal left radius above, almost certainly forms a pair with the left radius (7875) (see Figure 3.5).

	Number of fragments				
Age estimation	Phase 0	Phase 1	Phase 1/2	Phase 2	Total
6-11 yrs		1			1
12-17 yrs		1			1
'Sub-adult'		8			8
Total Sub-adult		**10**			**10**
'Probably adult'		13			13
'Adult'	1	58	1	2	62
Total Adult	**1**	**71**	**1**	**2**	**75**
Unobservable		4			4
Total	**1**	**85**	**1**	**2**	**89**

Table 3.14: Fragments by age estimation (including teeth)

The only other relationship that was identified was a tentative match based on size for two elements, a right clavicle (11978) and a right scapula (23097), which were both noticeably small and gracile, and both tentatively sexed as female. In addition both elements had evidence of cut-marks (see below). Although they were both recovered from the marsh deposits they occurred in spatially distinct locations, around 10 m apart and, if they belong to the same individual, represent good evidence for the deliberate disarticulation and scattering of this body. These two pieces are also from different layers within the wetland deposits that are separated by the clay event '28': the scapula (23097), was deposited first (earlier) in clayey peat layer 29, and then the clavicle (11978) was second (later) into the overlying peat layer 26. Although these deposits have very similar dates this demonstrates a temporality to the practices of deposition at the site, where parts of the same body were being deposited into the wetlands at different times.

Figure 3.5: Refitting and paired fragments from finds numbers (7881) and (7875), anterior view. Fragments of a right radius (7881), on the left of the picture, one of which has been refitted to the distal end of the left radius (7875), on the right of the picture.

3.3.6 Minimum number of elements (MNE)

The minimum number of elements represented by the fragments in the assemblage was 64 (see Table 3.17, Table 3.16, Table 3.17, and Table 3.18). As the vast majority (60/64) were from phase 1 of the site's occupation it is mainly those that are discussed in detail here (see Table 3.17). The other three phases are only represented by four elements and are therefore not discussed in terms of skeletal part representation, though these elements and grave 1 (phase 0) will be referred to where relevant.

The elements not represented in the assemblage were the manubrium and sternum, the pelvic bones (os coxa), the cervical and upper thoracic vertebrae and many of bones of the hands and feet. Although the pelvic bones were not represented, the sacrum, anatomically located between them, was present. The ribs also appear to be under-represented. These missing elements do not seem to be a factor of preservation alone as some of them are amongst the most robust in the skeleton. Many of the missing elements do, however, seem to be from the torso, particularly the upper torso. Where a side could be determined, there were a greater number of left elements than right elements.

	MNE			
Element	**left**	**right**	**l/r**	**Total**
Phase 0				
ADULT				
MT2 (foot)	1	0	0	1
Grave 1				-
TOTAL PHASE 0	**1**	**0**	**0**	**1**

Table 3.15 Minimum number of elements by individual element, Phase 0

	MNE			
Element	**left**	**right**	**l/r**	**Total**
Phase 1/2				
ADULT				
humerus	1	0	0	1
TOTAL PHASE 1/2	**1**	**0**	**0**	**1**
Phase 2				
ADULT				
Femur	0	0	1	1
Cranium	0	0	1	1
TOTAL PHASE 2	**0**	**0**	**2**	**2**

Table 3.16 Minimum number of elements by individual element, Phase 1/2 and phase 2

	MNE			
ADULT elements	**left**	**right**	**l/r**	**Total**
Cranium	-	-	4	4
Mandible	1	0	0	1
Clavicle	0	1	0	1
Scapula	1	1	0	2
Humerus	1	0	0	1
Radius	2	1	0	3
Ulna	1	1	0	2
Capitate (wrist)	0	1	0	1
Prox. Hand Phalanx	0	0	1	1
Ribs	1	1	0	2
T1	-	-	1	1
T11	-	-	1	1
T12	-	-	1	1
Thoracic vert.	-	-	3	3
L1	-	-	1	1
L2	-	-	1	1
L3	-	-	1	1
L4	-	-	1	1
L5	-	-	1	1
Sacrum	-	-	1	1
Femur	2	0	2	4
Tibia	1	2	0	3
Fibula	1	0	0	1
Foot: Tarsal	0	0	1	1
Foot: MT1	1	0	0	1
Foot: MT5	1	0	0	1
Foot: MT	0	0	1	1
P. Prox. Phalanx (toe)	1	0	3	4
P. Dist. Phalanx 1 (toe)	0	1	0	1
MxI2/22	1			1
MxM1/26	2			2
MxM2/17		1		1
MxM2/27	2			2
MxM3/28	2			2
MxPM1/24	1			1
MxC/23	1			1
MdM2/37	1			1
Total (adult)	**24**	**10**	**24**	**58**
SUB-ADULT elements				
P. Prox. Phalanx (12-17yrs)	0	0	1	1
MdM2 (Cr) (6-11yrs)	0	0	1	1
Total (sub-adult)	**0**	**0**	**2**	**2**

Table 3.17 Minimum number of elements by individual element, Phase 1

	MNE			
Element	**left**	**right**	**l/r**	**Total**
PHASE 0	1	0	0	1
PHASE 1	24	10	26	60
PHASE 1/2	1	0	0	1
PHASE 2	0	0	2	2
TOTAL MNE, all phases	**26**	**10**	**28**	**64**

Table 3.18 Minimum number of elements by individual element, total for all phases

3.3.6.1 Grave 2

Given that the cluster of disarticulated material on the dune top in phase 1, called 'grave 2', could represent a discrete act of deposition it was necessary to compare the elements within this group with the remainder of the material from phase 1. The elements considered to be part of grave 2 are shown in Table 3.19 (with fragments of the same element combined into a minimum number of elements).

	MNE			
Element	left	right	l/r	Total
ADULT				
Scapula	1	0	0	1
Radius	1	1	0	2
Ulna	0	1	0	1
Ribs	0	1	0	1
T11	-	-	1	1
T12	-	-	1	1
Thoracic vert.	-	-	2	2
L1	-	-	1	1
L2	-	-	1	1
L3	-	-	1	1
L4	-	-	1	1
L5	-	-	1	1
Sacral vert.	-	-	4	4
Tibia	0	1	0	1
Fibula	1	0	0	1
Total grave 2 (all adult)	3	4	13	20

Table 3.19: MNE in Grave 2 (phase 1)

Grave 2 was lacking in cranial elements (and did not contain any teeth, which may have indicated the presence of a skull at some point) and, aside from a left scapula (shoulder blade) and rib, was represented mainly by elements from the level of the lower arm and below, that is the lower thoracic, lumbar and sacral vertebra, and elements from the lower limb. These were all from an adult and there were no repeating elements. The two radii could be a matching pair from the same person. The body was also semi-articulated, as indicated by a sequence of lower thoracic, lumbar and sacral vertebrae (T11-S4) which appear to articulate. The biggest difference between grave 2 and the phase 1 assemblage was that, apart from two fragments of thoracic vertebrae, all of the vertebrae and the majority of the ribs and scapulae derive from grave 2.

3.3.6.2 Representation of the sexes

The majority of the material could not be assigned to a sex but the following table (Table 3.20) shows those elements for which sex could be determined.

Element	**MNE (total)**	**Male**	**Male?**	**Female**	**Female?**	**Unsexed**
Cranium	4	3				1
Mandible	1		1			
Clavicle	1				1	
Scapula	2			1		1
Humerus	1			1		
Radius	3					3
Ulna	2					2
Hand	2					2
Ribs	2					2
Thoracic vert	6					6
Lumbar vert	5					5
Sacrum	1					1
Femur	4	1			1	2
Tibia	3					3
Fibula	1					1
Feet	9					9
Total	47	4	1	2	2	38

Table 3.20 MNE, Phase 1: Adult elements by sex (excluding teeth)

Where an estimate of sex could be made this was often based on measurements that could be compared to metrical data from the osteological literature, principally differences in the robusticity of male and female skeletons, and are not as reliable as those based on the morphological characteristics of the pelvis and cranium. The low number of sexed individuals is due to the fact that sex was assigned to individual elements not whole skeletons. Both sexes were represented in low but comparable proportions; five elements were sexed as male or possibly male and four elements were sexed as female or possibly female. None of the elements from grave 2 could be sexed. Unfortunately the frequency of sexed elements is too low for statistically significant comparisons between them.

3.3.7 Minimum Number of Individuals

The minimum number of individuals was calculated for each phase from the number of repeating elements (using the MNE data), considering side, age and sex of the element. This showed that a minimum of three females, three males, two sub-adults (aged 6-11 yrs and 12-17 years) and three other adults (for whom sex could not be assigned) were represented at the site, a total of 11 individuals (see Table 3.21). In phase 0 two individuals were represented; one female from Grave 1, and a second adult individual represented by the metatarsal (foot) bone. In phase 1 a minimum of seven individuals were represented; one adult, of unknown sex in grave 2, and at least three males, one female and two sub-adults represented by the rest of the assemblage. This MNI differs to that published by Smits and Louwe Kooijmans who argued that the remains in Grave 2 represented two individuals based on the presence of two repeating elements (two left radii). One of these (radius 7881) is, however, from the right side which means that there are no repeating elements and reduces the MNI of Grave 2 to one person. In phase 1/2 just one adult of unknown sex was represented and in phase 2, a minimum of one adult, possibly a female, was represented.

Phase	Female	Male	Sub-adult	Unknown	Total
0	1 (Gr. 1)			1 (not from Gr.1)	2
1	1	3	2	1 (Gr. 2)	7
1/2				1	1
2	1				1
Total	3	3	2	3	11

Table 3.21: Minimum number of individuals (MNI) by phase

3.3.8 Skeletal part representation (BRI)

To account for the fact that some elements of the skeleton are more numerous than others the bone representation index was calculated (BRI) (Table 3.22 and Figure 3.6). The MNE was expressed as a percentage of the number of each element expected for the number of individuals represented.

Element	N Expected per person	N Expected for Phase 1 (MNI=6)	**N recovered Phase 1**	**% of expected**
Cranium	1	6	**4**	**66.7**
Mandible	1	6	**1**	**16.7**
Hyoid	1	6	**0**	**0.0**
Clavicle	2	12	**1**	**8.3**
Manubrium	1	6	**0**	**0.0**
Sternum	1	6	**0**	**0.0**
Scapula	2	12	**2**	**16.7**
Humerus	2	12	**1**	**8.3**
Radius	2	12	**3**	**25.0**
Ulna	2	12	**2**	**16.7**
Carpals	16	96	**1**	**1.0**
Metacarpals	10	60	**0**	**0.0**
Hand phalanges	28	168	**1**	**0.6**
Ribs	24	144	**2**	**1.4**
Cervical vert	7	42	**0**	**0.0**
Thoracic vert	12	72	**6**	**8.3**
Lumbar vert	5	30	**5**	**16.7**
Sacrum	1	6	**1**	**16.7**
Os coxa	2	12	**0**	**0.0**
Femur	2	12	**4**	**33.3**
Patella	2	12	**0**	**0.0**
Tibia	2	12	**3**	**25.0**
Fibula	2	12	**1**	**8.3**
Tarsals	14	84	**1**	**1.2**
Metatarsals	10	60	**3**	**5.0**
Foot phalanges	28	168	**6**	**3.6**
Teeth	52	312	**12**	**3.8**
Total	232	**1392**	**60**	**4.3**

Table 3.22 BRI Hardinxveld, phase 1

In total, only c. 4% of the expected elements for an MNI of six individuals were recovered. The cranium was the most frequently represented element, and the only element for which more than 50% of the expected frequency occurred. The majority of other elements were poorly represented, only the femur and the cranium, were represented by more than 30% of the expected number.

The main elements represented were those of the head, the upper limbs and the lower limbs. In other words, elements from the mid-line of the body; the hyoid, manubrio-sternum, vertebrae, sacrum and pelvis, were almost completely absent. Only a single rib and two thoracic vertebrae (and only a few (unidentified) axial fragments) were recovered from phase 1, the remaining vertebrae and sacrum all derived from 'grave 2' (highlighted on figure 3.6).

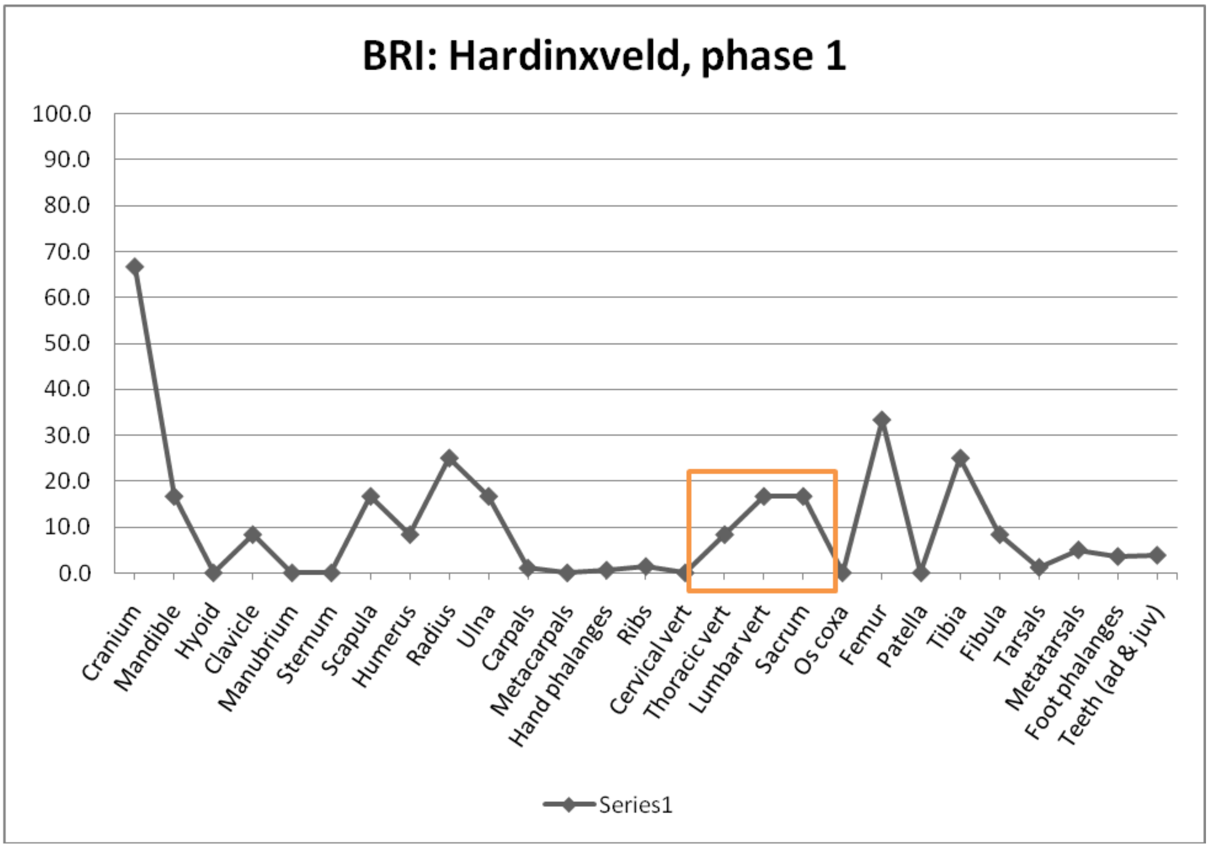

Figure 3.6 BRI for Hardinxveld, phase 1 (elements deriving from grave 2 are outlined)

Despite the presence of some upper limb bones the hand bones were also virtually absent (only two hand bones were recovered). The lower limb was mainly represented by the upper leg (femur) and the patellae were completely absent. The feet were also very under-represented, but the phalanges and metatarsals were better represented than the tarsals, and overall, feet were better represented than hands. Particularly unusual was the relative under-representation of the mandible compared to the cranium, perhaps indicating that these bones were deliberately removed, retained or lost. The tibia was also under-represented compared to the femur.

We can compare the representation of elements in phase 1 with the representation of elements from the inhumation at the site, grave 1 (see Figure 3.7). It is clear that whilst the preservation of the hyoid, manubrio-sternum, patellae, and possibly the vertebrae, may be relatively poor at the site as a whole, the low numbers of surviving limb bones and pelves are unusual.

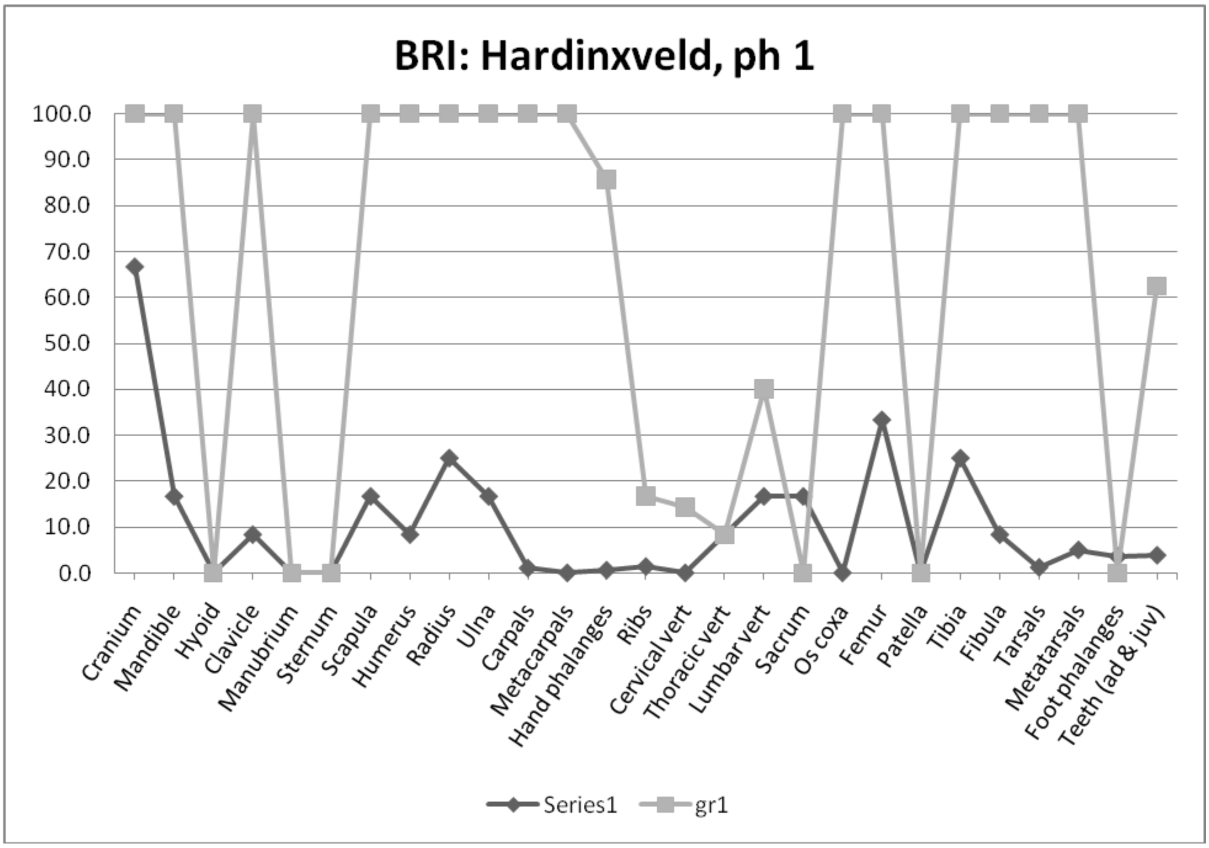

Figure 3.7 BRI : Comparison with whole body inhumation grave 1

We can also compare the representation of elements at Hardinxveld with that expected to result from the "common pattern of preservation [of the skeleton]... characterised by higher frequencies for more robust and dense bones and lower frequencies for smaller and more cancellous elements" (Bello and Andrews, 2006: 9) (see Figure 3.8). 'Grave 2' is shown separately to the elements in phase 1 and a smaller selection of elements are compared. Whilst phase 1 shows a similar relative trend to that intrinsic to the skeleton, a number of elements still show unusually low representation. There are relatively fewer mandibles than would be expected, fewer humeri, fewer sacra and fewer os coxae, as these robust elements should be relatively well-preserved. An under-representation of the tibiae (especially relative to the femur) is also not a characteristic of preservation.

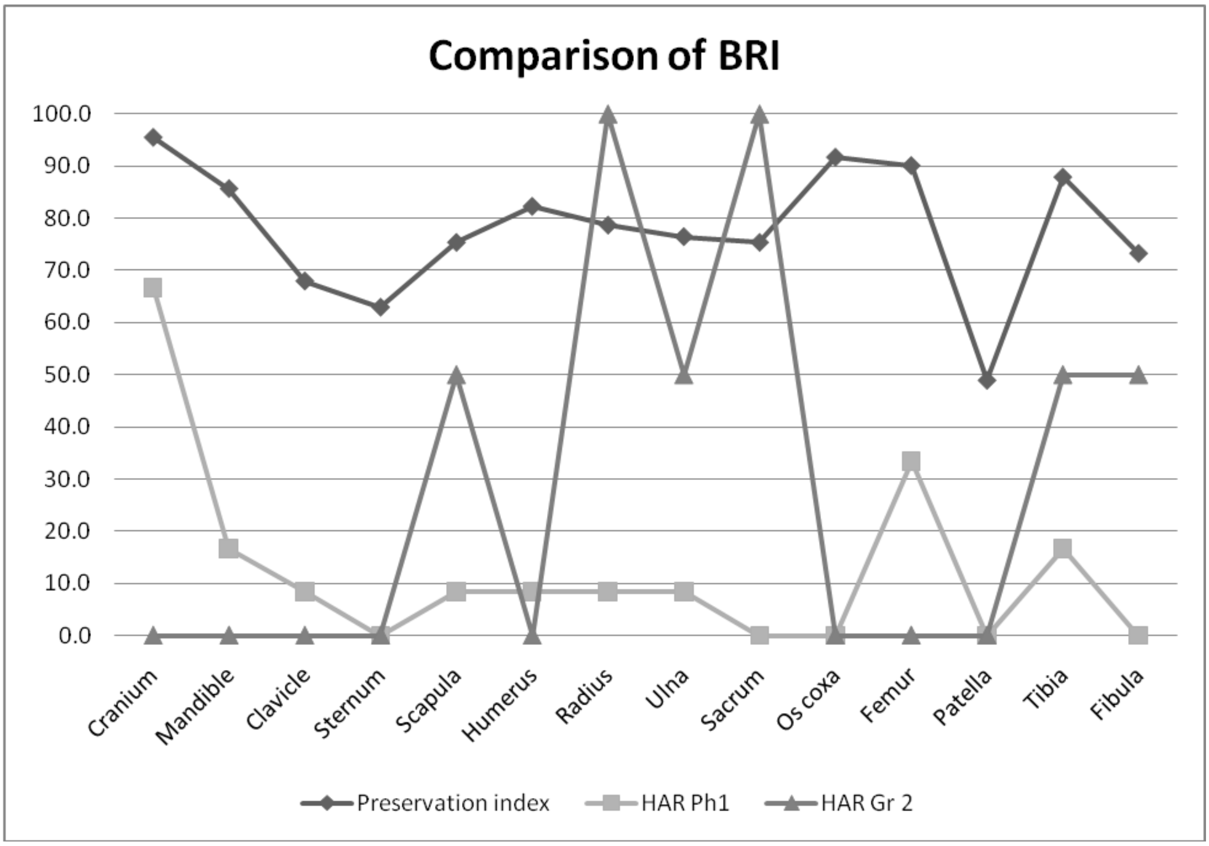

Figure 3.8 BRI at Hardinxveld compared to intrinsic preservation (N.B. the elements compared reflects the smaller list provided by Bello and Andrews (2006)).

3.3.9 Body modification and processing

Several fragments in the assemblage showed evidence for modification in the form of cut marks, areas of burning, and ‘dry’ fractures indicating that the bones were deliberately broken when (semi-)fresh (see Table 3.23). The modified fragments were all from adult individuals and the majority of the material was from phase 1, however, the only bone recovered from phase 1/2, a left humerus (24850), was also possibly fractured when relatively fresh. Of the total assemblage in phase 1, 20% (10/50 fragments), showed at least one type of modification (see Table 3.24). Elements with cut marks were the most frequent, observed on 12% (6/50) of the assemblage, and burning and fresh fractures were only slightly less frequent, affecting 6% (3/50) and 8% (4/50) of fragments respectively. In some cases a single fragment showed evidence for a combination of modifications. Cut marks and fresh fractures occurred together most frequently (on four fragments; two femurs, a radius and clavicle) and in one case, a cranium (10297), cut marks and burning occurred together. The most frequently modified element was the femur (three separate, non-refitting, fragments affected), and where the sex of the individual could be inferred it was most often a probable female.

Find Number	**Fragment ID**	**Age**	**Sex**	**Phase**	**Cut-marks**	**Burning**	**'Dry' fractures**
24055	Femur	Adult	Male	1	Yes?	-	Yes
27415	Femur	Adult?	Female?	1	Yes?	-	Yes
10297	Cranial	Adult	U	1	Yes	Carbonised	-
11978	Clavicle	Adult	Female?	1	Yes	-	Yes?
23097	Scapula	Adult	Female	1	Yes	-	-
27385	Radius	Adult?	U	1	Yes	-	Yes
6655	Femur	Adult?	U	1	Unobs.	-	Yes?
7752 (Gr. 2?)	Rib (frags)	Adult	U	1	-	Scorched/ carbonised	-
23356	Humerus	Adult	Female	1	-	Carbonised	-
13883	Mandible	Adult	Male?	1	-	-	Yes?
24850	Humerus	Adult	U	1/2	-	-	Yes

Table 3.23: Fragments with evidence for modification (all phases)

Phase 1: Modifications	**N**	**% of total fragments** (excl. teeth)
Cut marks	6	12
Burning	3	6
'Dry' fractures	4	8
Total modified	**10***	**20**

Table 3.24: Number of fragments with each type of modification in Phase 1. *Several fragments have more than one form of modification.

3.3.9.1 Cut marks

Several elements from the cranium, shoulder, and both upper and lower limbs of an adult or adults displayed fine cut marks which appear to indicate the processing of fleshed bodies (see Table 3.25 and Figure 3.9 and Figure 3.10). Cut marks on the crania and clavicle seem to be focused on the removal of the head from the adjacent vertebrae and clavicle. Those on the scapula seem to be related to the disarticulation/removal of the arm and light cut marks along the shafts of the two femora and a radius, are consistent with the removal of the muscle/flesh from the upper leg and lower arm in order to separate the limbs at the knee and the elbow. Elements from both sexes had been treated in this way, though there were more female than male elements. However, we must consider the fact that some of these elements may be from the same individual (as has been suggested for the scapula and clavicle, for example), in which case at least one male and one female showed evidence of cut marks.

Find no.	**Element**	**Location of cut marks**	**Purpose/function**
10297 *b	Cranium	Left parietal, left occipital	Removal of *m. epicranius*, and scalp. Severing of *m. sternocleidomastoideus/splenius capitis/occipitalis* and *m.rectus capitis posterior major* (?), and *semispinalis capitis* (?).
11978 *f	R. clavicle	Anterior aspect of lateral diaphysis (acromial end)	Severing of *m. deltoideus* - removal of the arm from shoulder.
23097	R. scapula	Anterior aspect - lateral border of subscapular fossa. Posterior aspect - infraspinous fossa and inferior aspect of scapular spine.	Severing of the ‘rotator cuff’ muscles – removing the arm from the shoulder; Posterior aspect – *supraspinatus*, *infraspinatus* and possibly *deltoideus*? Anterior aspect – *subscapularis.*
27385 *f	L. radius	Scratches on postero-lateral border of proximal 1/3rd of diaphysis	Removal of *m. supinator*
24055 *f	L. femur	Postero-lateral aspect of distal 1/3rd of diaphysis	Origin of the short head of *biceps femoris*/ popliteal surface?
27415 *f	Femur? / humerus?	Posterior aspect of mid diaphysis (linea aspera?)	Removal of the adductor or *vastus* muscles

Table 3.25: Location of cut marks (phase 1) (*f = also dry fractured, *b = also burnt)

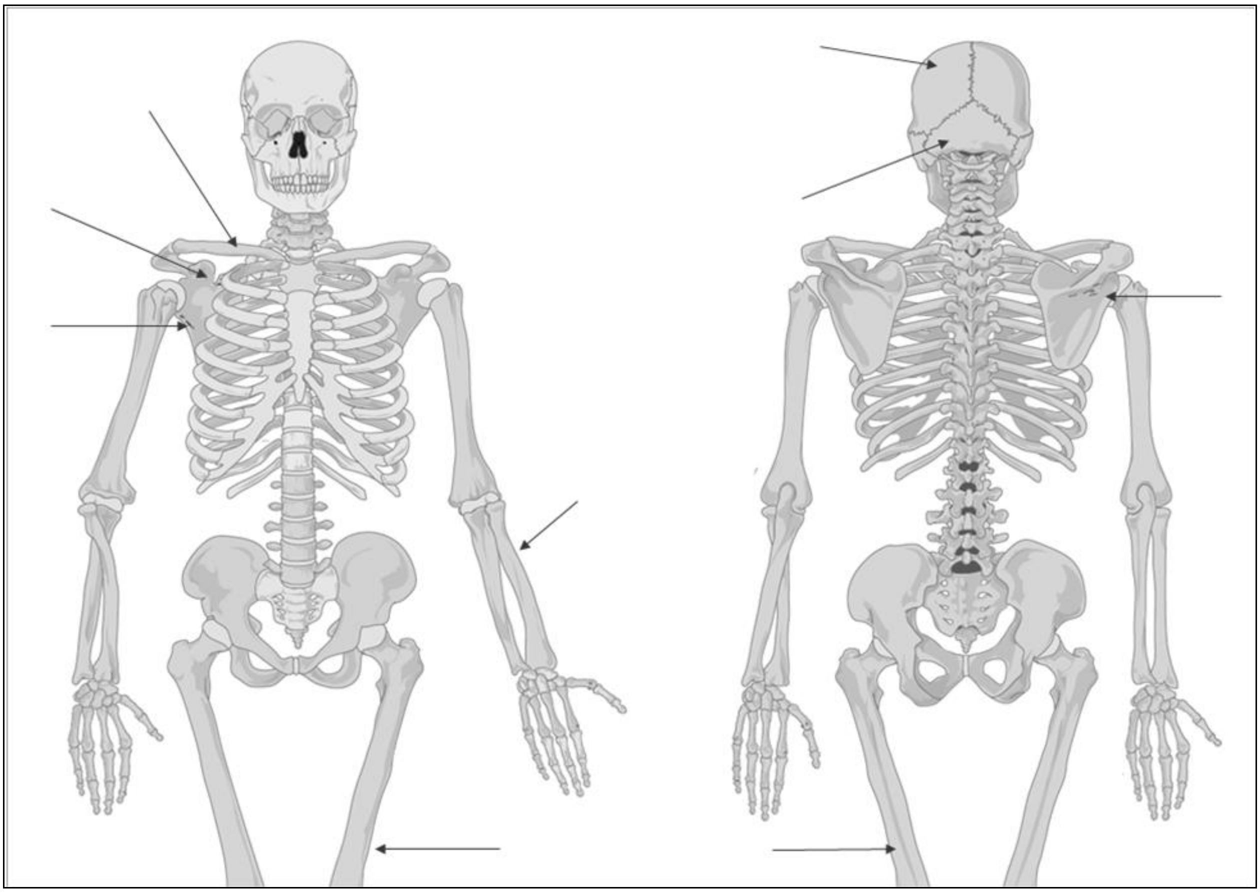

Figure 3.9: Distribution of cut marks on the skeleton (pooled data)

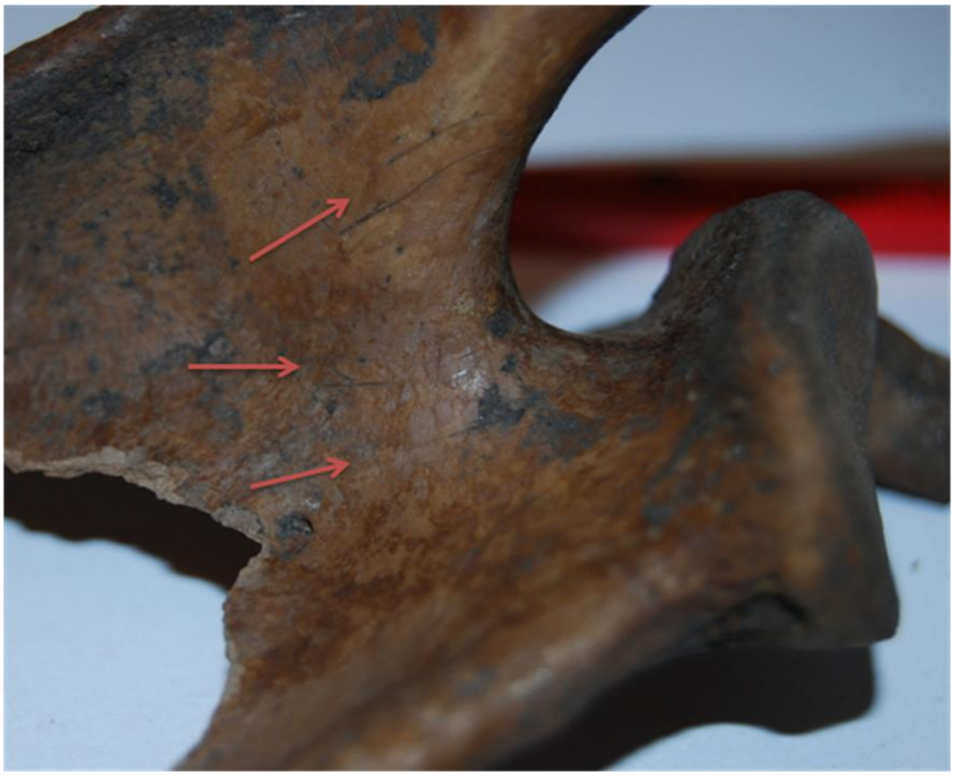

Figure 3.10: Detail of cut marks observed on a right scapula (23097)

3.3.9.2 Burning

In the assemblage three fragments (or groups of fragments) showed evidence for having been burned; a partial cranium (also cut marked, see above), some fragments of rib/s and a humerus (see Table 3.26 and distribution diagram Figure 3.11). The burning seen on the bones was not uniform but occurred in discrete patches. When present the bones had been scorched or carbonised, but the burning did not penetrate far below the surface of the bone. This degree of burning indicates prolonged contact with fire/heat but not at the high temperatures usually associated with cremation. Burning of the cranium (10297) (as shown in

Figure 3.12) could be indicative of de-fleshing, as it has been suggested that it could aid with the removal of the skin (J. McKinley pers. comm.). There is also the possibility that this is consistent with the cooking/roasting of fleshed joints, as has been observed in animal bone assemblages. The patchy nature and degree of charring (superficially scorched or carbonised) are consistent with the bone being partly protected from the fire/heat by a covering of flesh or possibly another material. It may also be possible that the charring occurred after deposition of the element, if it was present on occupation surfaces where hearths were subsequently located. Whether burning of fresh/fleshed bone can be differentiated from this latter circumstance is a question that requires further research.

Find ID	**Sex**	**Fragment ID**	**Location of burning**	**Degree of burning**
10297*c	Unsexed	Cranium	Localised patches of the left temporal, parietal and occipital bones	Carbonised
7752 (Gr. 2?)	Unsexed	Rib (frags)	Rib shafts	Scorched or carbonised
23356	Female	L. humerus	Lateral protuberances; deltoid tuberosity and lateral epicondyle	Carbonised

Table 3.26: Fragments with traces of burning (all adult, phase 1)

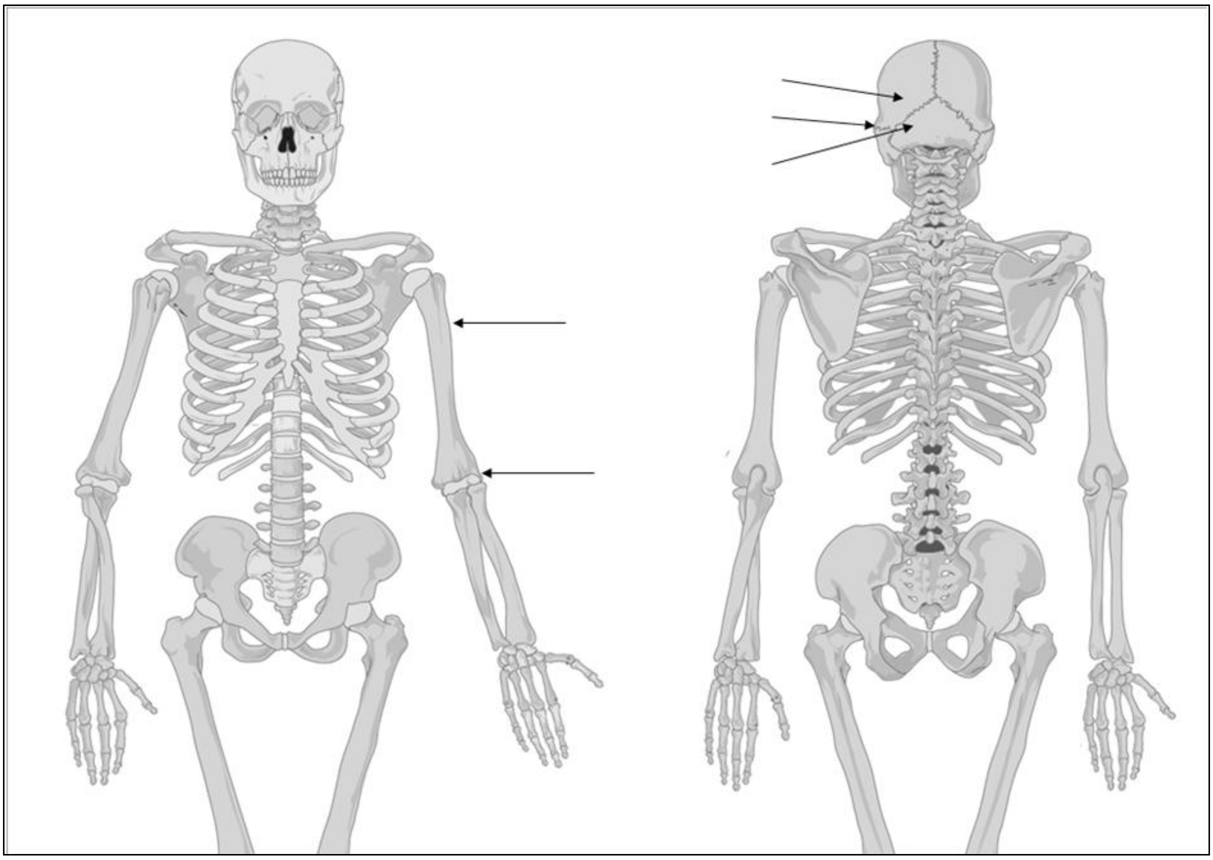

Figure 3.11 Distribution of burning (pooled data).

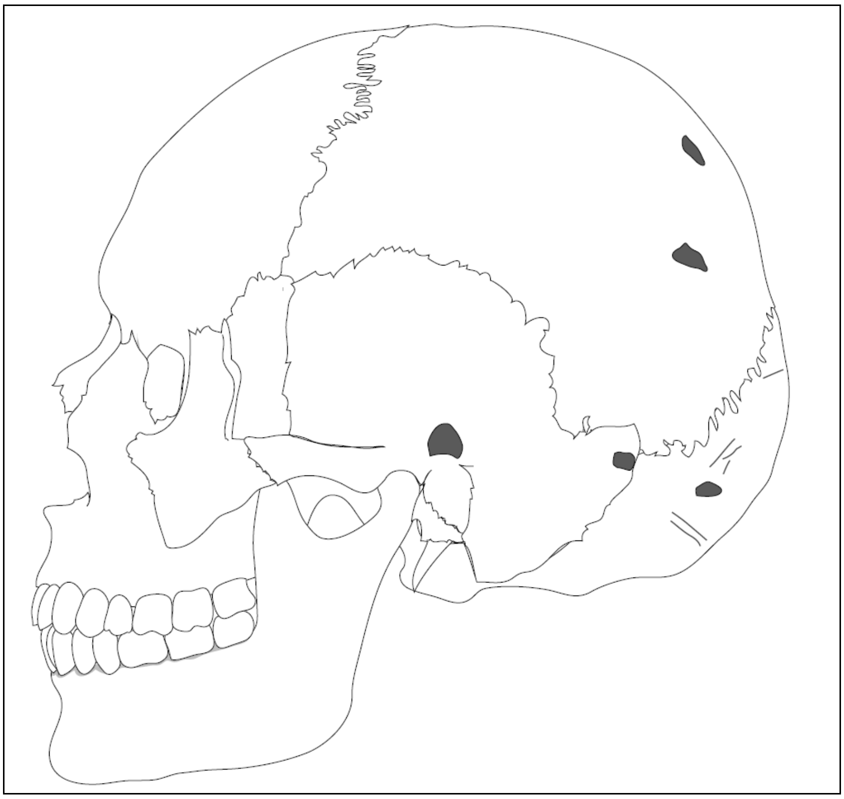

Figure 3.12 Patches of burning (carbonised) (shading) and cut marks (lines) on the left side of cranium (10297).

3.3.9.3 'Dry' fractures

This analysis revealed several examples of deliberate fracturing of semi-fresh bones, particularly the long bones and femur (see Table 3.27, Figure 3.13 and Figure 3.14). In animal bone assemblages the fracturing of elements is often for the purpose of marrow extraction. In this case, however, the bones were semi-dry and would not have been fractured for this reason. No 'dry' fractures were observed on unidentified fragments. Instead, fracture-type consisted of post-excavation breaks (fresh white edges) and post-depositional dry-bone breaks. Interestingly none of the fractured bone fragments refit, suggesting that either the other part of the bone was removed (either to an unexcavated part of the site or elsewhere in the landscape) or that that the bone was broken off-site and only the fragment was brought onto the site.

Find number	**Phase**	**Sex**	**Fragment ID**	**Location of fracture**
11978*c	1	Female?	Clavicle	Mid-distal 1/3rd diaphysis
27415*c	1	Female?	?Femur	Midshaft?
24055*c	1	Male	Femur	Mid-distal 1/3rd diaphysis
6655	1	U	Femur	Midshaft?
27385*c	1	U	Radius	Proximal and midshaft
? 13883	1	Male?	Mandible	Possible fracture of midline and neck of tempero-mandibular condyle?
? 24850	1/2	U	Humerus	Possible fracture of distal diaphysis / epiphysis

Table 3.27: Elements with 'dry' fractures (all adult)

Figure 3.13 Examples of ‘dry’ fractures, a comparison of femur shaft (24055) (top) and femur (6655) (bottom) (note the colour and angle of the fracture surface of (24055) and the difference in preservation). The flaking of the surface of the femur (24055) (top) is post-depositional.

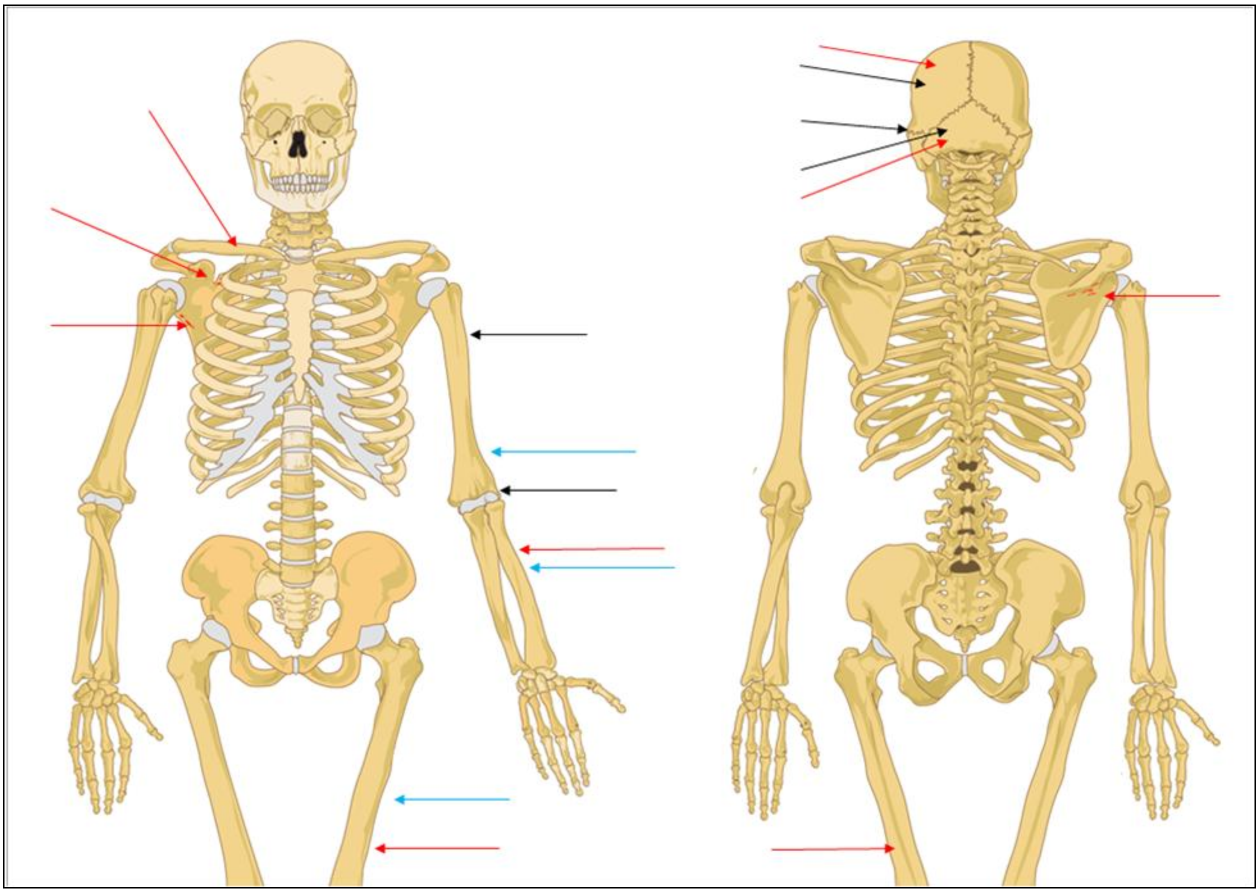

Figure 3.14: Skeletal distribution of ‘dry’ fractures (blue), burning (black), and cut marks (red).

3.3.9.4 Other modifications

No other modifications, including those associated with animal activities were observed. The lack of evidence for canid gnawing on the bones is surprising given the apparent frequency of dogs on the site (represented by three burials and a large quantity of scattered elements). This would suggest that whilst some material lay exposed on the surface, dogs and other scavenging animals were kept away from it.

3.3.9.5 Spatial distribution of the modified material

The spatial distribution (horizontal) of the modified fragments in phase 1 can be seen in Figure 3.15. The modified material does appear to be concentrated in the marsh deposits (eight fragments), as opposed to deposited on the dune top (two fragments). An examination of the type of modification reveals an even stronger association, as all of the fragments with cut marks are deposited in the wetlands. Of the two modified fragments on the dune top, one (a 'dry' fractured femur (6655)) was so heavily eroded/abraded that it was impossible to see any surface detail and the other is a collection of very small fragments of rib (7752), some of which are scorched.

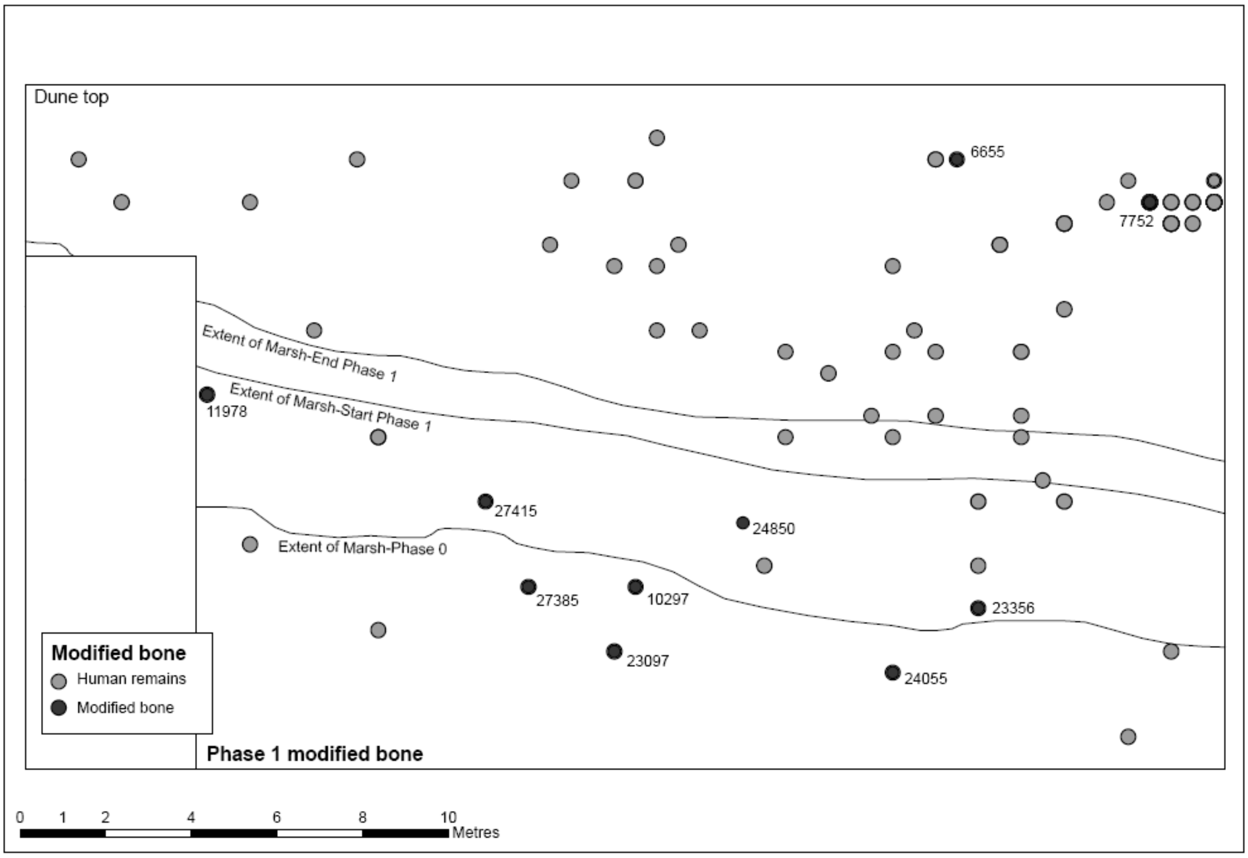

Figure 3.15: Spatial distribution of modified human bone in phase 1

It is possible that this pattern reflects differences in surface preservation as the material in the marsh deposits was generally better preserved than that on the dune top. This would make it harder to identify cut marks on the skeletal material from the top of the dune making them appear more common within the wetland assemblage. However, whilst preservation is more variable there *are* a large number of well preserved fragments on the dune top and if cut marks were more common then we may expect to see them better represented within this part of the assemblage. Therefore there could be a genuine relationship between the marsh and the persons, or parts of persons/bodies, that had been deliberately disarticulated and/or deliberately defleshed, or with the actions associated with these practices, resulting in the deposition of cut-marked material here. At wetland sites across Mesolithic Europe animal bones are preferentially found in waterlogged areas. Though preservational factors are undoubtedly a factor, these areas are generally interpreted as off-site refuse areas (e.g. Street 1991) or alternatively, less frequently, as areas of formal deposition (e.g. Conneller 2004). The discovery of cut-marked human bones in similar locations may be significant, perhaps furthering the connection of human and animal bones (even interpretations of cannibalism), or alternatively suggesting formal depositional practices focused on water.

3.4 Discussion

Given the very low quantities of skeletal material from the later phases at the site this discussion will focus on the assemblage from phase 1. The re-analysis of the assemblage of human remains from Polderweg has been successful in identifying the particulars of the 'complex body treatment' recognised at the site. It has revealed new evidence for the treatment of the dead body (identifying more cut marks, and new evidence for burning and fracturing of bones), explored the depositional context of the skeletal material (not previously addressed in detail) and examined the presence and absence of particular body parts in a more comprehensive manner.

The most abundant elements in the assemblage were the cranium and femur, and of the remaining elements the radius and tibia were the only other parts of the body where more than 20% of those expected were present. The mandible, clavicle, scapula, bones of the upper limbs, the fibula and the feet were all present but very under-represented and very few hand bones and vertebrae were recovered. The number of teeth present was also very low, and mostly derived from the maxillary dentition, reflecting the presence of the crania and the relative under-representation of mandibles. The representation of elements recovered from Grave 2 does seem to contrast with the scattered assemblage, although there is some overlap in the elements represented. Whilst the scapula, radius and ulna, thoracic vertebra, femur, and tibia are present in both assemblages, the lower torso (lumbar and sacral vertebrae) and the fibula are only represented in grave 2, whilst the hands, feet, femur, humerus, clavicle, mandible and cranium are *only* present in the scattered assemblage.

The representation of remains at Hardinxveld does not appear to be the result of variable bone preservation alone. The *os coxae,* which is normally well-represented due to its high density is entirely absent from the scattered assemblage whilst the thoracic vertebrae, which survive less well, are present, albeit in very low quantities. The hand and foot bones were both very poorly represented, though those of the foot were better represented than the hand, the opposite of what might be expected as a result of preservation alone. That fact that part representation is not a result of preservation alone is supported by the analysis of the BRI of the inhumed skeleton which, as there is no evidence for the removal of elements from this grave, should reflect the effects of preservation at the site. As such the presence of the pelvis, albeit in a fragmentary state, cervical and lumbar vertebrae, and bones of the hands and feet in the grave suggests that these elements should be better represented in the scattered assemblage if preservation alone was responsible for the presence or absence of particular elements.

Instead the pattern of skeletal elements may be due, in part, to the ways the bodies were treated during mortuary practice. To begin with, the under-representation of the bones of the hands and feet suggests that the fleshed bodies were exposed for some time as the corpse began to decompose. These small bones quickly become detached from the corpse whilst their small size can make them harder to recover if the body parts are collected for secondary burial. The relative absence of these bones from the site suggests that exposure took place at another location and that body parts were subsequently brought onto the dune top. The higher number of foot bones may simply be a chance occurrence but it is feasible that this could be an effect of some form of footwear remaining on the body, which kept the bones together. The higher frequency of long bones and crania indicates that these parts of the body were actively selected and brought to the dune top whilst the under-representation, or in some cases complete absence, of the bones of the torso suggest that these elements either remained at the exposure site or were taken elsewhere. The lower number of mandibles relative to crania suggests that the jaw bones were also left at the exposure site or deposited at another location. Although the exposure of the body took place off-site it may not have been very far away and may even have taken place on another part of the dune top. The concentration of skeletal material representing Grave 2 contains many of the elements that are poorly represented or absent from the rest of the assemblage. As such it may reflect what was left after the body had been exposed and the long bones and skull removed for processing. Similarly the scatter of very poorly represented skeletal elements may also have derived from corpses that had been exposed in the nearby area.

Although the bodies were partially decomposed by the time elements were removed (as shown by the lack of hand and foot bones) the presence of cut marks show that they were not totally skeletonised. In several cases the muscles keeping the long bones and skull attached to the body were cut, leaving small marks on the surrounding bone, and in others the flesh was cut or scraped off. Burning may also have been used to remove skin and hair from the skull. These activities may have occurred at the exposure site, allowing the elements to be removed from the corpse, or at the dune, where elements were cleaned of any adhering flesh or a combination of the two. During these practices of removal and processing some elements were broken, resulting in the 'dry' fractures recorded on several of the bones. This may have occurred accidentally, as the bone was separated from the body, or intentionally as a form of mortuary treatment. This is unlikely to include cannibalism, however, as the fractures occurred once the bone had already become 'semi-dry', making it an unsuitable source of marrow. Finally, once the elements had been removed from the body, de-fleshed and, in some cases, fragmented, some of the bones were selected and removed from the site. In several cases bones were broken or fragmented but only part of the element was taken away, with the remainder deposited at the site. This resulted in the lack of refitting elements that had evidence for 'dry' fractures. The material that remained at the site was either deposited on the dune top, sometimes in concentrations or discrete scatters, or in the surrounding wetland deposit. Given the high frequency of dog remains, and those of other animals, on the site, it is surprising that the human remains do not show any evidence for modification by animal agents. Since there is also evidence that some of the human material lay exposed on the surface for a period of time, this implies that animals (such as canids and rodents) were deliberately kept away from the material.

These forms of treatment applied to both males and females and people of different ages. Although there was very little evidence for the deliberate disarticulation of sub-adults, they were relatively under-represented at the site as a whole. However, not everyone was treated in this way. In particular the adult female in Grave 1 was buried and left undisturbed, the processes of decomposition, decay and skeletonisation occurring without any engagement with other people. The context of deposition may also have differed between people. An assessment of the preservation of the human remains combined with an analysis of their context of deposition revealed differences in depositional practices. Some elements deposited on the donk top had been subject to weathering, due to exposure on the surface and a slow rate of burial. There was also deliberate deposition of remains into the wetland deposits around the donk and, in particular, modified bones, especially those with cut-marks, were primarily deposited in the adjacent marsh contexts. Whilst this demonstrates an association between these elements and these contexts, it may be an indicator that these types of practices were carried out in the wetlands surrounding the site. Interestingly whilst humans were treated in broadly similar ways their mortuary treatment also has parallels with that of dogs. Dogs were both subject to inhumation as complete individuals and to disarticulation, either deposited as a cluster of elements (analogous to the human grave 2) or scattered across the donk top and marsh deposits.

4 Case study 2: Analysis of human remains from 'Petit Marais', Le Chaussée Tirancourt (Somme, France)

4.1 Introduction

In order to investigate the treatment of bodies from differing contexts of deposition this osteological case study focuses on the secondary burial from 'Petit Marais', Le Chaussée-Tirancourt (Somme, France) (48). Petit Marais is a site situated on the flood plain of the river Somme. Mesolithic occupation consisted of thousands of lithics and animal bone remains, and five pits, varying in date from early to late Mesolithic (Ducrocq and Ketterer, 1995). Human remains were recovered from two of these pits, one of which contained the cremated remains of several individuals (Pit/Fosse 1) and the other the secondary burial of an adult male, whose disarticulated remains had been carefully arranged within the pit (Pit/Fosse 4). A small amount of human bone was also recovered from the later Mesolithic layers. Although the individual in fosse 4 was disarticulated, there was no evidence for defleshing or disarticulation of the fleshed body, such as cut marks, though several bones of the lower arm and lower leg had been fractured whilst the bones were still relatively fresh. The bones were heavily root-etched and there was also some evidence for the presence of canids/canid access to the remains, in the form of a puncture mark on a lower arm bone. The remainder of the pits contained deposits of lithics, animal bone, and charcoal (*ibid.*), and the authors suggest they may have formed part of funerary rituals. Disarticulated human remains dating to the Neolithic were also recovered from the same site.

4.2 Site background

4.2.1 Circumstances of excavation

The site is located along the edge of the alluvial plain of the River Somme, near the confluence of the Somme valley and the River Acon. It was discovered in 1988 during the construction of a leisure park and was partly disturbed by terracing before rescue excavations over an area of *c*. 150m^2 were carried out during the latter half of 1990. The results of the excavations were presented in the *Bulletin de la Société Préhistorique Française* (Ducrocq and Ketterer, 1995) with five further papers dealing specifically with the secondary burial, (Ducrocq *et al.*, 1996, and Valentin and Le Goff, 1998), the cremated remains, (Le Goff, 2000), and the morphological characteristics of the skeleton compared to the French, and wider European, Epipalaeolithic and Mesolithic populations (Valentin, 1995, Valentin *et al.*, 1999).

4.2.2 Archaeological context

The stratigraphic sequence at the site consisted of Pleistocene loess, overlain by organic silts of alluvial origin (layer III) which formed during the early and middle Mesolithic (Boreal) (Ducrocq *et al.*, 1996: 211). These are sealed by late Mesolithic (Atlantic) peat, the base of which dated to 5969-5667 cal BC (6900 ± 60 BP, Gif-9619) (*ibid.*). The sequence ends in a diffuse layer (layer II) derived from the silting up of a palaeochannel and within this were about thirty human bones dated to the Neolithic (4515-4245 cal BC (5530 ± 70BP, Gifa-9238). For a schematic representation of this sequence see Figure 4.1, below.

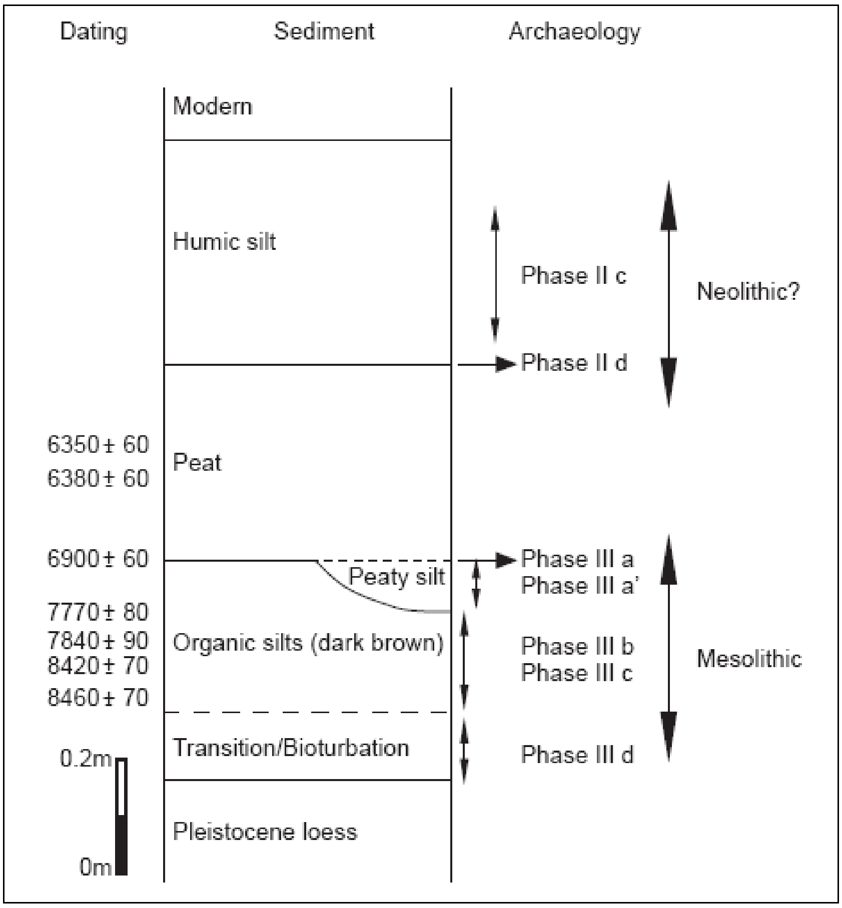

Figure 4.1 Schematic representation of the site stratigraphy (after Ducrocq and Ketterer, 1995: fig. 4).

The Mesolithic archaeology appears to form a number of distinct horizons within the organic silts[6]. The lowest of these (IIId) contained a low density of patinated lithics. Further up in the silt sequence (IIIb/c) was the primary Mesolithic assemblage dating to 7589-7333 cal BC (8420 ± 70 BP) and 6908-6442 cal BC (7770 ± 80 BP) (Gif-9330-9331) based on charred hazelnuts from two different areas. Overlying this, but confined to the

[6] *It should be noted that the archaeological remains are not necessarily directly above each other.*

east and south-east area of the excavation, was a more peaty-silt (lbt, 'III a') also containing Mesolithic artefacts. Finally in the sequence, above the silts (lbs) and peaty-silt (lbt), was an assemblage of animal bones situated on the interface between the silt and peat (IIIa). Fragments of human cranium, recovered from a disturbed area in the north-west of the excavation area (marked as 'A' on Figure 4.2), could perhaps be associated with these later (Mesolithic) levels (i.e. level IIIa).

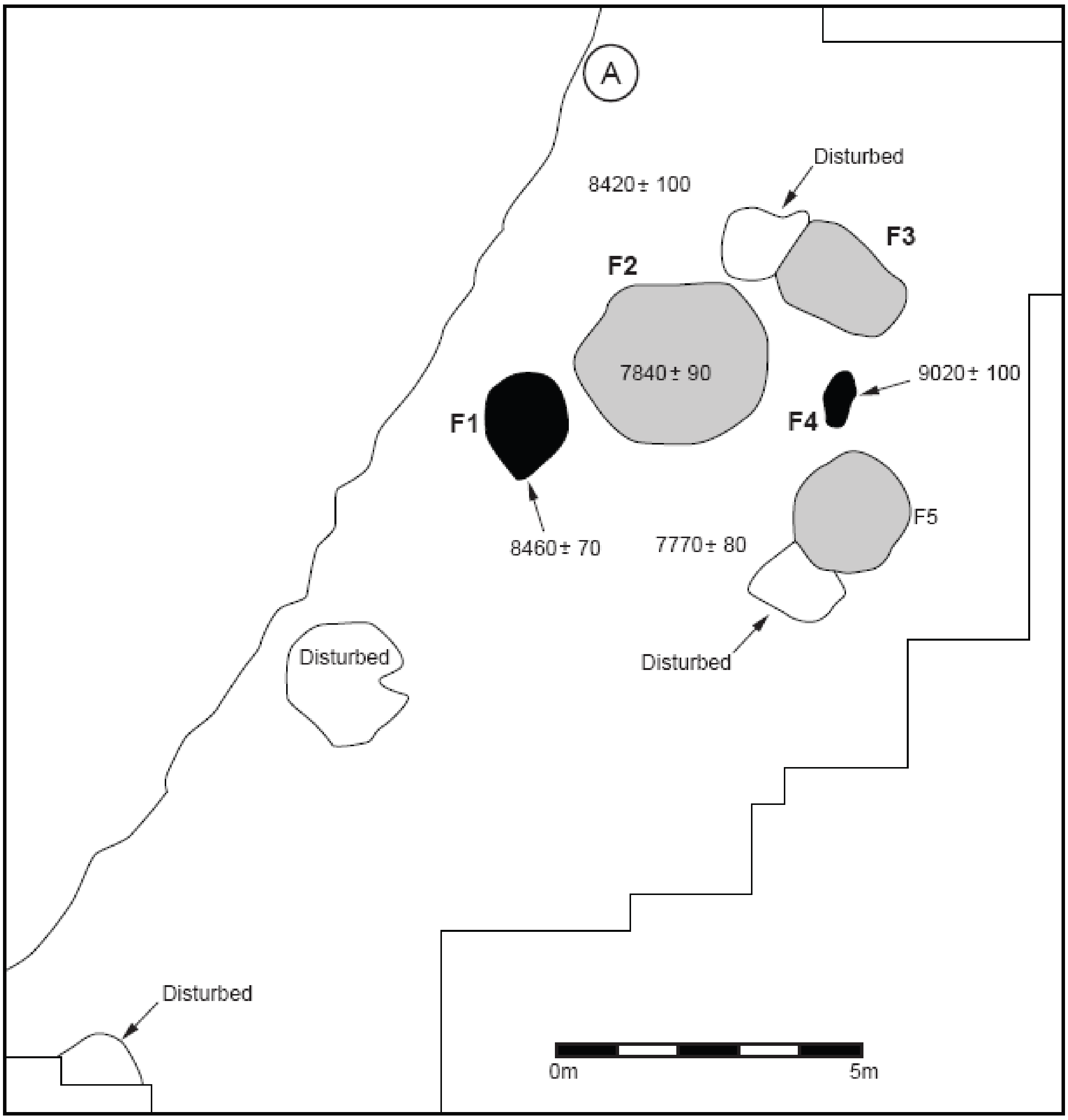

Figure 4.2 Plan of the site showing the location of the five pits (F1-F5) and the location (A) of several fragments of human cranium, after Ducrocq *et al.* (1996). Dates gained from the layers and pits are shown in un-cal BP.

Five pits within an area of around 56 square metres were discovered at the site, but they were only visible at the interface between the organic silts (IIId) and the underlying Pleistocene loess. The excavators suspect that the original level from which they were cut has been obscured by bioturbation of the silts and that, based on similarities in the artefacts collected, they may be contemporary with the main assemblage, layer IIIb/c.

Pit 1 (F1) and pit 4 (F4) contained human remains and are discussed in below. Pit 2 (F2), the largest of the pits at 3m diameter and 2m deep, contained abundant lithic debitage, a number of microliths, animal remains and perforated fossil shells (Ducrocq & Ketterer 1995: 254). A piece of charcoal (oak) from this pit was dated to 7840 ± 90 BP (Gif 8913) (7031-6501 cal BC) (*ibid.*: 252). The animal remains consisted of half a mandible of a deer, one of an auroch, and two from young wild boar, and whole long bones that had been placed separately near the top of the sides of the pit (*ibid.*). Although they do suggest that these remains could simply be refuse deposits, the authors prefer a hypothesis that these are funerary offerings associated with the nearby burials (*ibid.*). This is perhaps further supported by the presence of the perforated fossil shells, of which there were 20 within this pit, which have a demonstrable association with burials in France from the Palaeolithic (Taborin 2004).

Pit 5 (F5) was similar to pit 2 but slightly smaller in size at 1.8m diameter and around 1m deep. The base of the pit was filled by a thin layer of organic, water-worked, sediment devoid of archaeological material but rich in plant remains (seeds) and insects, and this was covered by loess material derived from the walls of the pit which constituted the majority of the fill (*ibid.*). The uppermost fill of the pit resembled the organic alluvium of the archaeological layer (LBS IIIb and c) but with a higher concentration of charcoal (*ibid.*). Possibly this pit was abandoned by the Mesolithic diggers due to the presence of a spring which caused the pit walls to collapse or it was deliberately dug for access to water (*ibid.*).

Pit 3 (F3) was of a different form. It was elongated in shape (2m x 1.5m, 0.7m deep) with a flat base upon which rested a large (bevelled) deer antler (*ibid.*). The majority of the fill was a homogenous ash deposit of wood charcoal (a hearth deposit?), which contained a large quantity of lithic debitage, in greater densities than the surrounding deposits, suggesting that this may have been a rubbish pit (*ibid.*). However deposition of large fragments of wild boar cranium and deer antler, and perhaps the grave-like shape of the pit, may indicate that the initial function of this structure was as a funerary offering (*ibid.*).

In the surface layers there were large quantities of burnt (un-worked) flint (>39,000 pieces) in two main concentrations. One of these lay over a pavement covering around $4m^2$ to the north of, and spreading over, the fill of the large pit 2. This does not appear to have been a hearth as there was no burnt sediment, only small amounts of charcoal, and non-burnt finds were also recovered from within the feature – suggesting that the burnt material was not *in situ*. The second concentration of burnt material was similar in character, therefore the authors interpret these deposits as either debris from hearth cleaning, or that the pavements represent two areas of habitation or structures linked to funerary rituals. No hearths could be clearly identified but the presence of burnt material and cremated human remains certainly implies their presence.

4.2.3 Dating and phasing

Radiocarbon dating of the pits (dates from F1, F2, and F4 only) demonstrates that they were not all contemporary and that pit 4, containing the secondary burial, was the earliest feature on the site, dating to 8533-7833 cal BC (9020 ± 100 BP (Gifa-92523)). The remaining dates indicate two further periods of Mesolithic activity, which, at least in terms of the dated features, do not overlap (see Table 4.1 and Figure 4.3). The dating suggests the following sequence; firstly the digging of pit 1, within which the remains of the cremated individuals were deposited, and contemporary occupation of the surrounding area (layer IIIb/c), and later, the excavation of pit 2 and the deposition of lithics, selected remains of deer, auroch, and boar and a number of perforated fossil shells within the pit, along with contemporary activity in the surrounding area (IIIb/c). The isolated human cranial fragments also date to this phase of activity, although they were thought to derive from the overlying, later layer IIIa. This is, however, described as a disturbed area of the site so it may be that they are no longer stratigraphically secure and were actually contemporary with the deposits in Pit 2, as their dating suggests. Alternatively, I would suggest, it is possible that these remains had been curated for some time, and subsequently deposited later in the sequence of occupation. Pits 3 and 5 were unfortunately not dated, but along with the other pits and the occupation layers (IIId, IIIb/c, and IIIa) were finally sealed by peat formation, which commenced at around 5969-5667 cal BC (6900 ± 60 BP, Gif-9619). It is also worth noting that the later features, pits 1 and 2, both respect the earliest feature, pit 4, whilst being significantly later in date. Whilst the date of pits 3 and 5 is unknown, there was no inter-cutting of features and pits 2, 3 and 5 appear to have been positioned around pit 4.

Based on the dating of the features the authors suggested two periods of occupation at the site:

- 8400 BP ('Gif 9329': 8460+/-70 BP, from pit 1 and 'Gif 9330': 8420+/-70 BP from layer IIIb/c)
- 7800 BP ('Gif 9331': 7770+/-80 BP from burnt hazelnuts in layer 10 in sq W4 and X4, 'Gif 8913': 7840+/-90 BP from charcoal in pit 2).

Pit 4 can also be considered to represent a distinct phase of earlier activity, at around 9000 BP.

Lab no.	**C14 date**	**+/-**	**cal BC from**	**cal BC to**	**Context/material dated**	**Source**
Gifa-92523	9020	100	8533	7833	F4, femur	Ducrocq *et al.* 1996:212
Gif-9329	8460	70	7597	7355	F1, burnt (hazlenut) material from the fill of pit 1	Ducrocq & Ketterer 1995: 252
Gif-9330	8420	70	7589	7333	Layer IIIb/c hazelnut (from burnt hazelnuts in area 4)	Ducrocq & Ketterer 1995: 252
Gif-95471	8360	90	7581	7179	F1, animal bone	Meiklejohn *et al.* 2010, Toussaint 2002
Gif-8913	7840	90	7031	6501	F2, from charcoal in pit 2	Ducrocq & Ketterer 1995: 252
Gifa-97521	7800	100	6760	6490	Cranial fragment [from IIIa?]	Meiklejohn *et al.* 2010
Gif-9331	7770	80	6908	6442	Layer IIIb/c hazelnut (from burnt hazelnuts in area 10, W4 and X4)	Ducrocq & Ketterer 1995: 252
Gif-9619	6900	60	5969	5667	Layer, base of peat (tourbe)	Ducrocq & Ketterer 1995: 251
Gif-8915	6380	60	5476	5226	Layer, mid of peat (tourbe)	Ducrocq & Ketterer 1995: 251
Gif-8914	6350	60	5469	5221	Layer, mid of peat (tourbe)	Ducrocq & Ketterer 1995: 251
Gifa-9238	5530	70	4515	4245	Neolithic human remains in lld	Ducrocq *et al.* 1996: 212

Table 4.1 Radiocarbon dates (shading indicates groups of features with similar dates)

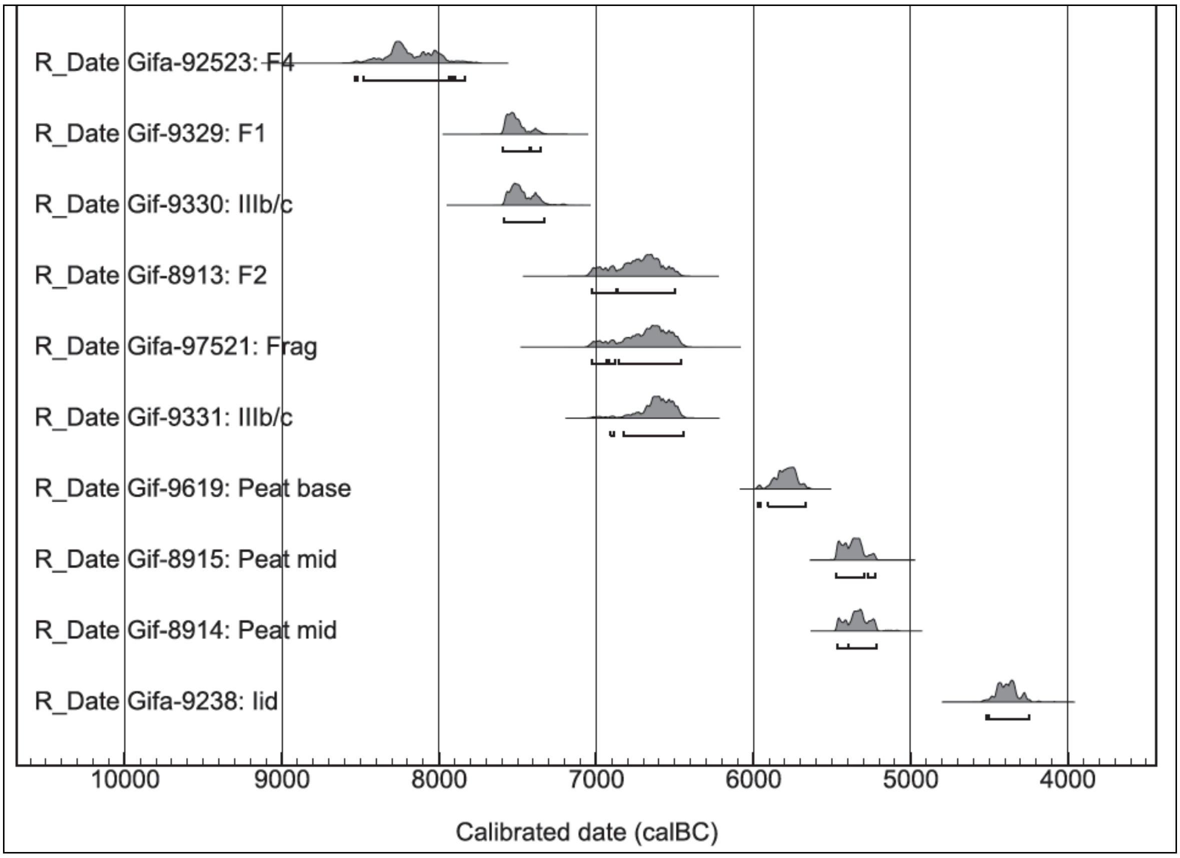

Figure 4.3 Calibrated radiocarbon dates (obtained using OxCal v4.1.7 (Bronk Ramsey, 2009), atmospheric data from Reimer *et al.* (2009))

4.2.4 Human remains and mortuary practice

In chronological order, the human remains from the site consisted of a secondary burial (pit 4/F4), the cremated remains of several individuals (deposited in pit 1/F1) and several isolated fragments of cranium recovered from the north-west of the site (from level IIIa). Aside from the latter fragments, no other human remains were recovered from the surface layers or the other pits. The authors suggest that the site could be interpreted as a cemetery – considering the finds from the pits, such as deer and boar mandibles, deer antler and perforated shells, as funerary offerings, rather than merely refuse (*ibid*.).

4.2.4.1 The secondary burial

The secondary burial (pit 4/F4) consisted of an almost complete human skeleton in a small, irregularly shaped depression, the limits of which were hard to define but was around 76 cm long by 42 cm wide and 30 cm deep, and orientated north-south (Ducrocq *et al.*, 1996: 211) (see Figure . The remains were mostly disarticulated and deliberately arranged in this small restricted space, contra to the ‘haphazard disposal’ described in a recent summary by Valdeyron (2008: 200). The long bones (tibiae, femora and humeri) were grouped and arranged parallel with the base of the pit, and the cranium was placed on top. The majority of the paired bones (clavicle, calcaneum, talus, *os coxa* (pelvis)) were placed symmetrically around the skull. The majority of the smaller bones were absent. Only one piece of non-human bone was recovered from this feature, a “small bone” from a wild boar (*ibid*.).

The authors describe how the 82 bones were arranged in the restricted feature which consisted of three parts; a central part and two parts on either side of the long axis. The central part was filled by nine large bones and eight small bones; six paired long bones (the humeri, femora and tibiae) were deposited in groups. Their proximal epiphyses were orientated to the north, except for the right femur which was placed with the proximal end (head) to the south – meaning the two femurs lay ‘head to tail’. On top of this group was placed the cranium and the os coxae. A right proximal phalange[7] had slipped between the larger bones and lay vertically next to the left femur. The eastern part of the feature contained 38 pieces. The left radius lay on three ribs and a group of thoracic vertebrae which were mixed with two tarsals (foot) and the left ulna (see figure 4.5, *ibid*.: 214). Added to this were the mandible and metatarsals in close proximity to the right clavicle and the left fibula. The 26 pieces in the west part were very loosely grouped, rarely overlapping, and several pieces were isolated on the periphery. The two scapulae were placed one over the other near to the sacrum, the two right lower-arm bones, some of the right and left tarsals and the cervical vertebrae.

It was also observed that four elements from this skeleton, the right and left radius, right ulna and left fibula, show evidence of spiral fractures normally associated with fresh bone breakage (Valentin and Le Goff, 1998). The left ulna was also present, but with no evidence for spiral fractures, only transverse, post-depositional breaks, and the right fibula was missing completely. The surface of the spiral fractures were, however, of an intermediate nature, reflecting neither fractures of truly fresh, nor completely dry, bone. The fracture surfaces were also unaffected by the surface erosion (root etching) seen on many of the bones. As the fractures interrupt the root etching, this suggests that they happened after this had occurred. Fracturing seems to have taken place before the body was moved to pit 4, as the fractured sections of the bone were not recovered amongst the disarticulated elements.

[7] The authors do not specify whether this is from the hand or foot (Ducrocq *et al*. 1996: 214)

Figure 4.4 Plan of the secondary burial (after Ducrocq *et al.*, 1996: 215, fig. 6)

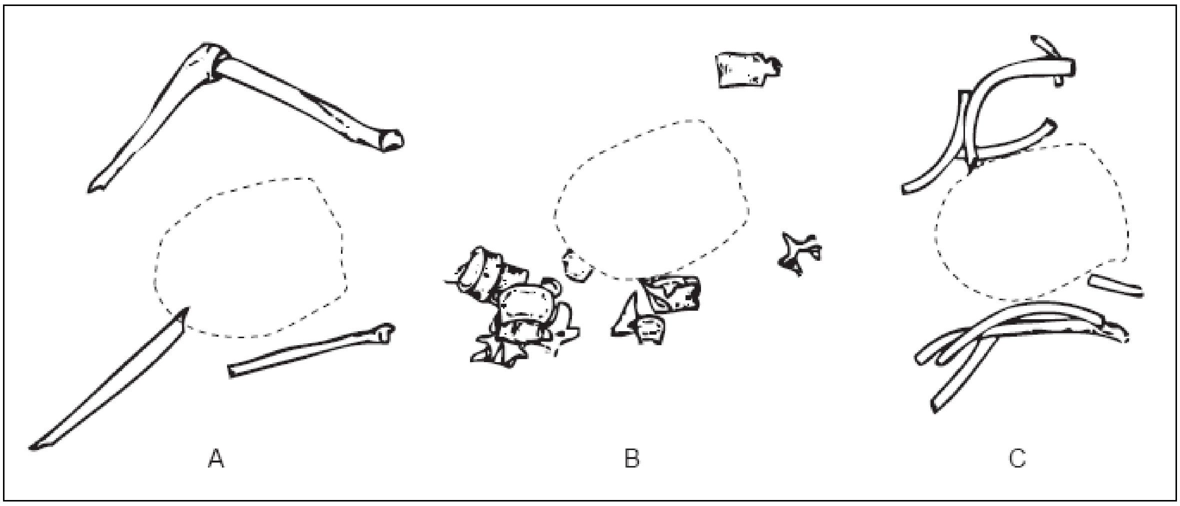

Figure 4.5 Plan of the secondary burial showing layers of remains (after Ducrocq *et al*. 1996: 214, fig 5)

The authors cite two factors that support their interpretation of these remains as a secondary burial; firstly, that there are several elements missing from the skeleton (only 82 elements were recovered, substantially less than a full skeleton; in particular it lacked some of the vertebrae, ribs and bone of the hands and feet) supporting the suggestion that it had been moved, and secondly, that this occurred after the body was completely skeletonised, to allow elements to lose all anatomical association, to be lost, and re-arranged, and that this obviously took place at another location. It was also noted that four long bone diaphyses (ulna, fibula, radius) were broken (fresh/dry) at the level of the distal or proximal quarter and it is suggested that this occurred whilst the body was moved. This also means that several centimetres of the bone shafts are missing, as these sections were not recovered from the pit, and should be included amongst the missing elements (Ducrocq *et al.*, 1996: 214).

4.2.4.2 The cremated remains

The cremated remains were recovered from Pit 1, an oval-shaped feature measuring 1.5m x 1m, and 0.3m deep, and after the secondary burial this was one of the earliest features on the site, dating to 8460±70 BP (Gif-9329). The pit contained around 100 fragments, representing at least three individuals, two adults and a child, as determined by Le Goff (2000). Repeating fragments of the cranium and two right carpal (wrist) bones indicated the presence of two adult individuals, one of whom was more robust than the other, and one may have been older than 45 years (as indicated by cranial suture closure) (*ibid*.). The child was represented principally by the bones of the cranium and was around 3 years of age, as indicated by the presence of three developing permanent tooth crowns.

The majority of the skeleton was represented and fragments of the cranium and upper and lower limb bones reached up to 5-10 cm in size and were present in the same proportions as expected for complete individuals (Le Goff, 2000: 117). There were also fragments from the vertebrae, ribs, scapulae, feet and hands, but of these, the central part of the body (the thorax and pectoral girdle (shoulder)) was relatively under-represented. This appears to be a frequent phenomenon in cremation burials and it may be that these elements are less likely to survive the cremation process, or once cremated, are more susceptible to destruction, either through the mode of collection or in the burial environment. The same applies to the post-cranial part of the child's skeleton which was also under-represented. The cranial bones tend to survive quite well as they are relatively dense, compared to the less dense and gracile bones of the juvenile post-cranial skeleton.

The human bone was also mixed with animal bone (species/elements not specified), flint tools and objects of decoration (shells?), as well as ashes, charcoal, burnt hazelnuts, ochre and pieces of reddened clay. The human remains were all burnt but half of the other remains (the lithics, animal bones and objects of ornamentation) had not been affected by heat/fire. The human remains were white/light grey in colour, indicating efficient cremation at high temperatures, but portions of the child's cranium were blue in colour, suggesting that they were cremated for less time or not fully exposed to the cremation fire.

The lack of burning on the base and sides of the pits indicated that the cremation took place elsewhere, perhaps coinciding with concentrations of natural, but burnt, flint seen across the occupation surface. There was no apparent organisation of the remains; the human bone, animal bone and artefacts were distributed throughout the whole fill of the pit, with no evidence for the separation of different materials. The cremated bone was also not confined to the visible edges of the feature (pit F1) as some of the flint and bone extended horizontally and vertically into the overlying deposits. The authors suggest that later erosion may have affected the pit edges.

It appears that all three individuals were deposited at the same time as different areas of the skeleton (the cranium and upper and lower limbs) were mixed and superimposed, and refitting of fragments (three pairs of fragments) showed that parts of the same bone could be up to 50 cm apart. There was, however, some possible clustering of the juvenile remains. Whilst the bones of each individual were spread across the whole feature, the bones of the child's cranium clustered together in the western half of the feature, whereas the adult bone was more concentrated in the eastern half. It was not possibly to determine whether this mixing of the three bodies indicated collective cremation or mixing of the already cremated remains before, or during, deposition in the pit.

4.2.4.3 The scattered/isolated remains

Four isolated fragments of cranium were recovered from a (possibly disturbed) archaeological layer in the north-west of the site (marked as A on Figure 4.2). The fragments derived from the occipital or parietal bones and were not conjoining fragments. These were possibly one of the latest deposits as they, along with other animal bones, derive from level IIIa at the interface between the alluvium and the peat (Ducrocq *et al.* 1996: 211). Dating revealed however, that these remains were contemporary with the fill of Pit 2 and the later of two dates from layer IIIb/c.

4.3 Osteological analysis of Petit Marais

Unfortunately the cremated remains were not available for analysis. The following analysis therefore focuses on the remains from pit 4 and the disarticulated elements from level IIIa.

4.3.1 Basic quantification

4.3.1.1 Number of identified specimens (NISP) and unidentified fragments (UF)

In total 122 fragments of human bone were recorded, all but four from pit 4 (F4) (see Table 4.2). These included 27 fragments (23%, 27/118) which could only be identified to a bone type rather than a specific element (or were too small to be recorded as a complete zone).

Fragment ID	Pit 4	Context IIIa
Cranial	1*	4
Mandible	2	
Hyoid	0	
Clavicle	2	
Manubrium	0	
Sternum	0	
Scapula	2	
Humerus	2	
Radius	2	
Ulna	2	
Carpals	0	
Metacarpal	4	
Hand phalanges	3	
Ribs	8	
Cervical vert	5	
Thoracic vert	11	
Lumbar vert	8	
Sacral vert	1	
R os coxa	1	
L os coxa	1	
Femur	2	
Patella	1	
Tibia	2	
Fibula	1	
Tarsals	6	
Metatarsals	6	
Foot phalanges	0	
Permanent teeth (maxilla)	6	
Permanent teeth (mandible)	12	
Total NISP	**91**	**4**
Unidentified fragments	27	-
Total fragments	**118**	**4**

Table 4.2. Total number of fragments recorded in re-analysis (* = a complete cranium)

Of the identifiable fragments, 20% (18/91) were teeth and the remainder (73 fragments) derived from all areas of the skeleton, apart from the hyoid, manubrium, sternum, carpals (wrist) and foot phalanges (toes), which were not present at all. The relative representation of skeletal *elements* (rather than fragments, which may derive from the same element) is discussed in more detail below.

The teeth recovered were all from an adult dentition and all derived from the intact adult cranium and mandible from pit 4 (see Table 4.3). They were either *in situ* in the upper and lower jaw or, if loose, could be re-fitted into their respective tooth sockets. Those that were missing all appear to have been lost post-mortem and not during life. There was no evidence of dental disease, though all of the teeth showed heavy tooth-wear, which could be associated with old age and/or a coarse diet. Of the unidentifiable fragments the majority were axial, that is small fragments of vertebrae or ribs, rather than pertaining to the long/tubular bones or the cranium (see Table 4.4).

Mandibular	***left***	***right***
I1	1	1
I2	pm	pm
C	1	pm
PM1	1	1
PM2	pm	1
M1	1	1
M2	1	1
M3	1	1
Total	***6***	***6***
Maxillary	***left***	***right***
I1	pm	pm
I2	pm	pm
C	pm	pm
PM1	1	1
PM2	pm	pm
M1	1	1
M2	1	pm
M3	1	pm
Total	***4***	***2***

Table 4.3 Number of teeth present (pm = post-mortem tooth-loss)

Unidentified fragments	
Unidentified: cranial	0
Unidentified: appendicular	3
Unidentified: axial	18
Unidentified fragments	6
Total	**27**

Table 4.4 Unidentified fragments by bone type

4.3.2 Surface preservation

The surface of all the bones had been subject to significant erosion (grades 3-4) caused by root action. The etching appeared to be uniform, as all surfaces of each bone were affected and all of the bones were affected (see Figure 4.6). Several elements had also been permanently reconstructed with glue, obscuring the fracture surfaces (Figure 4.7).

Figure 4.6: Example of erosion of the bone surface caused by root action (left distal humerus from F4) (Scale: Small squares = 1cm)

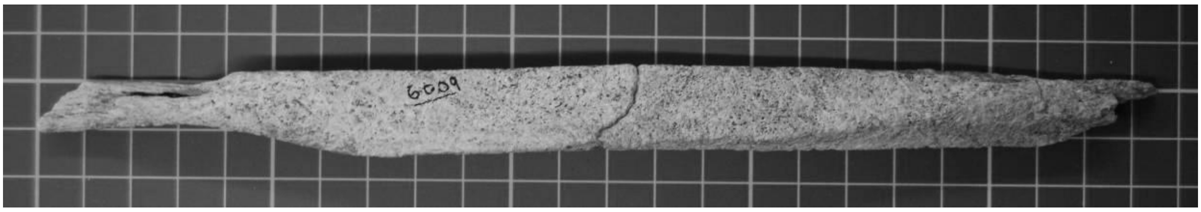

Figure 4.7 Reconstructed fibula (F4, 6008/6009): proximal and distal diaphysis fragments glued together (Scale: Small squares = 1cm)

4.3.3 Completeness of elements

Many of the elements in pit 4 were complete, either as intact whole bones or they could be reconstructed from a small number of fragments, and this is reflected in the calculation of the percentage completeness of elements; around 74% (89/121) of the assemblage was more than 85% complete (Table 4.5). The skull, the clavicle, the upper arm, the femur and tibia and the metatarsals were all found to be 100% complete. The pelvic bones were also virtually complete.

Element	No. of elements	Average no. of zones present per element	Maximum no. of zones possible	% complete
Cranium	1	15	15	**100.0**
Mandible	1	14	14	**100.0**
Clavicle	2	3	3	**100.0**
Humerus	2	11	11	**100.0**
Femur	2	11	11	**100.0**
Tibia	2	10	10	**100.0**
MT	6	3	3	**100.0**
Os coxa	2	11.5	12	**95.8**
Ulna*^{R}	2	8.5	10	**85.0**
MC	4	2.25	3	**75.0**
Scapula	2	6.5	9	**72.2**
Fibula*	1	4	6	**66.7**
Radius*	2	6	11	**54.5**
Ribs	8	1.5	3	**50.0**
Total	***37***	***107.25***	***121***	***88.6***

Table 4.5 % completeness of elements in Pit 4 (*indicates a fractured element)

Of the bones that were less than 75% complete, the lower average for the scapula (72%) and ribs (50%) can be explained by the fact that they are inherently more fragile than other elements and are prone to poor preservation and a high degree of fragmentation. They therefore have a low representation, even in closed burial environments that are not subject to post-dispositional disturbance. The remaining elements with lower completeness, the fibula and radius, were both subject to post-mortem fracturing, and the sections of the bones above/below the point of fracture are missing, resulting in a low average completeness. This also affected the ulna – on average it was 85% complete, the only part of the ulna that was missing being the distal part of the fractured right ulna.

4.3.4 Osteometric and morphological analysis

4.3.4.1 Estimation of age

The remains from pit 4 represent a mature adult (> 50 years), based on the auricular surface of the *os coxa*. The heavy tooth wear observed on the dentition and the degenerative lesions observed on the lower thoracic and lumbar vertebrae also are in keeping with an older adult. Ducrocq *et al*. (1996) also utilised observation of the cranial sutures for ageing, resulting in an estimated age of 44-74 years, again in keeping with a mature adult.

4.3.4.2 Estimation of sex

The morphology of the cranium, mandible and the pelvis display male and mixed male/female characteristics respectively, indicating that the individual was probably a male. The general size and robusticity of the skeleton also supports this. It was not necessary to rely on metrical estimations of sex as the morphological characteristics of the skull and pelvis were available and are much more reliable.

4.3.4.3 Estimation of stature

Based on the measurement of the femur, stature was estimated as 1.75m.

4.3.5 Results of refitting exercise

It was not possible to trace the spatial distribution of parts of the same element as many of the elements had been permanently reconstructed from re-fitting fragments. However, several parts of elements could be identified as missing from the assemblage. The scattered elements were compared with the remains from pit F4 and were identified as representing a second individual.

4.3.6 Minimum number of elements (MNE)

The 74 identifiable fragments (excluding teeth) from pit 4 represented a minimum number of 66 elements, see Table 4.6. The elements were all adult and represented the right and left sides of the body almost equally.

4.3.7 Minimum number of individuals

There was no repetition of elements within pit 4 and therefore only one individual is represented by these remains. The cranial fragments from the north-west of the site certainly represent a second adult individual as these cannot derive from the individual in pit 4, whose cranium was complete. At least three further individuals, two adults and a child of about 3 years of age, were also represented in the cremated material. It is possible that the cranial fragments derived from one/both of the adults that were later cremated but dating of the cranial fragments has confirmed that this is not the case. One of the cranial fragments was dated to c. 7800 BP which, presuming that they are all of the same date, is substantially later in date than the cremated remains, which were dated to around 8400 BP.

Element	*left*	*right*	*unsided*	**MNE**
ADULT				
Cranium			1	**1**
Mandible			1	**1**
Clavicle	1	1		**2**
Scapula	1	1		**2**
Humerus	1	1		**2**
Radius	1	1		**2**
Ulna	1	1		**2**
Hand: carpals				**0**
Hand: MC3	1			**1**
Hand: MC5	1			**1**
Hand: MC?		1	1	**2**
Hand: Prox. Phalanx			3	**3**
Ribs	4	3	1	**8**
Cervical vert.: C1			1	**1**
Cervical vert.: C2			1	**1**
Cervical vert.: C7			1	**1**
Cervical vert.			1	**1**
Thoracic vert.			9	**9**
Lumbar vert.			5	**5**
Sacrum			1	**1**
Os Coxa	1	1		**2**
Femur	1	1		**2**
Patella		1		**1**
Tibia	1	1		**2**
Fibula	1			**1**
Foot: MT1	1			**1**
Foot: MT2		1		**1**
Foot: MT3	1			**1**
Foot: MT4	1	1		**2**
Foot: MT5		1		**1**
Foot: tarsal (talus)	1	1		**2**
Foot: tarsal (calcaneus)	1	1		**2**
Foot: tarsals (other)	1	1		**2**
TOTAL elements	**21**	**19**	**26**	**66**

Table 4.6 Minimum number of elements

4.3.8 Skeletal part representation

Based on the MNI for Pit 4 it is possible to calculate the Bone Representation Index (BRI) (Bello and Andrews, 2006), that is, the percentage of bones recovered compared to that expected for one individual; see Figure 4.8 and Table 4.7. In total only around 40% of this individual's skeletal elements were recovered (or only 36% of elements if teeth are excluded). As well as the observed absence of some bones, such as the sternum, there are also a number of elements that are significantly under-represented. As well as the missing carpals (wrist bones), the remainder of the hand bones, the metacarpals and phalanges, are also poorly represented, only 40% and 11%, respectively, of those expected. The foot is also under-represented but displays a different pattern. In both the hand and foot the metatarsals/metacarpals (the main 'body' of the hand/foot) are the most frequent element. Likewise the phalanges are very under-represented in the hand and completely absent from the foot. Conversely, more than a third of the tarsals (ankle bones) are present but the equivalent bones of the wrist were completely absent.

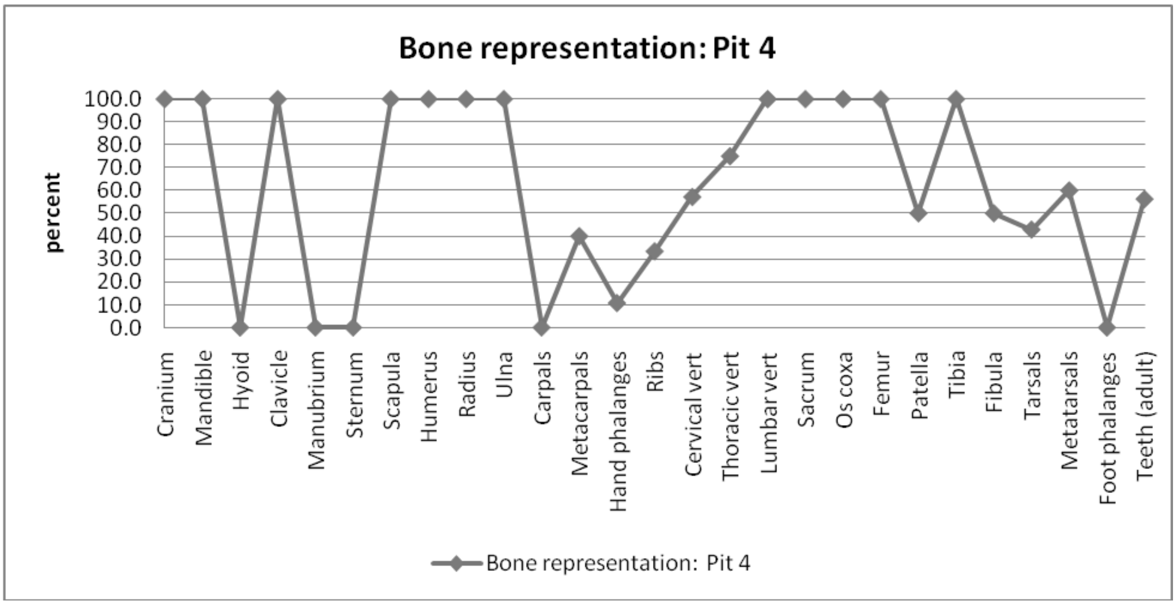

Figure 4.8 Bone Representation Index, Pit 4

As well as completely lacking the hyoid and the bones of the sternum, the thorax as a whole was poorly represented. Only a third of the ribs were present and the cervical and thoracic vertebrae, those of the upper thorax, were also under-represented.

There were also a couple of obvious missing elements, in that the left patella (knee-cap) and the right fibula were missing. It was also noted for the bones that displayed 'fresh' fractures that the ends of these bones were not amongst the assemblage (1996: 214).

Element	*Expected per person*	*Expected in Pit 4, MNI = 1*	**Number recovered from Pit 4**	**% of expected in Pit 4**
Cranium	*1*	*1*	**1**	***100.0***
Mandible	*1*	*1*	**1**	***100.0***
Hyoid	*1*	*1*	**0**	***0.0***
Clavicle	*2*	*2*	**2**	***100.0***
Manubrium	*1*	*1*	**0**	***0.0***
Sternum	*1*	*1*	**0**	***0.0***
Scapula	*2*	*2*	**2**	***100.0***
Humerus	*2*	*2*	**2**	***100.0***
Radius	*2*	*2*	**2**	***100.0***
Ulna	*2*	*2*	**2**	***100.0***
Carpals	*16*	*16*	**0**	***0.0***
Metacarpals	*10*	*10*	**4**	***40.0***
Hand phalanges	*28*	*28*	**3**	***10.7***
Ribs	*24*	*24*	**8**	***33.3***
Cervical vert.	*7*	*7*	**4**	***57.1***
Thoracic vert.	*12*	*12*	**9**	***75.0***
Lumbar vert.	*5*	*5*	**5**	***100.0***
Sacrum	*1*	*1*	**1**	***100.0***
Os coxa	*2*	*2*	**2**	***100.0***
Femur	*2*	*2*	**2**	***100.0***
Patella	*2*	*2*	**1**	***50.0***
Tibia	*2*	*2*	**2**	***100.0***
Fibula	*2*	*2*	**1**	***50.0***
Tarsals	*14*	*14*	**6**	***42.9***
Metatarsals	*10*	*10*	**6**	***60.0***
Foot phalanges	*28*	*28*	**0**	***0.0***
Teeth (adult)	*32*	*32*	**18**	***56.3***
Total	*212*	*212*	84	***39.6***

Table 4.7 Number of bones expected, and those recovered, from Pit 4

Whilst elements may be missing from the assemblage, some of this under-representation may be accounted for by natural variations in the preservation of different elements of the skeleton. In order to investigate this we can compare the representation of elements in Pit 4 at Petit Marais with the representation of elements in a skeleton which was buried in an undisturbed, closed environment see Figure 4.9. This data was produced by Bello and

Andrews (2006) to represent the intrinsic pattern of preservation of human skeletons, and was based on data from several cemeteries including the 18th-19th century crypt burials from Spitalfields, London.

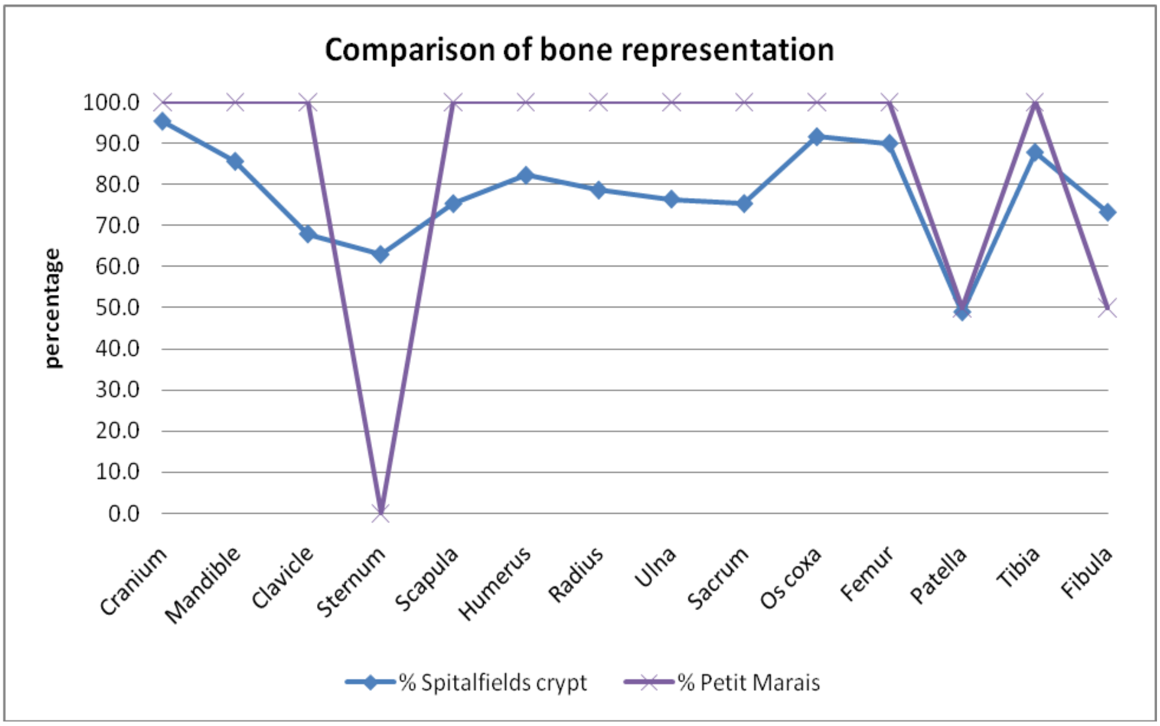

Figure 4.9 Comparison of BRI at Petit Marais with that from Spitalfields crypt (data from Bello and Andrews (2006)

Whilst it was only possible to compare a smaller selection of elements, this comparison shows that in normal circumstances we can expect to see a relatively low representation of the sternum, due to its low bone density, of the patella, due to its rapid disarticulation during body decomposition, and possibly also the fibula, perhaps due to its fragmentation as a result of its greater length than width (Bello and Andrews, 2006). The under-representation of the cervical vertebrae (except for C1 and C2) and the thoracic vertebrae may also be due to their low bone density. This may also explain the complete absence of the manubrium, sternum, and the relatively low numbers of ribs.

The complete absence of the carpals (wrist bones) and the phalanges of both the hands and feet may also be associated with the labile nature of their articulations and, considering the evidence that the body was moved to the pit after it was skeletonised, these loose articulations could explain the loss of these elements. The presence of the metacarpals (40% of expected), which are located between the carpals and the phalanges, is, however, a slight discrepancy. These elements are, however, larger and perhaps more readily identifiable than the other elements; for instance the carpals are often overlooked as they can resemble small pebbles.

4.3.9 Modifications

The only modifications observed were post-mortem, semi-fresh long-bone fractures and one instance of canid puncture marks. No cut marks were observed on the assemblage but the poor surface preservation, due to root erosion, may mean that they would be totally obscured.

4.3.9.1 Spiral or 'dry' fractures

Several elements from the lower arm (radius and ulna) and the lower leg (fibula) showed evidence of spiral post-mortem fractures (see table 4.8) which were also identified in the original analysis. These retain some of the characteristics of 'fresh' bone fractures (such as an oblique and relatively smooth fracture surface and a diagonal or spiral outline) and therefore occurred whilst the bone was still semi-fresh and not completely dry, so-called 'dry' fractures. The fracture surfaces were not affected by the root etching predominant on the surface of the bones, indicating that the fractures occurred later, and the root erosion did not continue after they had taken place (Figure 4.10). All of the fractures affected the proximal or distal third of the bone shaft, and sometimes both in one element, and occurred mainly on the bones of the lower arm. The remainder of the bone shafts, that is the proximal and/or distal ends, were not recovered in the assemblage.

Fragment ID	***Element***	***Location of fracture***
F4/6041	Right radius	proximal?, distal
F4/6009	Left radius	proximal, distal
F4/6036	Right ulna	distal
F4/6008	Left fibula	proximal, distal

Table 4.8 Fractured elements from Pit 4

Figure 4.10 Example of the root-etched bone surface and the unaffected fracture surface (Left fibula, F4/6008)

4.3.9.2 Evidence for animal activity

The actions of carnivores was only seen on the head of the left radius (F4/6009) which displayed characteristic puncture marks from carnivore chewing (Figure 4.11). The distal portion was also fractured (as above).

Figure 4.11 Carnivore puncture marks on the head of the left radius (F4/6009) (Scale – 1 square = 1cm)

4.3.10 Discussion of body treatment at Petit Marais

At the site of Petit Marais several different ways of treating the body were represented and rather than being contemporary, these seem to change throughout the occupation of the site. The earliest feature was the secondary burial in pit 4 and it is possible to propose a sequence of events which led to the deposition of the skeleton in the pit. The body probably lay exposed on the surface, or was shallowly buried, until it was completely skeletonised (as shown by the root activity on the remains). At least on one occasion during this time wolves or dogs gained access to the body causing some damage to the elbow joint, but they must have been prevented from further access as only a single element was affected. 'Dry' fractures were present on the bones of the right and left lower arm (at the proximal and distal ends of the right and left radii and the distal right ulna) and both ends of the left fibula. These fractures not likely to be caused by animals as no puncture marks or other damage around the fractured elements were observed.

The 'dry' fractures, however, certainly occurred *after* the root-etching of the remains (the fractures interrupt the etched surface and the fracture surfaces were not affected by etching), and also occurred *prior* to their arrangement in pit 4 as the corresponding proximal and distal fragments were not present in the pit. These fractures may have been caused during the collection of the bones from their place of primary deposition, if they had become difficult to extract from the surrounding vegetation (as the extensive root-etching may indicate), or they may have been broken intentionally or accidentally during the manipulation of the remains whilst preparing them for their final deposition. The radius, ulna and fibula have the smallest diameter of the long bones, and, in a semi-dry state, may have required less force to break than the other bones. It is also possible that they were broken as a result of trampling over the body, by humans or animals, especially if it was obscured by vegetation, though this seems less likely as it would have had to occur immediately before the removal of the body for the fracture surfaces to remain unaffected by the etching. The missing portions of the bones may have remained at the site of primary deposition or perhaps in an intermediate location, possibly collected later and curated.

The remains of the body were collected together, and carefully arranged, possibly in a fabric bundle, and placed in a small pit (pit F4), the long bones arranged at the bottom with the skull and the paired bones, such as the pelvis, placed around it. A small bone from a wild boar was also included. Some small elements, such as the wrist bones and finger and toe phalanges, along with the fractured portions of the lower arms, may have been overlooked and left behind, or deliberately selected and taken elsewhere.

At least 200 years later, further activity at the site included the cremation of two adults and a child. Presumably a pyre was constructed and the remains of the three people, collectively or individually, were placed on the pyre along with the remains of animals (perhaps food or symbolic parts of animals), flint tools, perforated shells and possibly ochre. Once the bodies were completely cremated, their remains, mixed with the ashes and charcoal from the pyre, were collected together and yet more lithics, animal bones and shells, that had not been cremated, were added to them before they were deposited into a pit about 5m to the west of the earlier burial.

At least several centuries later there is further evidence for body treatment in the form of the scattered parts of an adult cranium deposited during further activity at the site. We do not know how the cranium came to be skeletonised, whether through burial or exposure, or how it came to be disarticulated from the rest of the body. Around the same time that these elements were deposited, however, a third pit was dug (pit 2) and lithic debitage, microliths, charcoal and perforated fossil shells were deposited within it, along with the mandibles of deer, auroch and wild boar and several whole long bones. The nature of these materials, not least the perforated fossil shells, led the authors to suggest that this feature contained funerary offerings associated with the nearby burials. Whilst it is interesting to consider these, obviously structured deposits, as acts of commemoration and remembrance for the (*significantly*) earlier burials (pits 4 and 1), I would like to suggest that they could also be directly associated with the activities taking place in the treatment of the individual, represented by the cranium, which is contemporary with this pit.

A further feature, pit 3, contained similar deposits which were also interpreted as funerary offerings, though as it is undated it is not known where it is located in the sequence of activity. A large deer antler had been placed at the base of the pit and the fill consisted of a homogenous deposit of wood charcoal containing a massive quantity of lithic debitage, and again, selected animal parts consisting of large pieces of wild boar cranium.

The dated remains, and two further undated features (pits 3 and 5), clearly illustrate that there was repeated, if not continuous, occupation of this site throughout the early and middle Mesolithic, and though not exclusively, that this often involved the treatment of the body and mortuary rituals. A number of features that are clearly very separate temporally are situated spatially very close together over a relatively small area. The fact that this repeated occupation over nearly two millennia did not disturb earlier features suggests that these features were permanently marked, either physically, or at least in the minds of those who visited and occupied the site.

5 Case study 3: Analysis of human remains from 'Les Varennes', Val de Reuil (Eure, France)

5.1 Introduction

The final osteological case study focuses on the human remains from a burial at Les Varennes, Val de Reuil (Eure, France) (45). Rescue excavations discovered an isolated Mesolithic grave in the form of an oval pit which contained evidence for at least three different episodes of activity. The lower, primary, fill contained the remains of several individuals (at least one adult, probably male, and another younger adult) who may have been deposited one after each other on separate occasions, each time the remains being moved/rearranged to accommodate a further burial. The upper fill contained a further inhumation, probably an adult male, whose remains were less disturbed and partially in articulation. Very few other materials or artefacts were recovered except for a small number of un-retouched flint flakes and areas where the sediment appeared to be coloured by the presence of red ochre. Finally a deposit of wild animal bones which included the skulls of red deer, roe deer, and auroch, complete with antler and horns, and remains from wild pig and beaver, had been piled up over the pit and burnt *in situ*, seemingly to mark the end of its use.

5.2 Site background

5.2.1 Circumstances of excavation

The site is located on a sandy gravel terrace (c.12m OD) adjacent to a meander of the River Seine to the south of Rouen, where it also meets the River Eure. The Mesolithic burial pit was discovered during rescue excavations in the winter of 1991-1992 primarily directed at recording a Neolithic collective burial and funerary features dating to the Bronze Age. An area of around four hectares was stripped and the burial was the only Mesolithic feature within the area, around 43 m to the south of the Neolithic burial. The importance of the Mesolithic burial, being relatively rare in France, was identified from the outset and therefore the human remains were subject to meticulous excavation following the methodology of *anthropologie de terrain*. This included the identification of skeletal elements on site and recording of the orientation and relative location of each individual bone, (as outlined by Duday *et al.*, 1990). Osteological analysis of the Mesolithic remains was carried out by Frédérique Valentin (1998a) and her interpretations and a full description of the excavations and other finds were subsequently published in the *Bulletin* *de la Société Préhistorique Française* by Billard et al. (2001) (though see Billard *et al*. (1995) for the Neolithic and Bronze Age remains).

5.2.2 Archaeological context

The site was an open air site located to the south of a series of palaeochannels of the river Seine and the pit was an isolated feature in the area. The pit was roughly oval in shape, measuring 0.95 x 2.5m at the top and 0.8 x 2m at the base, and was cut into the natural substrate of sand and gravel. It contained a complex fill that could be divided into four phases.

The authors describe these, from the bottom up, as: brown clay derived from the weathering of the pit present in two pockets at each end (stratigraphic unit 1); a localised thin layer of gravelly sand overlying this in the north-east end of the feature (2); a brown-orange clayey-silt containing a series of disarticulated human remains at various levels, due to the fact that the deposit was thicker along the walls of the pit than in the centre (3); overlying this was a thick sandy fill, with bands of (illuviated?) clay, containing at its base a partially articulated human skeleton and at its top a large amount of burnt animal bone and burnt stones (4) (Billard *et al.*, 2001: 28). The articulated remains, despite their later stratigraphic position were actually at a lower level than the earlier bones (as can be seen in section A, see Figure 5.1). The sand in this latest fill varied in colour, becoming darker towards the top and centre of the deposit, from beige through to light pink, dark pink and eventually brown (as shown in Figure 5.1). This also coincides with the density of the burnt bone (c. 11 kg) which was mainly concentrated in the dark pink and brown sand, closest to the top of the deposit. As well as a drop-off in density, the size of the burnt fragments also reduces further away from the brown sand, leading the authors to conclude that the fragments in the surrounding, lighter, sand are a result of post-depositional movement (bioturbation). There was no charcoal in the deposit, but burnt pebbles (reddened, not fractured, by heat) were abundant and concentrated in the top 10 cm of the deposit, though un-burnt pebbles were also present, though in lower quantities, and at a lower level in the fill, according to Billard et al (2001). The cremated bones consisted of the remains of several animals whose dry bones, it is proposed, were arranged with flat bones and long bones at the base, and the skulls of red deer, roe deer and large bovids, along with their antlers and horns, and the front limb of a beaver, were laid over them.

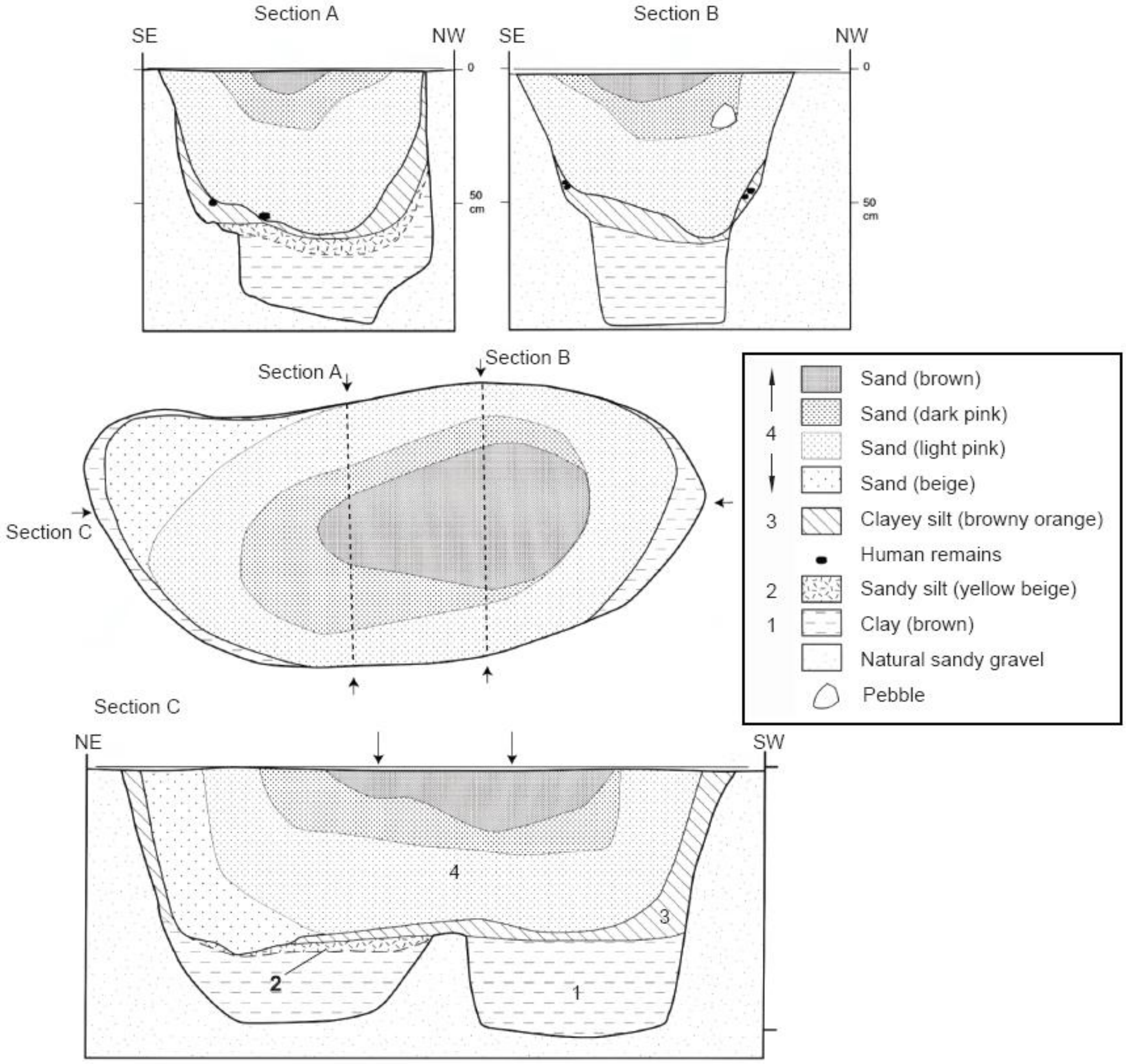

Figure 5.1 Transverse and longitudinal sections, and plan of the burial feature (after Billard *et al*. (2001))

The authors suggest that the most probable sequence of burial activity breaks down into two main phases:

Phase 1: A funerary deposit of two individuals, probably primary deposition, at least for the mature adult, although their simultaneity cannot be determined.

Phase 2: a) Re-opening of the burial after decomposition and rearrangement of the remains.

b) Deposition of a third individual, lying supine, close to the level that the first remains were deposited. Decomposition within a filled space is most probable.

c) A cremation structure was constructed above the burial and a collection of animal remains were burned. This cremation was probably an isolated event, not a recurring one.

Most importantly the authors also suggest that stages ‘a’, ‘b’ and ‘c’ of Phase 2 could, strictly, be contemporary, as stages ‘b’ and ‘c’, the second burial and the cremation, occur in the same stratigraphic unit and stages ‘a’ and ‘b’, the rearrangement of the remains and the second burial, can be considered part of the same funerary practice or actions (Billard *et al.*, 2001: 47).

To address these two points, it is certainly possible that the cremation of the animal remains was roughly contemporary with the second burial. However, the fill is described as containing bands of (illuviated?) clay, possibly indicating periods of silting from weathering, indicating that the pit was open and not backfilled all at once. The cremated remains do certainly represent the last stage in this sequence of filling-in.

However, with regard to the contemporaneity of the disarticulation/rearrangement of the first burial and the addition of the second, the fact that the disarticulated bone is in a separate context, which is subsequently cut by the activity during which the latest interment is deposited, implies that these bones were already disarticulated before the insertion of the latest burial, and that these activities cannot be contemporary, or part of the same activity, as is suggested. Had the latest interment disturbed bones from the previous layer, they would have been deposited in the *same* context as the interment. It *is* possible that the latest interment *removed* material from the layer of disturbed bones, as it cuts through this layer, but not that it was responsible for their disarticulation and re-arrangement. Their location towards the sides of the pit would appear to be a factor of truncation by the later burial. There is also no stratigraphic evidence that the initial deposit of human remains was originally articulated and later accessed and re-arranged, (though the later re-cut could have destroyed the stratigraphic evidence for this?). It seems more likely that they were originally deposited as disarticulated elements.

My interpretation of the section drawings would be that after the pit was dug there was an initial phase of silting up or weathering, distributed in two pockets at each end of the pit, or there may have been two pits next to one another. There was then a second phase when disarticulated human remains were deposited, perhaps truncating the original fill, and then the pit was backfilled again. Later, a third phase occurred when the pit was re-cut to a similar depth (but slightly wider at the top and narrower at the bottom) for the addition of a further body, perhaps removing some of the earlier human remains and leaving only those where the deposit remained undisturbed towards the sides of the pit. This new burial was backfilled (the body decomposed in a filled space) and then the animal bones were piled up over the filled pit, perhaps in a small hollow, and cremated *in situ* or perhaps deposited in the top of the feature immediately after cremation, whilst they were still hot.

5.2.3 Dating and phasing

A date for the burial was obtained from bones belonging to the latest, semi-articulated individual (A), using those which were too poorly preserved for any osteological observation – the right femur and fragments of the left femur, fragments of the left and right tibia, and a fragment of right fibula. The date obtained was 8715 ± 310 BP (Ly-6239), which is 8635-7066 cal. BC, placing burial A in the middle Mesolithic. As a consequence, however, the different phases of activity cannot be dated, only the deposition of individual A.

5.2.4 Human remains and mortuary practice

The authors determined that the remains of at least three people were present; the most recent burial of an adult male in anatomical position, lacking the torso and cranium (individual A), and amongst the disarticulated material, a second adult male with a cranium but lacking the torso (B), a young adult, only represented by teeth (C) and further remains that could not be assigned to a specific individual (grouped together as D but possibly belonging to B, C or additional individuals) (see Figure 5.2). The identification of individuals was carried out by Valentin (1998a) in the field and in the post-excavation osteological analysis, based on the identification of groups of articulating elements, refitting pieces of the same element, elements that could be paired (those that were symmetrically similar) and elements that were consistent in size and robusticity and may have derived from the same skeleton, e.g. the humerus, radius and ulna from the same limb for example. As I could not examine the relationship between elements in the field I have followed the groupings assigned in the original analysis.

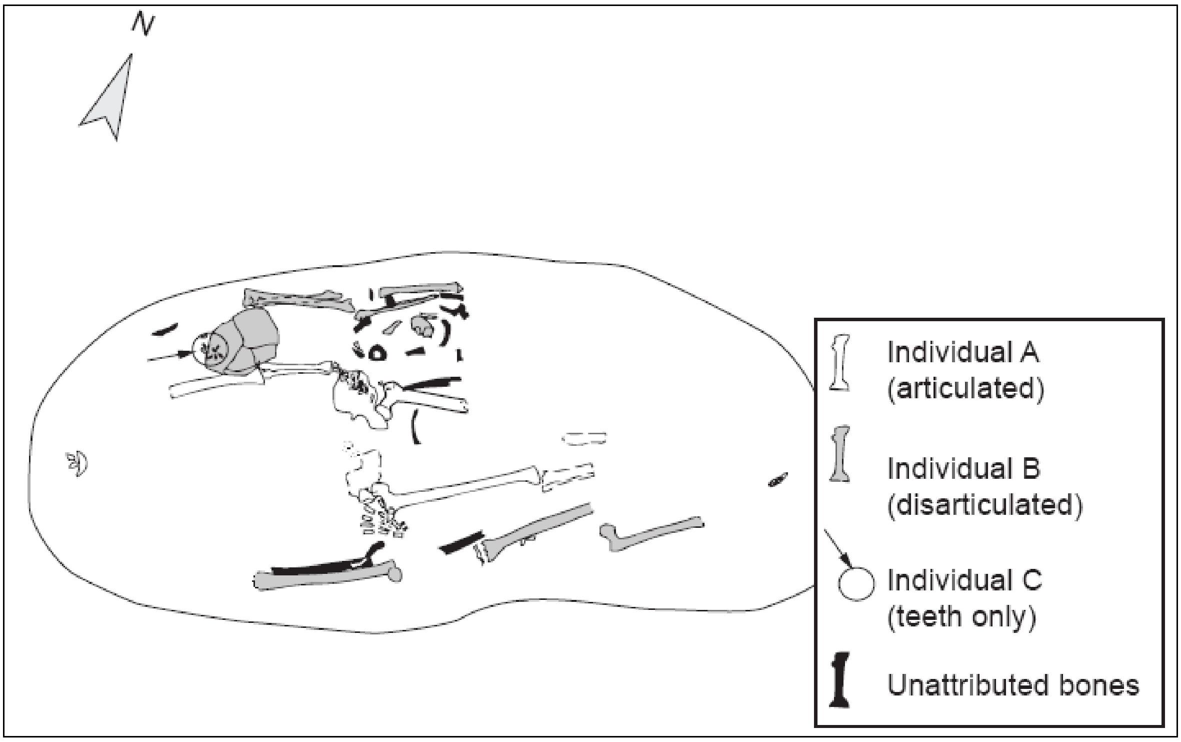

Figure 5.2 Plan of the human remains (after Billard *et al.* 2001)

5.3 Osteological analysis

5.3.1 Basic quantification

5.3.1.1 Number of identified specimens (NISP) and unidentified fragments (UF)

A total of 104 fragments were recorded which included 24 fragments (23%) which could only be identified to a broad bone type (see Table 5.1). 77 fragments were identifiable to a specific element and these included several groups of fragments which had been refitted and permanently reconstructed (with glue) during the initial analysis. The number of fragments is therefore no longer representative of the degree of fragmentation of the assemblage.

Of the identifiable fragments overall, teeth (16%) and hand phalanges (27%) were the most numerous and this is also representative of the fact that it was mainly only the head and limbs that were represented. The torso (manubrium, sternum, scapula, ribs, lumbar and sacral vertebrae) and the patellae, and foot phalanges (toes) were not represented at all.

This pattern was also reflected in the unidentifiable fragments as the majority of these also derived from the appendicular skeleton (the bones of the limbs) with few fragments of the axial or cranial skeleton (see Table 5.2). Very few of the unidentified fragments could be assigned to a specific individual due to the fact that they were not identifiable to a specific element and therefore could not be confidently assigned to a specific skeleton.

Fragment ID	*A*	*B*	*C*	*D*	Total
Cranial	0	1		1	**2**
Mandible	0	1			**1**
Hyoid	0				**0**
Clavicle	0			1	**1**
Manubrium	0				**0**
Sternum	0				**0**
Scapula	0				**0**
Humerus	1			1	**2**
Radius	1	1		1	**3**
Ulna	1	1			**2**
Carpals	6				**6**
Metacarpal	3			2	**5**
Hand phalanges	20			1	**21**
Ribs	0				**0**
Cervical vert	0			2	**2**
Thoracic vert	0			1	**1**
Lumbar vert	0				**0**
Sacrum	0				**0**
R os coxa	1				**1**
L os coxa	1				**1**
Femur	2	2			**4**
Patella	0				**0**
Tibia	2	3			**5**
Fibula	1			2	**3**
Tarsals	0	2			**2**
Metatarsals	0			2	**2**
Foot phalanges	0				**0**
Teeth (deciduous)	0				**0**
Teeth (permanent)	0	8	5		**13**
Tooth (fragment)	0				**0**
Total NISP	***39***	***19***	***5***	***14***	**77**
Unidentified fragments	1	3	0	23	27
Total fragments	***40***	***22***	***5***	***37***	***104***

Table 5.1 Total number of identified and unidentified fragments recorded

Unidentified fragments	*A*	*B*	*C*	*D*	*Total*
Unidentified: cranial				1	**1**
Unidentified: appendicular		2		13	**15**
Unidentified: axial		1		7	**8**
Unidentified fragments	1			2	**3**
Total	***1***	***3***	***0***	***23***	***27***

Table 5.2 Total number of unidentified fragments

5.3.2 Surface preservation

The surface of all of the material was affected by erosion (grade 4) caused by root action (see figure 5.3). As a consequence it was not possible to observe fine surface detail and as a consequence it was not possible to observe any modifications that occurred before the erosion.

Figure 5.3 Example of surface erosion on the assemblage

5.3.3 Osteometric and morphological analysis

It was not possible to take any measurements from the remains in this assemblage, due to preservation and surface erosion. Estimations of age and sex, where possible, were based upon morphological characteristics.

5.3.3.1 Estimation of age

All of the remains appeared to derive from adult individuals and the only difference in age was observed in the assemblage of teeth. A high degree of wear on the occlusal surface of eight teeth (maxillary and mandibular, skeleton B) meant that they could be distinguished from five further teeth (all different maxillary teeth) with very little surface wear indicating a different individual (skeleton C). Using Brothwell's (1981) scheme for age assessment based on tooth wear, skeleton B is that of an older adult and skeleton C a young adult or an adolescent. It was not possible to differentiate any of the post-cranial remains by age.

5.3.3.2 Estimation of sex

The sex of the skeleton could be tentatively estimated for skeleton A and skeleton B. The left os coxa (pelvis (N3.2047)) from skeleton A was estimated as possibly male, based on the morphology of the sciatic notch, the only sexually diagnostic part of the pelvis that was present. (The right os coxa was not seen by the present author at it was used for dating).

The morphology of the cranium of skeleton B was also estimated as indicating a male individual, based on the size and robusticity of the nuchal crest, mastoid process and supraorbital ridge. No sexually dimorphic characteristics were observable in the remainder of the material (D).

5.3.3.3 Estimation of stature

Stature could not be estimated due to the lack of long-bone measurements.

5.3.4 Minimum number of elements (MNE)

The 77 fragments recorded represented 75 elements (see Table 5.3). The minimum number of elements is not much smaller than the total number of identifiable fragments recorded as many fragments had been permanently reconstructed into recognisable elements.

Just over half of the elements (51%, 38/75) were attributed to skeleton A, the latest, articulated burial. The majority of the remainder belonged to skeleton B (24%, 18/75) and skeleton C (a younger adult, only reliably represented by teeth). The remaining 19% (14/75), the elements referred to as D, could not be attributed to either skeleton.

Both skeleton A and particularly skeleton B contained a predominance of left-sided elements over right-sided elements. For skeleton A we can see from the grave plan that the left side of the skeleton is more complete than the right side, which may be a factor of its position within the feature. The original authors noted that bone preservation was worse above the two 'pockets' at either end of the feature, shown as dashed lines on Figure 5.2, accounting for the absence of the upper and lower body of skeleton A. For skeleton B the difference in left and right elements is mainly due to a difference in left and right teeth, accounted for by the presence of only the left mandible, with equal numbers of left and right upper teeth present. The remaining elements, excluding the teeth, come from both sides of the body, at a ratio of 5:4. It is worth noting that the presence of upper teeth, attributed to this individual, indicates that a cranium (or at least the maxilla) was present at one time, perhaps represented by the fragment of the parietal bone, counted amongst the D

	Skeleton A				Skeleton B				Skeleton C				D				
Element	*L*	*R*	*u*	**MNE**	*L*	*R*	*u*	**MNE**	*L*	*R*	*u*	**MNE**	*L*	*R*	*u*	**MNE**	**Total**
Cranium							1	1							1	1	2
Mandible					1			1									1
Clavicle														1		1	1
Scapula																	0
Humerus	1			**1**										1		1	2
Radius	1			**1**		1		1					1			1	3
Ulna	1			**1**		1		1									2
Hand: carpals	6			**6**													6
Hand: MC	3			**3**											2	2	5
Hand: Prox. Phalanx	4	4		**8**											1	1	9
Hand: Int. Phalanx	3	5		**8**													8
Hand: Dist. Phalanx		3		**3**													3
Ribs																	0
Cervical vert.															2	2	2
Thoracic vert.															1	1	1
Lumbar vert.																	0
Sacrum																	0
Os Coxa	1	1		**2**													2
Femur	1	1		**2**	1	1		2									4
Patella																	0
Tibia	1	1		**2**	1	1		2									4
Fibula		1		**1**									1		1	2	3
Foot: Tarsal (talus)					1			1									1
Foot: Tarsal (calc)					1			1									1
Foot: Tarsal (other)																	0
Foot: MT													1		1	2	2
Foot: Phalanges																	0
Perm teeth: maxillary					2	2		4	2	3		5					9
Perm teeth: mandibular					4			4									4
TOTAL elements	**22**	**16**	**0**	**38**	**11**	**6**	**1**	**18**	**2**	**3**	**0**	**5**	**3**	**2**	**9**	**14**	**75**

Table 5.3 Minimum number of elements at Les Varennes

material. Equally this fragment could be part of the cranium of individual C, as this person is only represented by five upper teeth. The majority of the remains that could not be attributed (D) were unsided elements.

5.3.5 Minimum number of individuals (MNI)

Based on the stratigraphic position of the remains, re-fitting and paired elements the original analysis concluded that a minimum of three people were represented (A, B and C), at least two in the earliest deposit of human remains (B and C) and a later burial (A).

Elements from the earliest deposit (stratigraphic unit 3) that could not be assigned to a specific individual were grouped together as skeleton D. There were only two possible instances of repetition of elements present in B or C. Group D contained a fragment of cranium which cannot belong to B (who already has the same element and zone) but it could belong to individual C. Group D also contained a radius, though this was sided as left and so could belong to either B (a pair to the right radius) or individual C. So, these remains did not increase the minimum number of individuals (all the elements in D could belong to individuals B or C).

My analysis of individual A recorded five right-sided intermediate hand phalanges, two more than the original analysis and one more than the four expected for a single individual, potentially indicating the presence of a second individual. However, the identification of these partial elements is not very reliable and their siding is based on the position in the grave (the phalanges themselves being difficult to side accurately); for example, it is possible that the additional phalange may actually be from the left side, or may be a proximal rather than intermediate phalange, and in either case they would not be additional elements. As a result I do not consider them reliable enough evidence upon which to conclude the presence of a second individual.

5.3.6 Completeness of elements

Overall, where the same bones could be compared, there was no consistent difference between the completeness of elements from individual A and those remains from the earlier deposit (B and D). However, as perhaps could be expected, the elements from the semi-articulated individual A, did have a higher average completeness (33%) than those from the earlier context (24% and 20%) (see Table 5.4). Both groups of remains contained elements that ranged from being complete or almost complete (80-100%) to those that were a third, or less than a third, complete. The earlier deposit contained a few elements which were less than 10% complete but individual A did not. In both skeletons A and B the upper limb bones were on average more complete than the bones of the lower limb.

	% completeness of elements			
Element	***A***	***B***	***C***	***D***
Cranium	0.0	86.7	0.0	6.7
Mandible	0.0	7.1	0.0	0.0
Clavicle	0.0	0.0	0.0	100.0
Scapula	0.0	0.0	0.0	0.0
Humerus	100.0	0.0	0.0	36.4
Radius	81.8	72.7	0.0	9.1
Ulna	40.0	80.0	0.0	0.0
MC's	43.3	0.0	0.0	33.3
Ribs	0.0	0.0	0.0	0.0
Os coxa	37.5	0.0	0.0	0.0
Femur	77.3	50.0	0.0	0.0
Tibia	35.0	43.0	0.0	0.0
Fibula	50.0	0.0	0.0	50.0
MT's	0.0	0.0	0.0	50.0
Average completeness	**33.2**	**24.3**	**0.0**	**20.4**

Table 5.4 Completeness of elements (N.B. skeleton C was only represented by teeth, for which 'completeness' is not calculated)

5.3.7 Skeletal part representation

5.3.7.1 Bone representation index

Using the minimum number of individuals the bone representation index was calculated for each individual/group of elements and shows the number of elements present as a percentage of those expected for the MNI (see Table 5.5 and Figure 5.4). However, treating B, C and D separately is misleading as there is no evidence to suggest that the bones in group D belong to a separate individual (see section X above), and they most likely belong to individual B and/or C. So, for the purposes of the BRI the remains were grouped together as an assemblage representing a minimum number of two individuals (B, an older adult, and C, a younger adult), which is also in keeping with their context in stratigraphic unit 3.

Some elements were completely missing from all of the individuals, regardless of context, such as the hyoid, manubrium, sternum and scapula, the ribs, the lumbar and sacral vertebrae, the patellae and foot phalanges. In fact, the whole of the vertebral column was very poorly represented, since only two vertebrae (cervical (neck) vertebrae), were found in the whole assemblage (in unit 3). One of these was the second cervical vertebra (C2 or axis) which is the densest of the cervical vertebrae. The missing elements do seem to correspond with some of the most cancellous bones (e.g. the sternum and vertebrae) or thinner bones (e.g. the scapulae) of the skeleton which are known to preserve less well in the burial environment, and mostly, aside from the patellae and foot phalanges, it is the torso that is under-represented. The sternum, ribs and vertebrae have frequently been under-represented though the densest part of the scapula, the glenoid fossa (shoulder joint), does usually survive relatively well. The patellae are also frequently not recovered (Bello and Andrews, 2006).

Bone representation index (% of expected)					
Stratigraphic unit:	Unit 4	Unit 3			
Element	**A** (MNI=1)	**B+C+D** (MNI=2)	B (MNI=1)	C (MNI=1)	D (MNI=1?)
Cranium	0.0	**100.0**	100.0	0.0	100.0
Mandible	0.0	**50.0**	100.0	0.0	0.0
Hyoid	0.0	**0.0**	0.0	0.0	0.0
Clavicle	0.0	**25.0**	0.0	0.0	50.0
Manubrium	0.0	**0.0**	0.0	0.0	0.0
Sternum	0.0	**0.0**	0.0	0.0	0.0
Scapula	0.0	**0.0**	0.0	0.0	0.0
Humerus	50.0	**25.0**	0.0	0.0	50.0
Radius	50.0	**50.0**	50.0	0.0	50.0
Ulna	50.0	**25.0**	50.0	0.0	0.0
Carpals	37.5	**0.0**	0.0	0.0	0.0
Metacarpals	30.0	**10.0**	0.0	0.0	20.0
Hand phalanges	67.9	**1.8**	0.0	0.0	3.6
Ribs	0.0	**0.0**	0.0	0.0	0.0
Cervical vert	0.0	**14.3**	0.0	0.0	28.6
Thoracic vert	0.0	**4.2**	0.0	0.0	8.3
Lumbar vert	0.0	**0.0**	0.0	0.0	0.0
Sacrum	0.0	**0.0**	0.0	0.0	0.0
Os coxa	100.0	**0.0**	0.0	0.0	0.0
Femur	100.0	**50.0**	100.0	0.0	0.0
Patella	0.0	**0.0**	0.0	0.0	0.0
Tibia	100.0	**50.0**	100.0	0.0	0.0
Fibula	50.0	**50.0**	0.0	0.0	100.0
Tarsals	0.0	**7.1**	14.3	0.0	0.0
Metatarsals	0.0	**10.0**	0.0	0.0	20.0
Foot phalanges	0.0	**0.0**	0.0	0.0	0.0
Teeth	0.0	**20.3**	25.0	15.6	0.0
Total	**17.9**	**8.7**	**8.5**	**2.4**	**6.6**

Table 5.5 Summary table of BRI, by individual skeleton and by stratigraphic unit

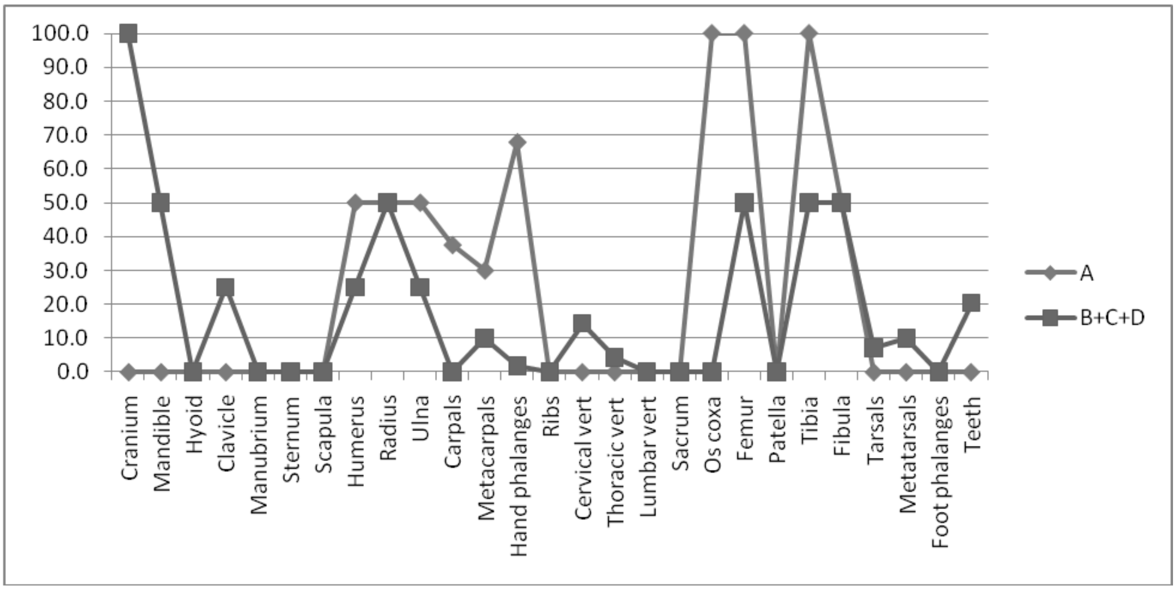

Figure 5.4 Bone representation index for individuals at Les Varennes

No parts of the head, neck, and shoulders or the upper and lower torso were represented for Skeleton A. The elements are limited to those of the upper limb, the pelvis and lower limbs. Between a third and two-thirds of the different categories of hand bones (carpals, metacarpals and phalanges) were present but none of the foot bones were recovered (despite the relative robusticity of the tarsals in particular). Only the left upper limb was present, though the position of the hand bones (lying over the right and under the left hip) indicated that both hands were present. The missing right upper limb, along with the head and torso, is presumably due to the differential preservation in the grave causing the deterioration of these elements, as described by the excavator, as there was no evidence for later removal.

The individuals in unit 3 showed a slightly different pattern of skeletal part representation. In contrast to the later inhumation, the skull (cranium and mandible) and part of the shoulder girdle (clavicle) were present along with some of the upper torso (cervical and thoracic vertebrae) though, apart from the skull, all in relatively low quantities. There was some representation of the upper and lower limbs, similar to individual A, but generally in relatively lower quantities than expected, and in particular, with fewer hand bones when compared to A and no pelvic bones. Conversely, where A did not have any foot bones represented, there were small numbers of tarsals and metatarsals present, though only 10%, or less, of those expected.

The majority of the unidentified fragments (26/27) in the assemblage were derived from unit 3 (B, C, & D) and these were mostly from the appendicular but also from the axial skeleton (eight small fragments), increasing the representation of the torso but not by a significant amount.

Generally there was a lower representation of elements than expected for BCD when compared to skeleton A. Comparatively the representation of the head and hands and feet differed most.

5.3.7.2 Comparison with the intrinsic pattern of skeletal representation

It was also possible to compare a smaller selection of elements with the bone representation index expected for undisturbed skeletons, that is, the intrinsic pattern of preservation of the skeleton as suggested by (Bello and Andrews, 2006). Elements from skeleton A and skeletons BCD were compared with those from Spitalfields crypt, see Table 5.6 and Figure 5.5, as in previous chapters,

Skeleton A appears to follow the relative trend of the Spitalfields data, in that the upper limb is less well represented than the lower limb and in the lower limb the patella and the fibula are comparatively poorly represented. The head and the bones around the shoulder however are under-represented, as is the sacrum.

Element	% Spitalfields crypt	% VdR A	% VdR BCD
Cranium	95.4	0	***100.0***
Mandible	85.6	0	***50.0***
Clavicle	67.9	0	***25.0***
Sternum	62.9	0	***0.0***
Scapula	75.3	0	***0.0***
Humerus	82.2	*50.0*	***25.0***
Radius	78.6	*50.0*	***50.0***
Ulna	76.4	*50.0*	***25.0***
Sacrum	75.3	*0.0*	***0.0***
Os coxa	91.6	*100.0*	***0.0***
Femur	90.0	*100.0*	***50.0***
Patella	48.9	*0.0*	***0.0***
Tibia	87.8	*100.0*	***50.0***
Fibula	73.2	*50.0*	***50.0***

Table 5.6 BRI at Les Varennes compared to pattern of intrinsic preservation (Spitalfields crypt data from Andrews and Bello (2006))

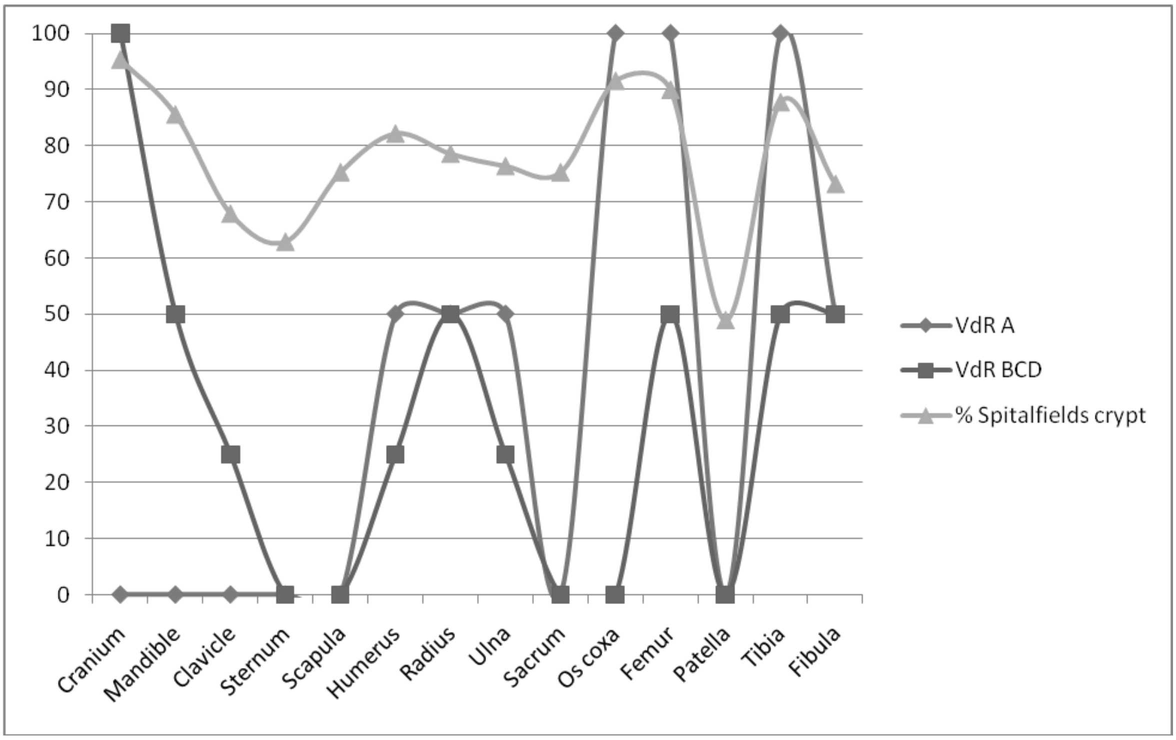

Figure 5.5 BRI of Les Varennes A and BCD compared to pattern of intrinsic preservation

The skeletons represented by BCD also seem to follow the relative trend but with the absence of some specific elements. Whilst the cranium is present, the mandible, the bones around the shoulder and the sacrum are again under-represented. In contrast to skeleton A, the bones of the upper limb, particularly the humerus and ulna, and the os coxae, were also poorly represented.

5.3.8 Spatial distribution of the remains

Spatially, the earlier deposit of skeletal material (BCD, unit 3) was disorganised in a number of ways. The remains were concentrated along the sides of the feature, parallel to its long axis, and no anatomical connections were maintained. In fact not only were elements from upper and lower limbs mixed together but some elements had also been inverted. The proximal end (that closest to the head) of the majority of the bones was orientated towards the south-west end of the pit but several elements, on both sides of the pit, had been inverted. Links were identified between parts of the same bone, articulating bones or paired bones, spanning both the width and length of the pit (see Figure 5.5). These characteristics suggest that the remains do not simply represent an inhumation that has been moved to one side, as a greater degree of movement and re-organisation is implied. There was no trace of remains in the centre of the pit as this had been truncated by the later burial. If this later excavation did disturb remains they appear to have been removed and not redeposited.

Skeleton A was inserted parallel with the long axis of the pit, re-cutting it to roughly the same level as the earlier remains and slightly wider. It appears to have been laid supine and extended, with arms along the sides of the body and the hands by the hips, and similarly to the earlier deposit, with the head towards the south-west end of the pit. Several flint blades were also deposited along with it. Neither skeleton extended, or, was preserved along the whole of the features' length; bones were very scarce at each end, just a fragment of cranium and a fragment of mandible, respectively. The body of skeleton A probably decomposed in a closed space, as indicated by the position of the remains, therefore the burial must have been backfilled relatively soon after deposition.

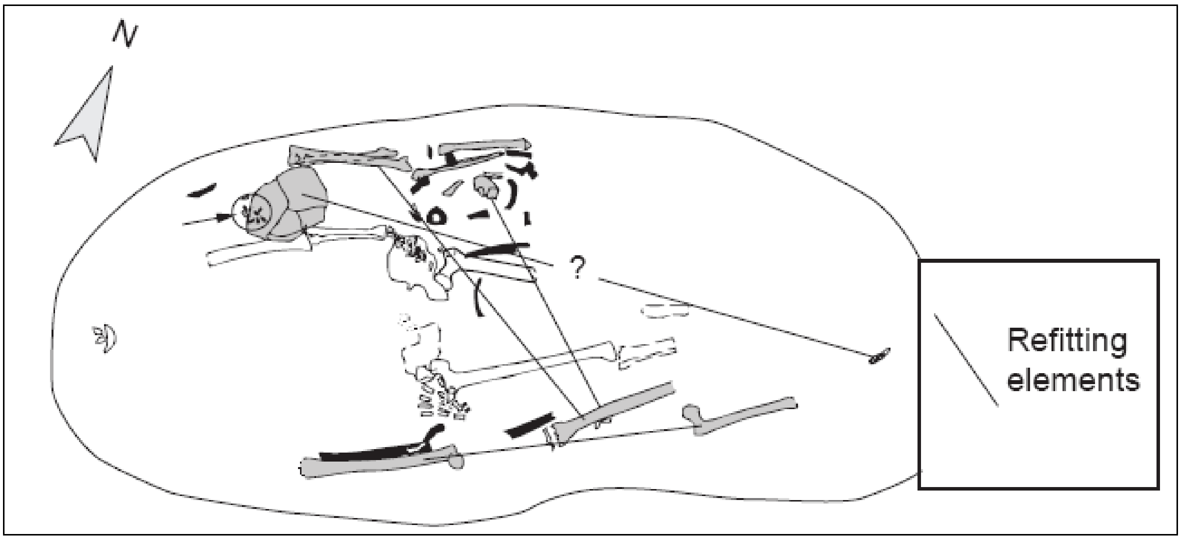

Figure 5.6 Plan of the burial showing the orientation of elements and refitting or paired elements (after Billard *et al*. (2001))

5.3.9 Modifications

No modifications were observed.

5.3.10 Discussion of body treatment at Les Varennes

The remains from Les Varennes demonstrate variation in the treatment of the body within the use of just one feature.

Firstly, one, or possibly two adjacent, pits were excavated (depth c. 1m) and after they had at least half filled-in the pit was re-excavated to accommodate a collection of human remains. At least two individuals were deposited, a young adult or adolescent and a mature adult. Their remains were substantially disarticulated and re-arranged and several elements were missing. It was not possible to determine whether their remains had been deposited as disarticulated elements, or whether they had originally been placed in the grave as articulated bodies and rearranged at a later date. Any stratigraphic evidence for subsequent opening of the pit and re-arrangement of the remains, would have been destroyed by later truncation. One reason why it was not possible to differentiate between these scenarios was that there was very little evidence for the method of disarticulation, not least because of the degree of erosion/root-etching of the bone surfaces. If they were deposited as disarticulated elements presumably disarticulation and/or skeletonisation occurred elsewhere through excarnation, burial elsewhere or manual dismemberment. It was also not possible to demonstrate the contemporaneity of the two individuals, though there was no evidence to suggest successive deposits. Less than 10% of these individuals bodies were represented but again it was not possible to determine whether the missing elements were due to deliberate removal or loss, poor preservation, or later truncation. What is certain, if the stratigraphic representation of the feature can be relied upon, is that these remains were disarticulated and commingled *before* skeleton A was inserted into the grave, and they were not moved aside as part of the same practice as A's deposition (contra Billard *et al*. (2001)). These remains appear to have been completely back-filled, up to the level at which the present feature was recorded.

Apparently different in its nature was the deposition of a further individual, represented by skeleton A. The pit was re-excavated down to a similar level as the deposition of the earlier remains but this time an intact (fleshed) body was laid extended along the length of the pit, lying supine (on the back). The burial was back-filled relatively soon afterwards, the body later decaying within this filled space, and an impressive funerary offering of animal remains, complete with antler and horns, was piled up and burnt above the pit. This inhumation has been dated to the middle Mesolithic but the length of time between this and the earlier deposit is not known. There are some possible indications that the feature was alive in social memory; the later burial is orientated the same way as the predominant orientation of the earlier remains, and the insertion of the latest burial close to the level of the earlier remains may also have been deliberate.

6 Different and complementary: Comparisons of mortuary practice using osteological data

6.1 Introduction

In this chapter I will review and compare the mortuary practices identified in the osteological case studies and discuss how different practices may be identified in the relative representation of skeletal parts and patterns of modifications such as cut-marks and dry fractures. I will then place these practices and sites in a wider context by comparing the case studies with several other sites from north-west Europe where comparable osteological data were available. The aim is both to develop the interpretation of practices at the case study sites and to shed new light on existing interpretations of other sites. I will also explore the possibility that some seemingly different practices may simply be different components of broader mortuary rites where the body was treated in a range of different ways at different locations. Finally I will also consider how the small assemblages of disarticulated skeletal material, sometimes referred to as 'loose human bone', relate to the different aspects of Mesolithic mortuary practice.

6.2 Mortuary practices at the case study sites

The case studies showed that the treatment of the body could vary both between different sites and within them, as several different practices were identified at each site. These were described in Chapters 3, 4 and 5 and will be briefly reviewed here before comparing them with each other and with other sites in north-west Europe.

6.2.1 Hardinxveld

At the site of Hardinxveld more than one form of body treatment was carried out; the remains of six individuals (MNI) were scattered across the site and a further person was buried shortly after death, their body placed in an extended supine position in a single inhumation. At least four adults and two sub-adults were represented by the scattered human bone and both the representation of the different elements and their deposition did appear to be the result of mortuary practices and not post-depositional disturbance (as discussed in Chapter 3). I have suggested that one possible explanation for the pattern of elements recovered is as follows: after death, bodies were excarnated by exposure, either at another location or another part of the site, and animals were prevented from gaining access to them, perhaps by elevation on scaffolding. During this process hand and foot bones became disarticulated from the body and the cranium was also separated, at least partially, though cut marks on one (cranium 10297) suggest that some tissue was still present. The cranium and long bones were recovered from the body and were subject to further processing. This included the defleshing and disarticulation of the cranium, scapula, clavicle, radius and two femora from different individuals to remove any flesh or ligaments still adhering to the bone, and the deliberate breakage of the clavicle, radius and femora. After this some elements (or fragments of them) were deposited in the marsh or on the donk surface whilst others were removed from the site. The remainder of the body, the torso (ribs, vertebrae, and pelvis), was either left behind at the exposure site or collected up and deposited elsewhere. The concentration of elements referred to as grave 2 may represent such an assemblage.

6.2.2 Petit Marais

At Petit Marais, burial practices consisted of at least three different types carried out over several centuries: secondary burial, cremation of the body, and the deposition of disarticulated remains (a single fragment of cranium). Detailed part representation data was only available for the secondary burial so the cremated individual could not be considered in this comparison. The remains indicated that the body of a single individual had probably been left on the ground surface, or in a shallow burial, and when completely skeletonised and disarticulated the remains were collected together and rearranged in a small feature in the ground. The long bones were placed at the bottom of the feature and the skull placed on top with paired bones arranged around it. Missing elements were consistent with the effects of two processes; firstly, the movement of the skeleton was probably responsible for the loss of the maxillary teeth, the hyoid, hand and foot phalanges and carpals and tarsals; secondly, the differential preservation of elements probably explains the absence of the manubrium and sternum, and the under-representation of the ribs and the cervical and thoracic vertebrae. The bones of both lower arms and the lower leg had also been deliberately or accidentally fractured after the skeletonisation of the body but before the bones were deposited in the pit, perhaps during the preparations for the secondary burial. Portions of these bones were either left behind at the site of primary deposition, lost during its transportation, deposited where the preparation of the body took place, or perhaps even curated.

6.2.3 Les Varennes

At 'Les Varennes' (Val-de-Reuil), variation in the treatment of the body was observed within a single feature. A grave-like oval pit contained an initial deposit of the partial and disarticulated remains of at least two individuals (9% of their expected remains). It was not possible to determine whether they had been deposited as disarticulated elements, after skeletonisation elsewhere, or as complete bodies which were re-arranged at a later date.

These remains were subsequently truncated by the reopening of the feature for the inhumation of a single body, laid supine and probably extended, along the long axis of the pit. This person appears to have been buried not long after death as the decomposition and skeletonisation of the body took place within the backfilled feature (as shown by the position of the hand bones/hip joints). The head, torso and lower legs of this individual were probably missing due to poor preservation, but disturbance or deliberate removal of elements cannot be ruled out. After this person was deposited in the feature a spectacular arrangement of animal bones (skulls of red deer, roe deer, and auroch, complete with antler and horns, and remains from wild pig and beaver) was placed over the fill of the pit and burnt.

6.2.4 Comparing the representations of different practices

These different practices are clearly represented in differences in the bone representation index (BRI) for each site (Figure 6.1, Figure 6.2, and Figure 6.3). This is the number of bones present in the assemblage compared to the number of bones that would be expected for the number of individuals that the assemblage represents. Petit Marais for example stands out as it has the highest overall skeletal representation, with around 40% of the body represented, compared to around 4% at Hardinxveld. At the former only the hands, feet and upper torso are under-represented, and even then they are mostly better represented than at the other sites. It is the only site where more than 10% of the foot bones were represented, for example. Conversely the Hardinxveld scatter is characterised by the near absence of the torso, upper limbs and hands and feet, in contrast to the other sites.

Equally, similarities in practice may result in similar profiles. The BRI for the first group of remains deposited at Les Varennes (BCD) does appear to resemble that of the Hardinxveld scatter. For both, the cranium and lower limbs are the most abundant (with the addition of the radius at Les Varennes) but the torso and hands and feet are under-represented. This may support the theory that the remains at Les Varennes may have been partially skeletonised by exposure before deposition in the pit.

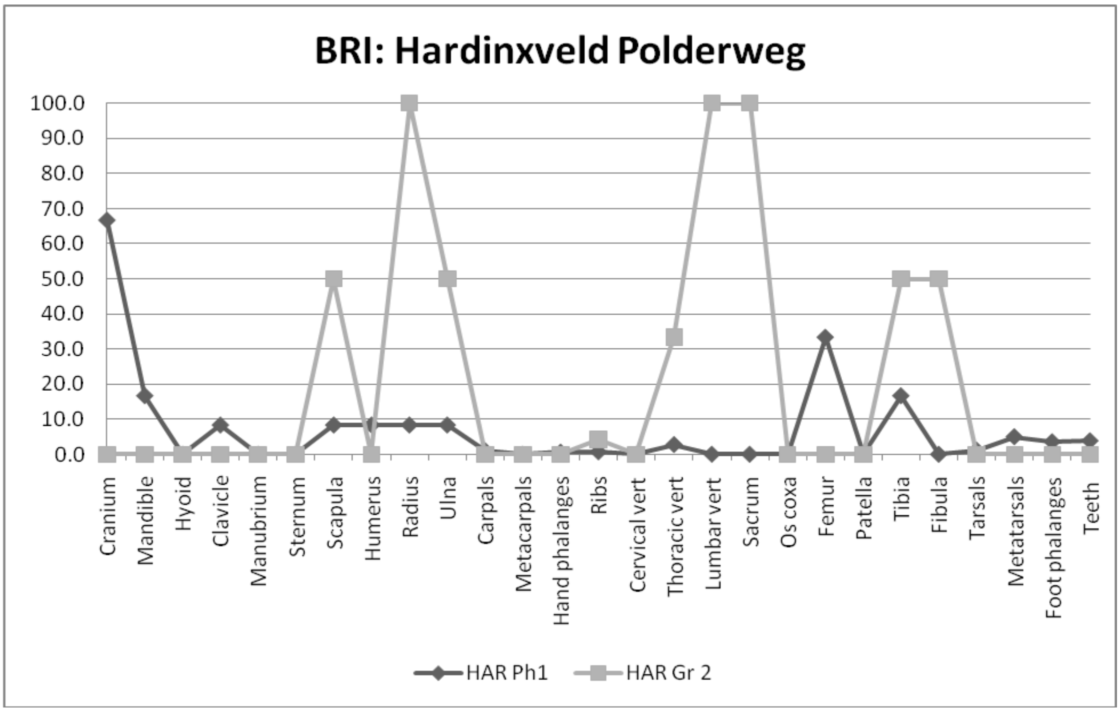

Figure 6.1 Bone representation index for individuals at Hardinxveld-Polderweg

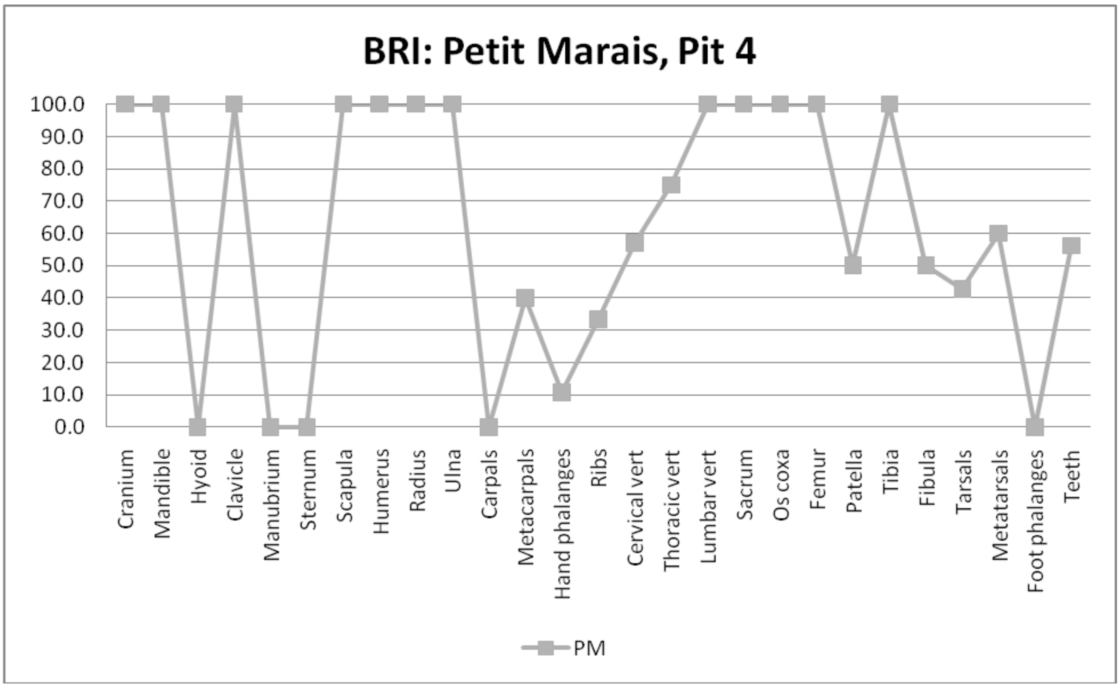

Figure 6.2 Bone representation index for the individual from Petit Marais, Pit 4

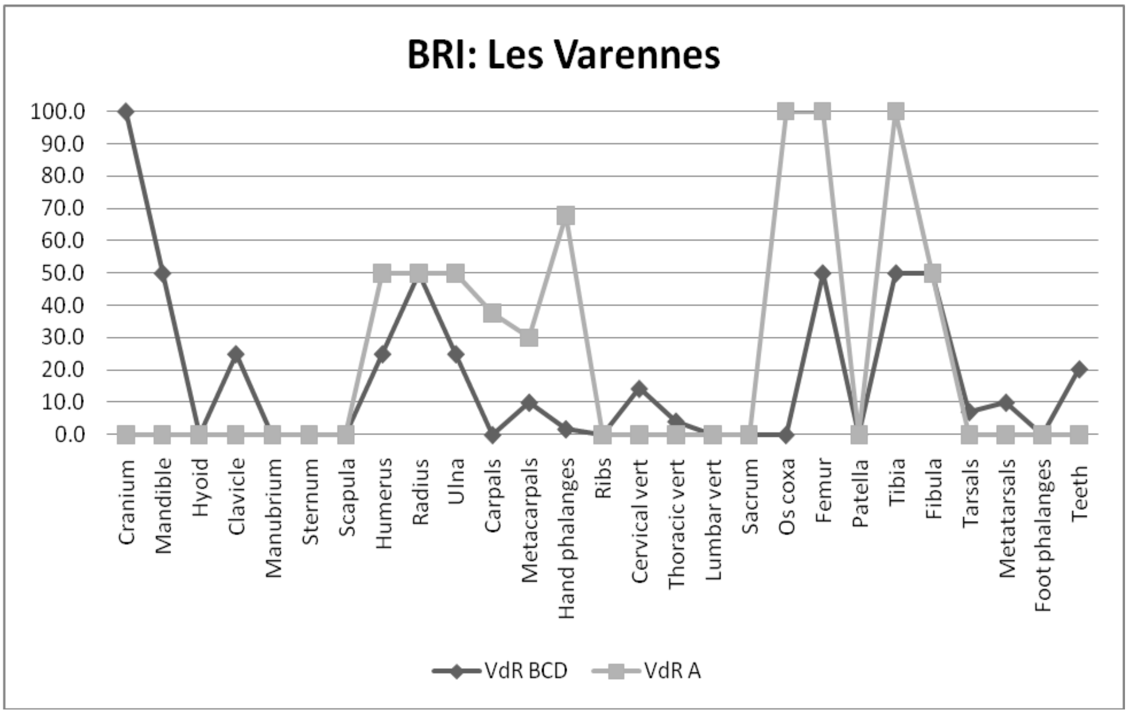

Figure 6.3 Bone representation index for individuals at Les Varennes

Some other general similarities could also be observed. All of the assemblages were missing the hyoid bone and the manubrio-sternum and very few foot phalanges were recovered from any site. The hyoid is a small bone located in the structures of the neck, which as well as being a target for scavenging animals, may disarticulate (once skeletonised) into three separate parts and is frequently not recovered. The bones of the sternum are frequently under-represented due to their low bone density and possibly their superficial position in the body, which means they are amongst the earliest elements to skeletonise. Foot bones are also generally under-represented, and often less well so than those of the hands, and the survival of phalanges appears to be directly related to their size, being smaller than the other foot bones. Finally, where they occur deliberately fractured bones do not refit with any of the other fragments indicating the corresponding parts of the bone have been removed.

There were also differences and similarities in the occurrence of other taphonomic indicators recorded in each of the case studies. Of the sites examined here, indicators of defleshing and disarticulation (cut marks) were only present on the scattered material from Hardinxveld[8]. This was focused on the head (cranium and clavicle), shoulder (scapula), lower arm (radius) and thigh (femur). This was combined with traces of burning on the

[8] Although this does not necessarily mean that it did not occur at the other case study sites – disarticulation/defleshing by an experienced practitioner can be achieved without leaving a trace on the bones and subsequent erosion of the bone surface may obscure these types of marks.

same cranium which may have also been associated with defleshing. The majority of bones displaying cut marks had also been fractured. Dry fractures of the clavicle, radius, and femora indicate that these elements were broken, probably deliberately, a further indicator of secondary burial practices. The fractured elements at Petit Marais could also be seen as evidence for deliberate fragmentation of bones. Furthermore, as at Hardinxveld, the radii were fractured indicating similarities in the types of bone that were being broken and fragmented. Whilst evidence for processing is rare, instances of cut marks, deliberately fractured bones and evidence for burning are increasingly being recognised on material from Mesolithic sites across north-west Europe, as will be outlined below.

6.3 Interpreting mortuary practices at other European sites

The preceding summary and comparison of the case study sites provide an impression of how these practices may be represented in the osteological data, in particular skeletal element representation and bone modification (patterns of cut marks, burning and fracturing). With these data in mind, the results of these case studies will be compared with a number of other assemblages of Mesolithic human remains from north-west Europe, with the following aims:

- To identify similarities and differences in the treatment of bodies across Mesolithic north-west Europe (wider context)
- To shed new light on the practices undertaken at other sites
- To inform the interpretations of the case study sites by comparison with assemblages that are thought to result from specific practices, such as cannibalism
- To examine how an understanding of process and practice will help us to interpret the smaller assemblages of human bone

Five sites in the catalogue of sites compiled in Chapter 2 were identified as having a comparable level of skeletal data; Noyen-sur-Seine (39) and Grottes des Perrats (32) in France, Cnoc Coig in Scotland (27), Abri des Autours (57) and Grotte Margaux (58) in Belgium. Either a sufficiently detailed inventory was available to allow the construction of a BRI (based on an MNE) or published descriptions of part representations allowed some comparisons to be made.

6.3.1 Noyen-sur-Seine

The first of these sites is Noyen-sur-Seine (Seine-et-Marne, France) (39), a mid-late Mesolithic site excavated in the 1980’s by Claude and Daniel Mordant (see Marinval-

Vigne *et al.*, 1989, Mordant and Mordant, 1992). Located on a gravel promontory in a meander on the edge of the river Seine, the site was originally known as a mid Neolithic causewayed enclosure and Mesolithic remains were only discovered when excavation was extended into the adjacent peat deposits in search of contemporary organic material in the surrounding wetlands.

Mesolithic remains were located in the peat deposits on the edges of channels and ponds and consisted of several thousand animal bones and lithics, around a hundred bone tools and several rare wooden artefacts, such as fish traps, a dug-out canoe and baskets. These were distributed over two main levels in the peat, indicating at least two periods of occupation between 8000 and 6500 uncal bp (*ibid*. 59). The inhabitants of the Seine valley occupied a varied landscape: river channels and grass-covered gravelly islands surrounded by wetlands and wooded terraces. For the middle Mesolithic, faunal remains indicate an emphasis on fishing, especially of eel, and hunting, dominated by forest-dwelling animals, such as red deer and wild pig, but also including aquatic birds and river mammals, such as beaver and otter (*ibid*.: 59).

Human remains were also recovered from amongst this material, and have been linked to the middle Mesolithic levels, dated to 7246-6638 cal BC (8000 ± 100 bp (Gif-6633) *ibid*.: 58) These scattered remains consisted of four crania, a mandible, long bones from the upper and lower limbs, and a few vertebrae and foot bones (*ibid*.: 61). Previous analysis has shown that they represent at least four individuals (Auboire, 1991: 230). This analysis also identified cut marks on the external aspect of the mandible (ramus/coronoid process), and the proximal left radius and left ulna. These result from the severing of the *masseter* muscle, which attaches the lower jaw to the upper jaw, and probably the *brachialis* and *flexor digitorum profundus*, which flex the forearm and flex the distal hand phalanges, respectively (ibid.:234, Stone and Stone, 2000). The cut marks appear to derive from the action of detaching the lower jaw from the cranium, the lower arm from the upper arm, at the elbow, and the hand from the lower arm, at the wrist. A left femur (femur no.3, Frag no. 133) also displayed traces of burning on the femoral head (proximal joint surface). There were no modifications indicating that animals had access to the remains, despite the presence of canids at the site, as indicated by the remains of wolves amongst the faunal material.

The original analysis suggested that these modifications could either be the result of cannibalism or funerary rites, though without any further discussion (Auboire, 1991: 235). They do, however, cite a forthcoming comparison with the cut marks observed on the animal remains, with the aim of investigating the issue further, though unfortunately this has not yet been published.

Using the descriptions and illustrations in Auboire's published specialist report it was possible to record the 24 fragments recovered to the level of zone, and enter them into the 'Fragments' database. The only exceptions were the fragment of maxilla (cranium), fibula and the three vertebrae, which were not described in detail, and could only be recorded as present. It was not possible to access the material to check for re-fits but the zoning of elements ensured that potentially conjoining or overlapping fragments could be identified. The fragments represented a minimum number of 22 elements (the MNE), and, as in the previous analysis, a minimum number of four individuals, three adults and one sub-adult (*c*. 6-11 years). The bone representation index (BRI), was subsequently calculated using the MNE and MNI.

Based on the analysis of the BRI the distribution of skeletal parts at Noyen-sur-Seine is most similar to that of the scattered material from Hardinxveld (see Figure 6.4). The similarities between the two profiles are remarkable, they both show a complete lack of hand and foot bones, and the entire torso (the ribs, vertebral column and pelvis) was almost entirely absent. As at Hardinxveld, the cranium and femur were the most abundant elements, the mandible was under-represented in comparison with the cranium, and very few teeth were recovered. At both sites bones of the upper and lower limbs were present, but they were still very under-represented. The evidence for manual disarticulation (cut-marks) at Noyen and patches of burning on bones were also similar to those seen at Hardinxveld. Cut-marks on the radius and ulna at Noyen, and the scapula and radius at Hardinxveld, show that the arm was a focus for disarticulation practices at both sites. The head was also subject to disarticulation but practices differed slightly. At Noyen, cut-marks on the mandible suggested that the lower jaw was removed from the head and at Hardinxveld cut-marks on the cranium and clavicle indicated that the head was separated from the body, with no evidence for removal of the jaw. However, the clavicle was not recovered from Noyen and the occipital bone was only present on one of the crania, so this difference may be a result of differences in the elements represented.

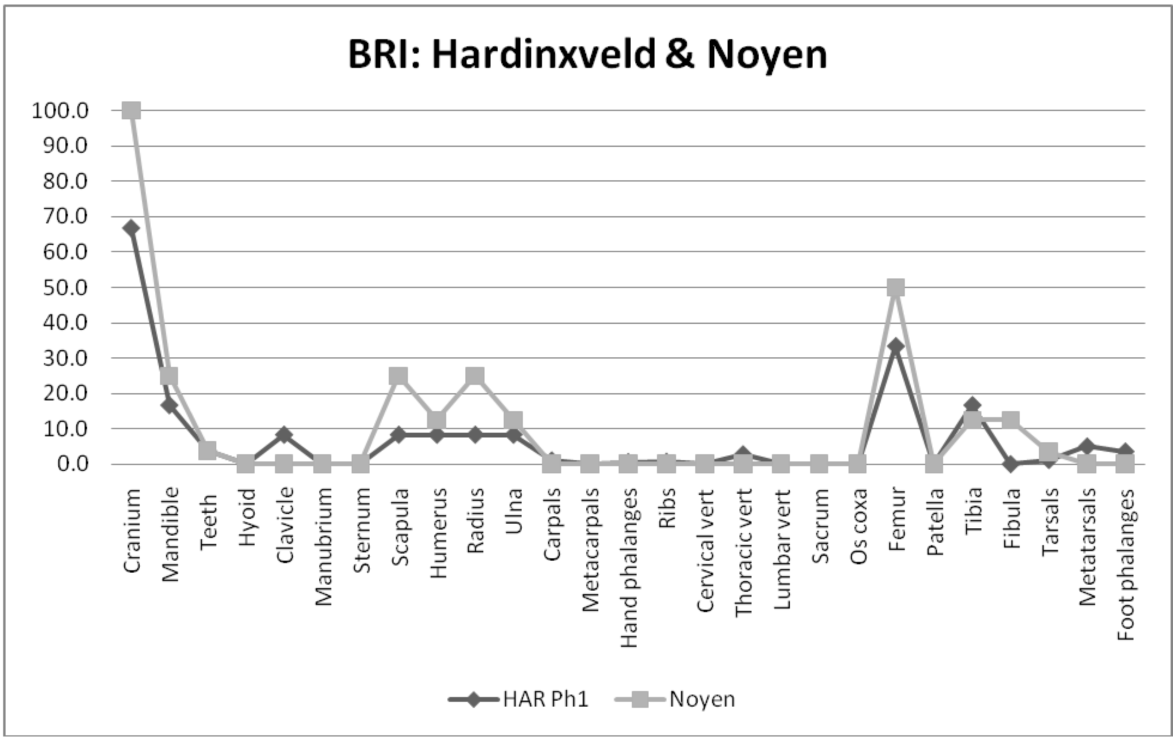

Figure 6.4 Comparison of BRI at Hardinxveld (phase 1) and Noyen-sur-Seine

The patch of burning described on the surface of the femoral head from Noyen also seems similar to that observed on elements at Hardinxveld, where patches on the edges/protruding areas of a humerus and cranium were burnt. As discussed for the remains at Hardinxveld, it is possible that bones in surface scatters are exposed to heat accidentally, through proximity to fires and hot waste, though we might expect this to produce a more randomly distributed pattern of burning on the effected elements. The evidence from Noyen, again limited to the end/edge of the bone, may, however, lend support to the idea that the burning is the result of deliberate practice. The pattern of burning could be consistent with exposing fleshed elements to heat, whereby those areas with least tissue covering them, typically the ends of long bones and bony protuberances, become charred. The purpose of this could be to aid the defleshing of the body or, of course, for consumption, drawing obvious parallels with the cooking and eating of animals. No other evidence for the consumption of human remains (such as fresh fractures) has been recovered from Hardinxveld or Noyen, however. Whilst cut marks indicate that the body was disarticulated and defleshed, the fragmentation of elements appears to have occurred when the bones were partially dry, rather than completely fresh, which is not consistent with fracturing for the extraction of marrow for consumption.

The types of elements represented and modifications that have been observed at Noyen would suggest that similar practices were occurring here as have been argued for

Hardinxveld: disarticulation of the body, possibly through a combination of exposure and manual disarticulation, and defleshing of certain elements (the head, arms and legs), which were then deposited at the site.

6.3.2 Cnoc Coig

Another assemblage of scattered material, where data was available for comparison, was recovered from Cnoc Coig (27), one of five later Mesolithic shell midden sites on the island of Oronsay in the Inner Hebrides, Scotland.

The majority of the material was recovered during excavations carried out by Paul Mellars in the 1970's, during which 49 human skeletal elements were found dispersed within the well-stratified midden deposits (Meiklejohn and Denston, 1987: 290). A smaller number of fragments were also recovered from two other middens, Caisteal nan Gillean II (five pieces) and the Priory Midden (one piece), and there was no evidence for inhumation of complete bodies at any of the sites (*ibid*.). Collectively this material was comprised of teeth, hand and foot bones, some other postcranial bones and fragments of cranium, but those of the hand and foot predominated at all three sites (*ibid*.: 296). These represent a minimum of seven individuals for the three sites, including at least one child, an adolescent/young adult (<21-24 years) and other adults, probably of both sexes. None of the material exhibited cut marks and only one bone, a fragment of cranium, showed evidence of burning. Several of the Cnoc Coig bones have been dated to *c.* 4100 cal BC (Richards and Sheridan, 2000).

At Cnoc Coig, spatial analysis identified that the human bone fell into five main groups (groups 1, 2A, 3A, 4, 5) and two related subgroups (2B and 3B). There were also seven isolated bones though the locations of four of these could not be determined[9]) (Nolan, 1986) (see Figure 6.5). The subsequent discovery of refitting fragments and paired elements between groups 2A and 2B and group 3A and 3B supports the association of the sub-groups suggested by Nolan (Meiklejohn *et al.*, 2005).

Osteological analysis of the remains suggested two types of deposit, the first dominated by hand and foot bones (groups 2A and 2B, 3A and 3B) and the second consisting of the remaining elements (groups 1, 4 and 5, and the isolated bones). Group 2 contained cervical vertebrae, metacarpals, hand phalanges, tarsals and metatarsals, and was considered to represent a minimum of three individuals (MNI = 3) (*ibid*.: 93). Group 3 contained a tooth, fragments of clavicle, vertebrae, and tibia, metacarpals, hand phalanges, tarsals and foot

[9] They were mostly recovered from sieving

phalanges, and also represented at least three individuals (MNI = 3) (*ibid.*). These are not necessarily different or additional individuals, as there was no repetition of elements between groups 2 and 3. The three smaller groups consisted of fragments of cranium, clavicle, os coxa, ribs, and foot phalanges, while the isolated bones were teeth, fragments of vertebra, ?patella and foot and hand phalanges When considered as a whole, these represent at least two adults and a sub-adult.

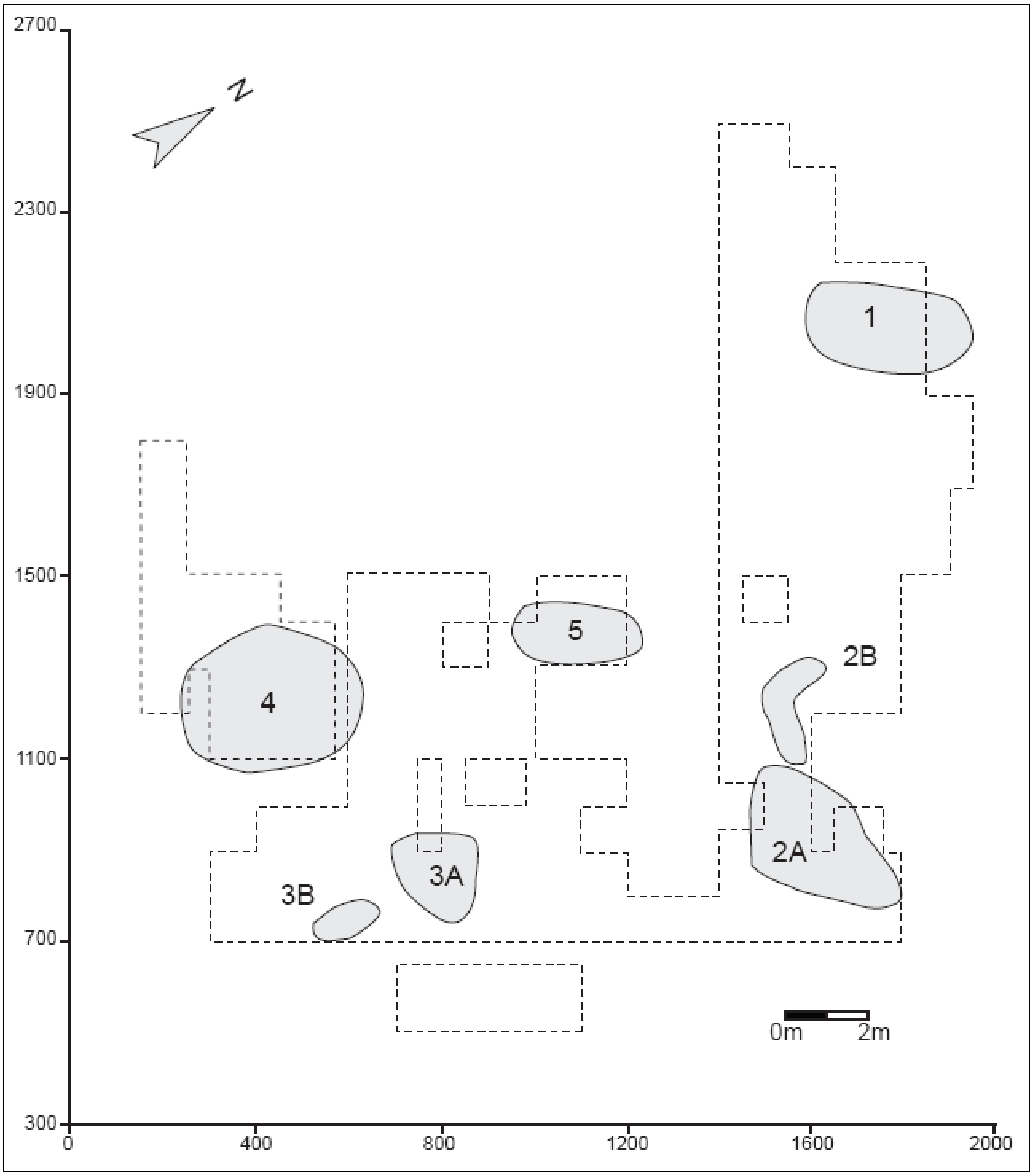

Figure 6.5 Distribution of remains at Cnoc Coig (All human bones, all depths (levels 7-28), after Meiklejohn, 2005: 90)

The material has been interpreted as representing two types of practices: intentional practices, resulting in the deposition of hand and foot bones (i.e. groups 2 and 3), and other, non-specific, taphonomic processes, resulting in the deposition of a range of elements, comparable to the ‘loose bone’ phenomenon (see Chapter 1) (groups 1, 4, 5 and isolated elements) (Meiklejohn *et al.*, 2005). Both Meiklejohn *et al.* and other researchers have suggested that the groups dominated by hand and foot bones could be the result of exposure of bodies on the midden, where the larger bones are taken away and smaller elements are left behind (Pollard, 1996, Bradley, 1997, Telford, 2002, King, 2003). However, Meiklejohn *et al*. take this further arguing that the grouped nature of the bones “represent a phenomenon differing from any other reported deposition of human bones in a European Mesolithic context” (2005: 98).

In general the BRI for the whole assemblage from Cnoc Coig (all groups combined), when plotted alongside Hardinxveld for comparison, shows that although hand and foot bones dominate the assemblage they are actually under-represented in terms of the number of individuals represented at the site[10] (see Figure 6.6). This is equally true when groups 2 and 3 are considered separately (see Figure 6.7). The clavicle and the cranium are in fact the best represented elements, followed by the metacarpals and hand phalanges, the pelvis (os coxa), tibia and foot bones.

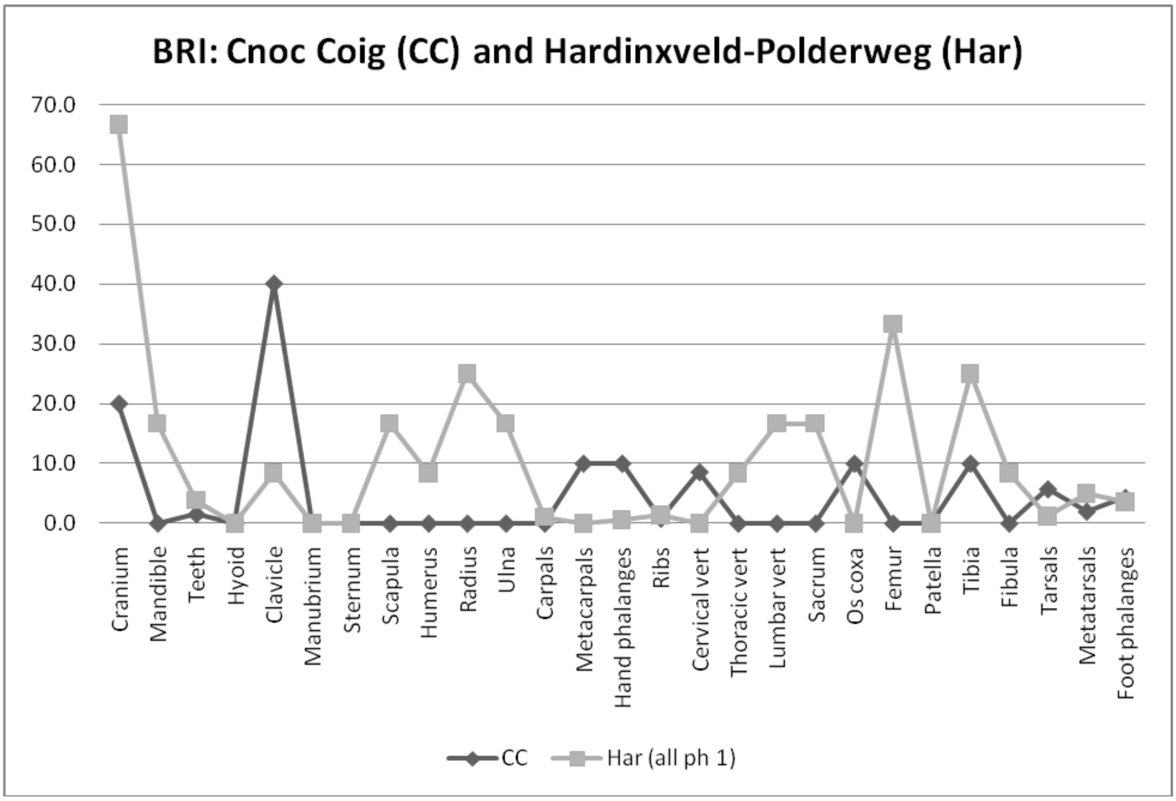

Figure 6.6 BRI (% of expected elements) at Cnoc Coig and Hardinxveld

[10] The BRI accounts for the fact that hand bones are more numerous in the body than other elements

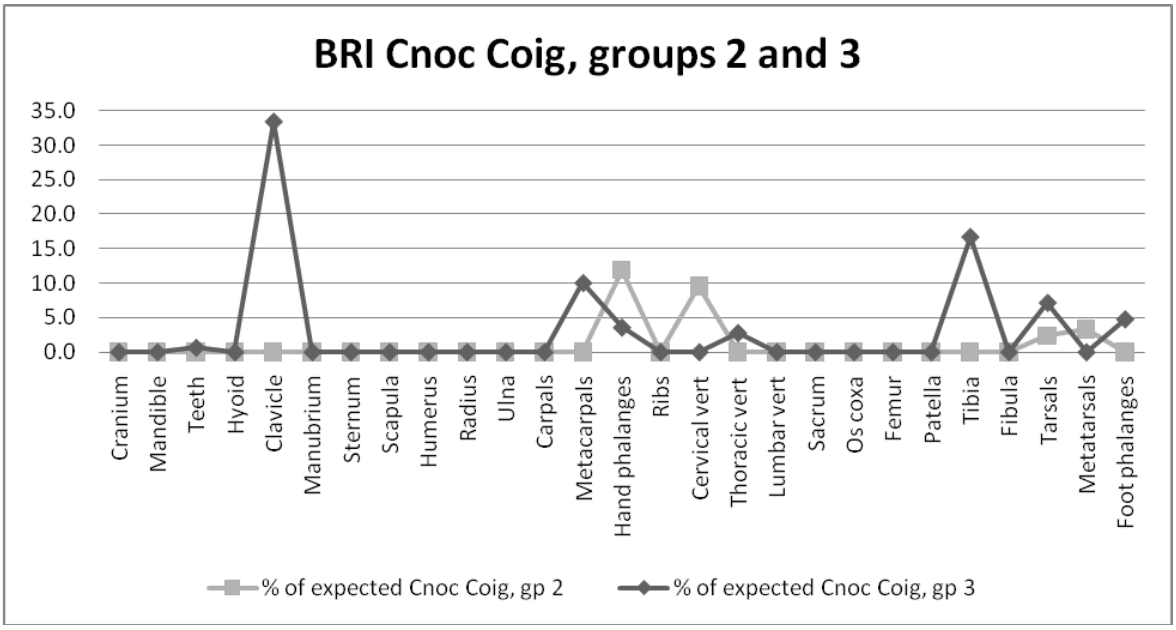

Figure 6.7 BRI at Cnoc Coig, comparison between group 2 and group 3

Overall the pattern of elements deposited at Cnoc Coig is unlike those observed in any of the other assemblages discussed in this chapter, with a total lack of upper limb bones and femora but with the presence of elements rarely represented in the other scattered assemblages, such as the hands and pelvis.

Hand and foot bones may physically outnumber other elements in the assemblage but this is partly a product of the large number of these bones in the body – a single person possesses a total of 106 hand and foot bones (30 carpals/tarsals, 20 metacarpals/metatarsals and 56 phalanges), compared, for example, to only two clavicles per person. In the assemblage as a whole, individual people are equally as well-represented by the vertebrae, pelvis and tibia, as they are by bones of the hands and feet (see Figure 6.7).

That is not to say that the distribution of hand and foot bones does not suggest some deliberate collection of elements. Group 2 consists *mainly* of hand and foot bones, though it does also include two cervical vertebrae, representing three individuals. Furthermore, these elements had been placed in direct association with the bones of a seal's flipper, which is further evidence that they had been deliberately selected and grouped together,

> "... the main concentration of human group 2 is virtually horizontally coterminous with that of seal group 3, although the human group lies just above the seal group. However, this vertical separation is so slight that they must represent successive depositional events which were very closely spaced temporally. Indeed, if the bones of the two groups were assigned to one species, they would almost certainly be judged to be depositionally contemporaneous" (Nolan, 1986: 255).

Both the grouping of the human remains and the juxtaposition with those of a seal would appear to be deliberate acts.

I would suggest that, whilst the pattern of deposition at Cnoc Coig may not have been seen before, it does not necessarily represent a practice "restricted to western Scotland" (*ibid*.: 85). Meiklejohn *et al*. cite the lack of other examples of the pattern seen in bone groups 2 and 3 as a limiting factor in drawing specific conclusions (*ibid*.: 102) yet they fail to see that this may be the biggest clue to its interpretation. The pattern of the presence and absence of skeletal elements recorded at Cnoc Coig is the opposite of those seen at the other mortuary sites included in this study and may therefore, be complementary to them. For example many of the elements that are present at Cnoc Coig are either poorly represented or absent from Hardinxveld and *vice versa* (see Figure 6.6). In both cases the skeletal assemblage is consistent with excarnation or exposure but whilst the material at Hardinxveld had been brought *from* the excarnation site the assemblage at Cnoc Coig represents the place where excarnation was carried out. This is reflected in the presence and absence of particular elements at Cnoc Coig where larger elements (such as crania, arm and leg bones) have been recovered and taken away, leaving behind hand and foot bones, which naturally disarticulate early in the sequence, and inevitably, other parts of the skeleton.

6.3.3 L'Abri des Autours

The skeletal material from the cave site 'Abri des Autours' (57) provide a useful comparison to the sites already discussed. Excavations by Nicolas Cauwe revealed two early Mesolithic 'collective tombs' (the site of Abri des Autours and Grotte Margaux) containing the remains of multiple individuals that were subject to disarticulation and manipulation (Cauwe *et al.*, 1994, Cauwe, 1995, Cauwe *et al.*, 1998, Cauwe, 2001). The caves are situated around 800m apart in the limestone cliffs of the Meuse valley, southern Belgium, and a further eight burial sites are known in the region, all within caves and rock shelters.

The Autours rock shelter is relatively small (*c*. 20m by 5.5m) and held three well-differentiated bone assemblages. The earliest was a single inhumation (labelled AA3 in Figure 6.8) containing the tightly crouched remains of a mature woman covered in ochre, dated to the early Mesolithic (9500 ± 75 BP (OxA-4917)) (Polet and Cauwe, 2007). The second assemblage, the collective burial (labelled AA2), consisted of the scattered remains of six adults and six children and also dated to the early Mesolithic (9090 ± 140 BP (OxA-5838)) (*ibid.*), although there was no stratigraphic connection between them (Cauwe, 2001:

154). Above these were also the remains of three adults and six children (AA1) dating to the mid-Neolithic (5300 ± 55 BP (OxA-5837)), though these are not described in detail here (see Polet and Cauwe, 2007).

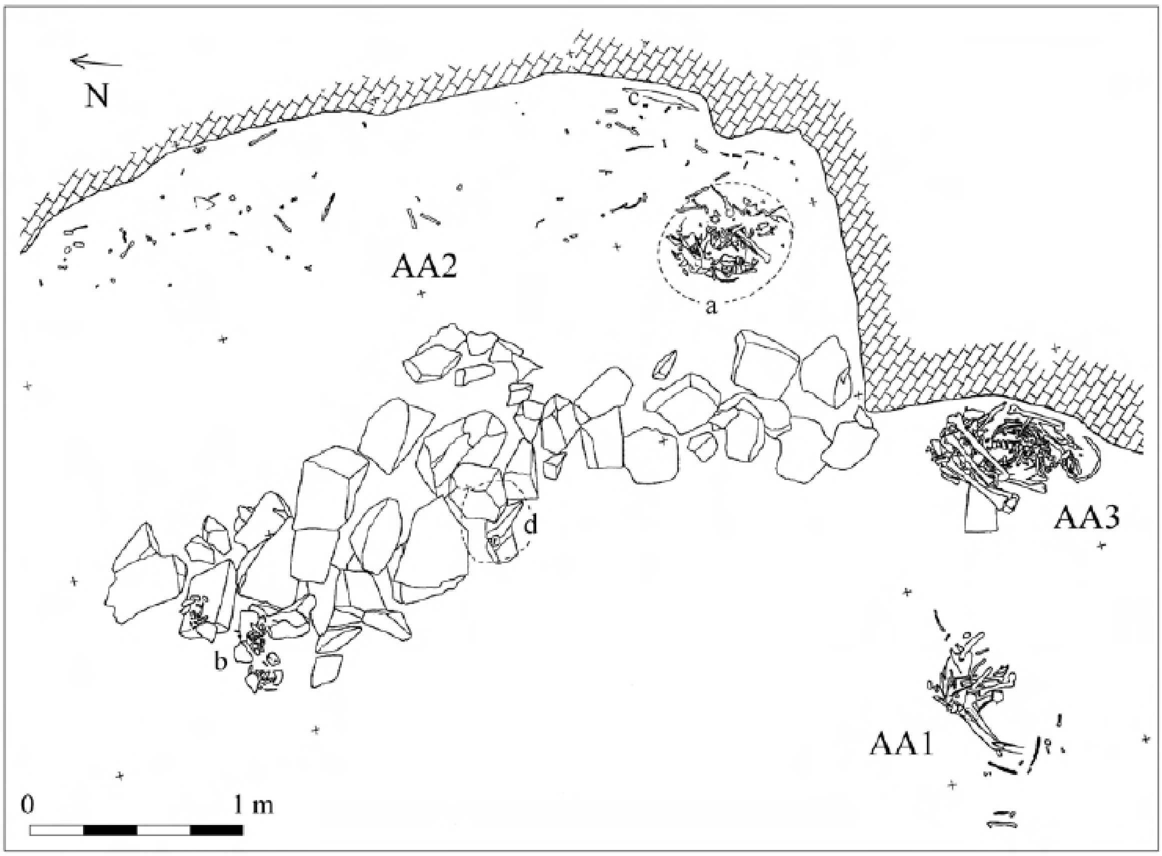

Figure 6.8 The location of remains at Abri des Autours.

Key: AA1: Neolithic collective burial, AA2: Mesolithic collective burial, AA3: individual Mesolithic burial, a: circular pit, b: remains disturbed by previous excavations, d: pit below the dry stone wall (Drawn by N. Cauwe, reproduced with permission from C. Polet).

In the collective burial a minimum of six adults, representing all ages from younger to older adults and both sexes, were present, one of whom had been cremated. At least six juveniles were also represented, ranging in age from 2-4 years, 6-9 years and 12-14 years (Polet and Cauwe, 2007: 91). The remains were distributed over the floor of the eastern half of the cave, between the cave wall and a linear arrangement (or 'wall') of stones, which appeared to close off the area containing the scattered remains (see Figure 6.8). Some of the remains were also deposited within a pit in the south-east corner of the area (labelled as 'a' on Figure 6.8) and a small number of remains were recovered from a pit beneath the middle of the stone wall (labelled as 'd'). The area between the stone wall and the cave wall at the northern end of the cave had been destroyed by previous 'illicit' excavations and disturbed remains were recovered from the northern extent of the stone wall (labelled as ‘b’). Four un-retouched flint bladelets were the only other material found amongst the human bone (Cauwe, 2001: 154) although a few fragments of cremated animal bone were found in association with the cremated individual (2007: 93).

The distribution of the remains within the cave, and the pattern of skeletal elements recovered, indicated that funerary practices included the intentional movement of bones within the cave, and the removal of elements from bodies (and from the cave) *after* deposition. Age at death was also a factor in the spatial distribution of the remains.

The intentional movement of bones around the cave was indicated in a number of ways. Firstly the remains of the adults, including the cremated individual, were disarticulated and dispersed widely throughout the cave, having been deposited within the circular pit (‘a’), on the surface immediately surrounding it, and along the cave wall to the north (2001: 154). This dispersal may have been a gradual process; the remains of two adults were concentrated within the circular pit and whilst some elements had been moved they were less disturbed than the other remains (2007: 87). The base of the vertebral column and the pelvic girdle were still in articulation, showing that some anatomical connections were maintained, and the authors suggest that these may have been some of the latest skeletons deposited, having not yet been fully disarticulated and dispersed throughout the cave. Several elements belonging to these individuals had, however, already been moved; a temporal bone which could be paired to one of the individuals had been placed in the small pit beneath the middle of the stone wall (labelled ‘d’ on Figure 6.8), and several elements (a clavicle, fibula and calcaneus) found in the area disturbed by previous excavations also derived from one of the skeletons in the large circular pit (they demonstrated the same pathological changes). The partly articulated remains of the individuals in the pit may be an indication that complete bodies were brought into the cave and disarticulated *in situ*.

Further evidence for the intentional movement of bones around the cave was found in a natural crevice in the wall of the cave. Here, 16 hand bones and 16 foot bones (a mix of carpals, tarsals, metacarpals, metatarsals, and proximal and distal phalanges) along with a single tooth and a rib, had been placed in the crevice (*ibid*.: 90). Several other bones found in the vicinity of the crevice were also those of the foot. Of the bones within the crevice, the hand bones derived from at least three different adults, one of which was the cremated individual, and the foot bones represented at least two adults (*ibid*., contra Cauwe 2001: 157), therefore mixing the remains of at least three different bodies. These could have been collected together at the same time, as part of one act, or perhaps these elements were selected each time someone new was placed in the cave, and so the collection in the crevice accumulated gradually over time. In either scenario they represent the deliberate selection of similar body parts and mixing of the remains of several persons, mirroring the wider mixing and intermingling of bodies in the cave.

These practices appear to have an obvious parallel in those occurring at the (later Mesolithic) Cnoc Coig midden, where the hand and foot bones of at least three individuals were recovered together in groups. These groups are not as clearly the result of intentional collection and deposition as is seen at Autours, because groups of elements on the midden could be the result of repeated behaviour. However, the deliberate placement of one of these groups of hand bones directly above the analogous remains of a seal flipper, implies that they were intentionally assembled.

Age was also a factor in the positioning of remains in the Autours rock shelter. In contrast to the remains of adults, the disarticulated remains of juveniles were not so widely dispersed. They were confined to the northern part of the area along the cave wall, and were completely absent from the pit.

Evidence for the deliberate removal of certain elements from bodies deposited within the cave was based on the skeletal element representation. Unfortunately it was not possible to create a directly comparable BRI for this site (a full inventory/MNE was not available) but the authors note that the long bones, crania, vertebrae and the pelvic and shoulder girdles are under-represented, whilst, in contrast, the teeth, patellae (kneecap) and bones of the hands and feet were well-represented (Polet and Cauwe, 2007: 90). There were also some slight differences in the under-represented elements: the lower arm was better represented than the upper arm, and the lower leg was better represented than the femur (thigh). So amongst the long bones, the humerus and femur were the most under-represented. A similar pattern was seen in the sub-adult remains where again there was an under-representation of relatively robust elements, particularly the cranium, which was totally absent, and the humerus (though not the lower arm), femur, and lower leg were under-represented, as they were for the adults. The patellae and vertebrae were however under-represented amongst the sub-adults, in contrast to the adults, perhaps due to the smaller size and lower bone density of these elements in the juvenile skeleton. The authors suggest that while preservation could account for the under-representation of the vertebrae, for example, elements such as the crania and long bones must have been deliberately removed. This is further supported by the presence of the teeth, patellae and feet, for example, as they indicate that both the preservation of the skeleton was generally good and that the crania and legs were probably once present in the cave.

This is quite a different pattern when compared to that observed at sites like Hardinxveld and Noyen where the parts of the body that were well-represented at Autours, the teeth, patellae and hands and feet, are amongst the worst represented elements. In particular, apart from one carpal and one phalange at Hardinxveld, the hand bones were entirely absent from both sites, as were the patellae. In contrast, whilst long bones and crania are the principal component of the assemblage at Hardinxveld and Noyen, they are under-represented at Autours. This is likely to reflect differences in the practices occurring at the sites.

At Autours we can suggest a scenario where complete, fleshed bodies were brought into the cave, where they decayed and became disarticulated *in situ* and were later subject to deliberate movement and manipulation, including the complete removal of some elements. This is supported by the presence of several elements still in articulation in the pit, as discussed above, and the lack of evidence (such as cut marks) for manual disarticulation of fleshed bodies, which suggests that Mesolithic people were handling skeletons not corpses (*ibid*.: 95). The presence of the teeth, patellae, and feet, is also evidence that, at one time, the skull and legs were present. Investigation of fracture type at the site also suggested that it was not fresh bones that were being manipulated. No examples of true fresh fractures were observed and the majority of bone fractures occurred when the bone was not fresh but not completely dry either, the so-called 'dry' fractures that were also observed at Petit Marais and Hardinxveld.

This is an interesting counterpoint to the practices occurring at Hardinxveld and Noyen. Whilst these three specific sites are obviously not directly related to one another (deriving from differing periods and regions), the actions taking place can be seen as corresponding parts of the same type of mortuary practices. Autours was a site to which bodies were brought and transformed into skeletons, enabling specific types of elements to be removed, whereas Hardinxveld and Noyen were places to which disarticulated elements, taken *from* bodies, were being brought. Although they may represent two parts of the same or similar practice, some differences can be teased out, reflecting localised differences in treatment. A number of the elements taken to Hardinxveld were subject to further disarticulation, defleshing or cleaning, whilst those at Autours appear to have been completely disarticulated by the time elements were removed and did not require further processing. This reflects that fact that the body was disarticulated in a different way at the two sites.

There was also some variation in how bodies were treated within the site of Autours itself. For one young adult the scenario was different, and their body was cremated before it was brought into the cave. The cremation itself certainly took place elsewhere, as there was no trace of fire within the rock shelter (Cauwe 2001: 157). In this case rather than the decay of the soft tissue and the disarticulation of the body occurring in the cave, this was achieved by cremation of the fleshed body[11], at another location. This individual was, however, subsequently brought into the cave for final deposition and their body was incorporated into the collective burial by the same processes of manipulation and movement as for the other adult remains: they were distributed between the pit, the surface and placed in the natural crevice. It is not clear whether elements were also deliberately removed from this body. The complete absence of any teeth or bones of the feet differentiates this individual from the other adults, but it is difficult to determine whether other elements are under-represented without a full inventory and MNE. That said, the head may be under-represented based on the proportion of fragments of the cranium and mandible by weight (2007: 94). Cauwe suggests that the head and feet may have lain beyond the cremation fire and were not collected, as may be indicated by a lower degree of burning on a tibia and the cranial fragments, or that these elements were deliberately selected and removed, as was common in the remainder of the assemblage, especially for the head, though less so for the foot bones (2001: 157). Whilst a clearly different method, the cremation of the body appears to have served the same purpose as the exposure of the corpse within the shelter: preparing the body in the same way for integration with the remains of others.

Why this one person's body was cremated is difficult to determine, but may have included differences surrounding the circumstances of their death, such as illness, where cremation may have been seen to cleanse the body of diseased flesh. Alternatively they may have died some distance away from the burial at Autours and the transportation of cremated remains was more practical or desirable. Also, and not mutually exclusive from other motivations, the manner in which their body was transformed may have been determined by their identity: their youth, gender, social status or relationship with those already interred at Autours, or their relationships with the living that were responsible for dealing with their death and their remains. It is interesting to note that this was the only body that had material associated with it (cremated animal bone), which serves to highlight the different nature of their treatment.

---

[11] Longitudinal and transverse fractures of the surface of the cremated bone indicated that a fleshed body (cadaver) was burnt, rather than a skeleton (Polet and Cauwe, 2007: 94 and fig. 21)

6.3.4 Grotte des Perrats

The assemblage of human remains recovered from Grotte des Perrats is considered to result from practices of cannibalism, and, as such, it is an important site for comparison. Here modifications such as cut marks, burning and bone fractures, seen at some of the case study sites, are amongst the indicators of such practices.

The Grotte des Perrats (Agris, Charente) (32) is located in a karstic cave system in western France. Originally discovered by cavers in 1981 the site was excavated during the 1990's under the direction of J. Gomez de Soto, *Centre National de la Recherche Scientifique* (CNRS), and was occupied in the Mesolithic, Neolithic, Bronze and Middle Ages (see Gomez de Soto and Boulestin, 1996). The main cave is around 27m in length and over 500 fragments of Mesolithic human remains were recovered from the large porch or gallery-like entrance. These have been dated to the Middle Mesolithic (8100 ± 90 BP (GifA-95476 – human tibia 291)) and were the subject of an extensive taphonomic and osteological study by Bruno Boulestin (1999). Continuing excavations at the site (especially 2007-2008) have now doubled the assemblage of human remains and, though they are not yet fully analysed, they continue to display evidence for the same treatment (Boulestin and Gomez de Soto, 2008: 48). Recovery can be expected to be very good at the site. Whilst only a small portion of the sediments were sieved, excavation was undertaken using dental tools, tweezers and brushes and sample sieving showed that very little material was missed by the excavators (Boulestin, 1999: 12).

Boulestin determined that the remains of eight individuals, three children and five adults of both sexes, were represented (1999: 15). The fragmentary remains displayed wide-spread evidence for body processing such as deliberate fracturing of fresh bone, including notches, percussion marks, and peeling, numerous cut and scraping marks, burning, and damage caused by chewing. The human remains were deposited along with charcoal, a few lithics, and *c.* 450 fragments of animal bone, from roe deer, wild boar, red deer, badger, wild cat, marten, hedgehog, dog, auroch, and smaller quantities of bat, microfauna and birds (*ibid.*: 16). Boulestin concluded that, on balance, the practice of cannibalism best explains the modifications observed in the assemblage from Perrats (1999).

An astonishing 45% (79/177) of the human elements displayed cut marks, affecting over half of the adult elements and a fifth of those belonging to children, and these were widely distributed throughout the skeleton, observed on the bones of the head, upper and lower limbs, ribs, vertebrae, pelvis and phalanges (*ibid.*: 172, and Table II-25, 176). In fact, 100% of the crania, scapulae, claviculae, and ulnae, and almost 90% of the femora and tibiae, displayed cut-marks (*ibid*.). The only adult elements *not* affected by cut marks were the tarsals, carpals and metacarpals (*ibid*.). For the sub-adults, the lower arms, ribs and vertebrae were also not affected, in addition to these elements (*ibid*.). This is far more frequent and widespread when compared to a rate of only 10% (6/60) of elements at Hardinxveld and 13% (3/22) of elements at Noyen with cut-marks. Around 17% (30/177) of elements at Grotte de Perrats also showed evidence of scraping, and this was mainly focused on the cranium, scapula, humerus and long bones of the leg, but was also observed to a lesser degree on the pelvis, lower arms and ribs (*ibid*.: 179).

Generally the cut marks appear to represent a mixture of disarticulation, defleshing, and skinning practices. Cut and scrape marks on the head, for example, indicate the removal of the ears, the eyes, the tongue, the lower jaw, the scalp and possibly the nose[12]. The cranium appears to have been a focus for processing as it was also the most fragmented element (*ibid*.: 179). As well as the defleshing of the skull the bones of the face were removed through percussion at specific points and the cranium was fractured, probably, the author suggests, to access the brain (*ibid*.: 189). Animals do not appear to have had access to the remains as only recent gnawing was observed on the bones. Evidence for chewing was, however, observed at the ends of five long bones, a sub-adult humerus (*c*. 2 years of age), three adult radii and an adult femur, and, as they differ in appearance from those caused by small and large carnivores, or other known scavengers, they have been interpreted as the result of human chewing (*ibid*.: 171, Appendix: Plate V (C) and VI (A-C)).

Traces of burning were also observed on 4.2% (23/544) of the fragments, but the majority of these were burnt after they were fractured and fragmented, and are therefore deemed to represent accidental rather than deliberate burning (*ibid*.: 151). A similar incidence of burning was observed at Hardinxveld and at Noyen, where 3.5% (3/86) and 4.5% (1/22) of elements showed traces of burning, respectively. The pattern of burning at these sites does appear to be less random than at Grotte des Perrats, though as no fractured elements were affected it was not possible to determine the timing of burning precisely.

The pattern of elements recovered from Grotte des Perrats can be directly compared with the sites outlined in this chapter and most closely resembles that from Hardinxveld/Noyen-sur-Seine (see Figures 6.9 and 6.10). But whilst they show a roughly similar pattern there are some significant differences. The crania are similarly well-represented at both sites but at Perrats there is no relative under-representation of the mandible, as was seen at

[12] Similar treatment/cut-marks to those recently described on Palaeolithic skull 'cups' from Gough's Cave, Somerset, by (Bello *et al*., 2011).

Hardinxveld/Noyen. At both sites low numbers of teeth were recorded, though at Perrats this only reflects the number of loose teeth and does not include the teeth which remained in situ in the mandible and maxilla. Whilst similar limb bones are present at both sites they are relatively under-represented at Hardinxveld but very well-represented at Perrats, as is also the case for the shoulder girdle (clavicle and scapula). The pelvis, noticeably absent from Hardinxveld/Noyen, is, however, represented at Perrats.

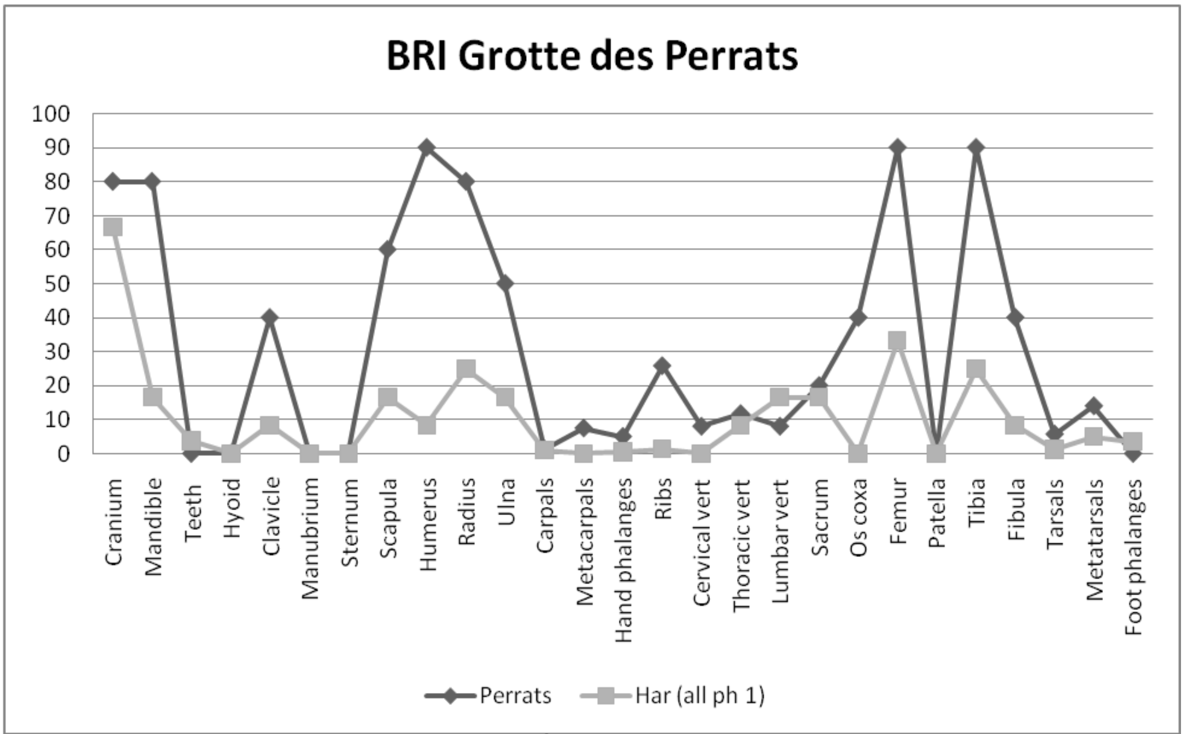

Figure 6.9 BRI at Grotte des Perrats[13], with data from Hardinxveld-Polderweg for comparison

Aside from the often observed absence of the hyoid, manubrio-sternum and patellae, the main elements that were absent or very under-represented at Perrats were the vertebrae and the bones of the hands and feet. Given that there does not appear to be any exposure of bodies at Perrats the lack of hand and foot bones is unusual. From the hand, only one carpal, three metacarpals, eight proximal phalanges and two (?)intermediate phalanges were recovered. Each type of hand bone, except for the carpal, displayed crushing or peeling of the bone and one proximal phalanges and one intermediate phalanges was cut-marked (*ibid.*: Figure 62 and 176). Of the foot bones, only four tarsals and eight metatarsals (one of which was cut-marked) were recovered, but no foot phalanges were recovered. The hands and feet do therefore appear to have been subject to some crushing,

[13] based on ‘PR’ (*pourcentage de représentation*) data from Boulestin (1999: Table A-4)

defleshing and/or disarticulation and it may be that these processes have affected their survival in the assemblage or were carried out with the aim of removing these elements. Whilst recovery bias does not appear to be a problem at the site a small number of elements displayed recent scavenging activity (gnawing), and this cannot be ruled out as a cause for the missing elements.

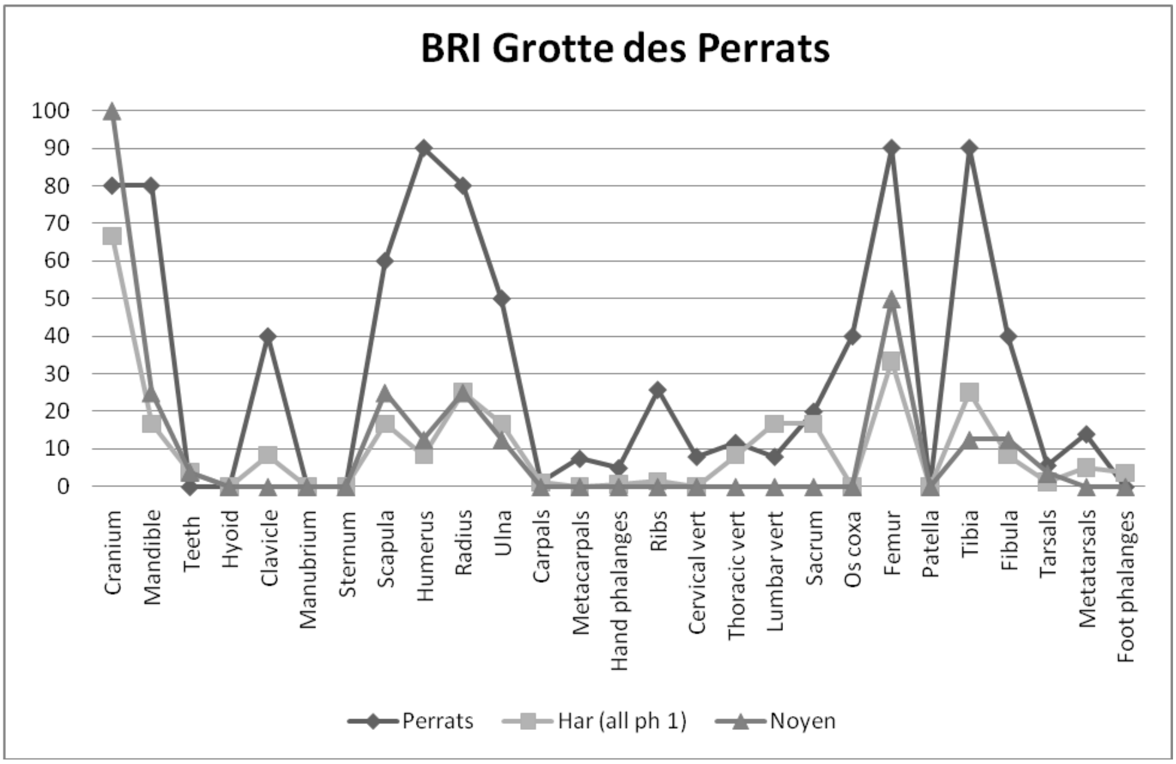

Figure 6.10 BRI at Grotte des Perrats compared to Hardinxveld and Noyen-sur-Seine

6.3.5 Conclusions

It is clear from the above discussion that a wide range of different practices are represented by the skeletal assemblages, varying both within specific sites and across north-west Europe. Amongst the sites that I have discussed are places where complete bodies were brought, skeletonised through exposure and then mixed together (Autours), where parts of bodies were brought from other locations and deliberately defleshed and disarticulated (Hardinxveld and Noyen), where whole bodies were defleshed, disarticulated, fragmented and, possibly, consumed (Perrats) and where bodies were exposed before being removed to other places (Cnoc Coig). There are also sites where cremated bodies were deposited, in pits or along with other non-cremated bodies (Petit Marais, Autours) and where bodies were simply buried, either on their own (Hardinxveld) or joining the remains of earlier burials (Les Varennes), and either remaining undisturbed (Hardinxveld) or being subject to rearrangement at a later time (Les Varennes).

Rather than representing a wide range of *different* practices some of this variation can be seen to simply reflect different **components** of the same or similar practices. This is partly indicated by the fact that many of the sites described here would have had at least one other corresponding site, with a *contrasting* pattern of remains. For the Autours 'tomb', for example, we know that the cremation was carried out at another place, where there were presumably traces of the fire, cremation debris, and stray elements, and also for this site, a place to which some elements were taken after exposure and disarticulation in the cave. The remains recovered from Petit Marais lay exposed or shallowly buried for a period of time in another location and the wrist bones may have been left there along with fragments of fractured elements. Alternatively, the wrist bones and/or the fractured fragments may have been deposited in yet another place, perhaps lost during transport or deposited where the body was prepared for the secondary burial. Bodies were probably exposed at another location before parts of them were selected and taken to Hardinxveld and the vast majority of the body was taken away to another place after exposure on the Cnoc Coig midden.

Some of these corresponding places can be identified in the sites studied here. Cnoc Coig and the Autours rock shelter, for example, could be seen as exposure sites similar to those where elements were removed for deposition at Hardinxveld or Noyen, or for secondary burial at Petit Marais. We may not always see a corresponding site, however, not simply because they have not yet been discovered, but due to the way the remains were treated. If the bodies exposed at Cnoc Coig were not deposited at a site like Hardinxveld or Petit Marais, they may have been subject to other practices, many of which could render them archaeologically invisible, such as crushing or grinding, feeding to animals, or scattering at sea or other bodies of water. A rare example of an alternative practice can be found in several bone tools recovered from the river Bann, Ireland, some of which are thought to have been made from human bone (Woodman and McCartan, 2008).

For sites where elements, or portions of them, were taken away, we only need look at the catalogue of sites in north-west Europe to see the frequent occurrence of isolated skeletal material dated to the Mesolithic. Small groups of bones or isolated elements have been recovered from a range of different contexts, such as pits, caves and swallet holes. For example a fragment of maxilla and a cut-marked and fractured portion of an ulna were recovered from Kent's Cavern (Devon, England) (Chandler *et al.*, 2009). Whilst admittedly some of these disarticulated remains may be the result of later disturbance, given the practices outlined here, a proportion of this material may also represent the deliberate deposition of parts of bodies that have been taken away from other sites. These sites also emphasise the idea that mortuary practices were extended across space, one which I will develop further in the following chapter.

It is also clear that as well as variations in practices between sites there were many differences in the way bodies were treated at the same site. For example, at Autours, where exposure was the primary form of body treatment, one individual was cremated, whilst at Hardinxveld, where already partially disarticulated bodies were brought to the site, one individual was buried whole. The example from Autours is particularly interesting as whilst for this individual the method of mortuary treatment was different (eg. defleshing by cremation rather than exposure in the cave) it appeared to serve the same purpose, allowing them to be deposited in the cave and dispersed and mixed with other bodies. In this example different practices appear to have been roughly contemporary, whilst at other sites, such as Petit Marais, practices at the same site change over time. Here one individual was exposed and then buried, and several centuries later a group of individuals were cremated and buried at the same site.

Looking at mortuary practices in this way starts to reveal (and emphasise) the temporal and spatial aspect of the treatment of the body. Rather than specific sites for burial the sites described here were part of a network of places where bodies were dealt with and their remains were deposited. This contrasts with the notion of undisturbed deposition in formal disposal areas set aside for burial.

7 Discussion

7.1 Introduction

In this chapter I will look more broadly at mortuary practices across the study area and, in particular, how we can understand the degree of variation that existed in Mesolithic north west Europe. The previous chapters have looked in detail at a number of different sites in order to identify some of the range of practices and mortuary treatments that were taking place. I will now bring the results of this analysis together with published data from across the study area to explore the character of Mesolithic mortuary practice in more detail. To begin with I will look at the spatial and chronological variability in the treatment of the dead, looking specifically at regional and temporal trends. In particular I will discuss whether particular practices were specific to certain areas and whether mortuary treatment changed across the study area throughout the Mesolithic. Once I have done this I will go on to discuss the practice of mortuary treatment, and in particular the physical engagement between the living and the dead. In doing so I will consider how the way the living engaged and interacted with a corpse could have been bound up with both cultural attitudes towards death decay and the body and the identity of the deceased. Finally I will look at how funerary practice extended the body across space and time.

7.2 Variability in practice

From the previous discussion it is clear that there is great variability in mortuary practices and body treatment between different sites across north-west Europe. As argued in the previous chapter, at least some of this observed variability is due to the fact that separate sites may represent different components of the same mortuary practice. For example, I demonstrated that a primary exposure site might be an expected component of the treatment of remains taking place at Hardinxveld or Petit Marais. This exposure site would not therefore represent a *different* mortuary practice, rather a different aspect or stage of the same mortuary practice, one that happens to be extended across a number of sites in the landscape.

Several distinct mortuary practices could however be identified (from the osteological analysis and the catalogue of sites in chapter 2):

a) exposure or shallow burial of the body after which the majority of the body was collected and then buried (secondary burial), for example at Petit Marais

b) cremation of the fleshed body or bodies followed by burial of the cremated remains (within a pit or with other inhumations)

c) exposure or shallow burial of the body after which only selected elements were retrieved and later deposited

d) intensive dismemberment, disarticulation and fragmentation of the fleshed body – for the purposes of consumption (cannibalism) or *body processing*

e) head burial – intentional removal of the head from the fleshed body for burial alone or in small groups

d) repeated deposition of several individuals in a defined feature/place, where, once disarticulated, bodies were intermingled in a 'collective burial'

e) inhumation of a fleshed body, either: remaining undisturbed, later uncovered and moved aside to accommodate further interments in the same grave, or uncovered to remove specific elements and/or to rearrange the skeleton

This list is not exhaustive, not least because it does not include what may happen to elements that are retained, removed or lost during these practices. Specific elements or parts of elements are unaccounted for in all of these practices even when the majority of the body was recovered/deposited (with the exception of the one example of cannibalism). I have not referred to these as 'loose' human bones as I do not believe they can be seen as a phenomenon in their own right, deriving, as they may, from a number of different practices. There is also growing evidence that elements were deliberately selected for removal and were intentionally deposited (such as the placement of selected hand, foot and other bones in a crevice at Autours, and the juxtaposition of human hand bones with those of a seal's flipper, at Cnoc Coig).

Some parallels can also be observed between these practices. Seemingly different practices may achieve the same result but by a different method. For example, secondary burial of the remains of a cremated individual could be seen as the same practice as the secondary burial of an exposed individual. The practice is the same, only the skeletonisation of the corpse was achieved differently. Also, the addition of cremated remains to an inhumation could be seen as a form of 'collective' burial.

So, how can we account for this variability in mortuary practices across Europe? In the remainder of this chapter I will explore the different ways in which this variability may have come about and be explained looking in particular at regional differences in practice, changes in practices over time, how mortuary treatment may vary according to the individual.

7.3 Regional practices

Some degree of regional variation is clearly apparent in the evidence for Mesolithic mortuary practice from the study area. For example, the burials at Abri des Autours (57), described in Chapter 6, are part of a regional pattern of collective burial occurring in southern Belgium. Autours is just one of eight early Mesolithic burial sites located in caves and rock shelters in the cliffs of the valley of the river Meuse or its tributaries. With the exception of Loverval (51), which contained the burial of a single individual (Bocherens *et al.*, 2007: 12), the remaining sites are all thought to be 'collective' burials, each containing between four and six individuals, and where remains had been rearranged to accommodate new burials (Toussaint, 2011: 100). The disarticulated remains of at least two adults and possibly two children from Bois Laiterie cave (56) (Otte and Straus, 1997) are considered to display the "same treatment" as at Autours and Margaux (Cauwe, 2001: 158), and the Grotte Lombeau (50) was the only other site with evidence for the use of red ochre similar to that in the earliest inhumation at Autours and at Margaux (Toussaint, 2011: 100). Despite the common 'collective' nature of these burials there is some variation in the practices that took place at the sites. At Abri des Autours, for example, fleshed bodies were brought into the cave where they became skeletonised whilst at Grotte Margaux bodies were deliberately disarticulated before being brought into the cave (Cauwe, 2001). It is important to note, therefore, that whilst broadly similar traditions of mortuary practice may exist within a region localised variations in the way bodies were treated may still exist.

Another mortuary practice that appears to be regionally specific are skull (or more accurately head) burials which are known from four sites clustered across southern Germany and the neighbouring area of eastern France. These are characterised by the deposition of the head only – that is, a cranium accompanied by the mandible and at least the first cervical vertebra, usually still in articulation, indicating that it was the head that was deposited, not a defleshed skull. This type of deposit is without parallel as it has not been recorded at any other sites in north-west Europe.

As these have not been specifically discussed in the thesis so far, I will briefly outline the evidence for mortuary treatment at these sites. Perhaps the most well-known of the head or skull burials is the late Mesolithic site at Ofnet cave (Grosse Ofnet-Höhle) (95). Here, 34 skulls had been deposited in two pits, one containing 28 skulls and the other six skulls, all orientated in the same direction, each one consisting of a cranium and mandible and up to four of the neck (cervical) vertebrae (Orschiedt, 2005). Each pit contained a mixture of women and men of all ages and children from neonates to adolescents, although the majority (27) of the individuals were children aged 1-6 years (17) and younger adults (10), mostly women, aged 20-30 years (*ibid*.: 67). Cut-marks consistent with their decapitation were present on the cervical vertebrae of nine of the individuals and six individuals appear to have suffered violent deaths, as indicated by 14 separate peri-mortem cranial injuries, probably caused by axes, and a lack of healing indicating the fatal outcome of these injuries (*ibid*.: 69). Two of these individuals also possessed older, healed, injuries which they had survived. The skulls were covered with red ochre, and accompanied by over 200 perforated red deer teeth and thousands of shell "ornaments" (some imported from the Mediterranean), some of which were found on top of the skulls, but the majority lay "beneath the neck region" (*ibid*.: 68).

Similar practices were observed at the contemporary site of Hohlenstein-Stadel (Baden-Württemberg) (98) where the heads (the cranium and articulated mandible and neck vertebrae) of three individuals, an adult male and a female, and a child, were deposited onto stones laid in a pit (Orschiedt, 1998: 147). All of them had suffered from peri-mortem cranial trauma and the presence of cut-marks on the cervical vertebrae again indicated that the heads had been removed from the body shortly after death (*ibid*.). As at Ofnet the skulls were covered with red ochre and tooth ornaments, and unperforated fish teeth found around the female skull were interpreted as the remains of a necklace.

Two further finds from the area also appear to belong to this practice. The cranium of a young adult male, with the mandible and first two cervical vertebrae attached, was recovered from the Hexenküche at Kaufertsberg (nr. Lierheim, Bavaria) (94), and although it is not yet radiocarbon dated, it is considered to be Mesolithic (Grünberg, 2000a, 2000b, Orschiedt, 2005: 72). At Mannlefelsen I (Haut-Rhin, France) (36) in neighbouring Alsace, the cranium, mandible and first cervical vertebra of an adult male was placed on a deliberate arrangement of stone blocks (Thévenin, 1978). Neither of these examples displayed evidence for cranial trauma like that seen at Ofnet and Hohlenstein-Stadel, but cut-marks on the mandible and base of the skull at Mannlefelsen I (*ibid*.), and the presence of articulating neck vertebrae, suggests they were similarly deliberately decapitated shortly after death.

Based on these sites, Orschiedt (1998, 2005) has postulated that there was a late Mesolithic tradition of skull burial in the region of Bavaria and further west in the neighbouring area of France. This is in contrast to the traditional interpretation, for Ofnet at least, that the remains represent the victims of a single massacre – the result of a violent episode with another 'group' which included the retrieval of heads as trophies (for example see (Frayer, 1997)). Orschiedt argues that the absence of cranial injury in the majority of skulls, the carefully and uniformly executed removal of the heads, the meticulous placement of the heads, and the application of red ochre, indicate a distinctive burial rite rather than a massacre, where the clusters of skulls are the result of repeated deposition, and that the teeth and shell ornaments were 'grave goods'.

Regardless of whether the skulls burial represent the result of violent encounters or were a distinctive form of funerary practice they do appear to form a regionally specific type of mortuary treatment. It was not, however, the only form of burial practice that that was undertaken in this area. At Falkensteinhöhle (101), for example, the disarticulated remains of at least one individual (an adult male) were recorded around a hearth. Although the remains themselves are undated radiocarbon dates from the deposit range from 7540 ± 120 to 7820 ± 120 making it contemporary with Ofnet. Additional sites are also known from the area, such as the burial of a child at Felsställe-Mühlen (99) but this is only dated to the Mesolithic.

For Britain and Ireland Conneller has suggested that disarticulation formed the major mortuary practice (Conneller 2006:139) and, whilst the evidence from this area is often scarce and fragmentary, such practices have been noted at a number of sites. Overall disarticulated material is found in a variety of different contexts, predominantly coastal and inland caves, but also middens, pits, a palaeochannel and within occupation horizons. Unfortunately much of the material lacks any detailed contextual information making it difficult to determine whether it had been deliberately disarticulated in the Mesolithic or through post-depositional processes. That said, indications of deliberate practice have been noted at several sites.

At Kent's Cavern (Devon) (23), for example, there was evidence for the deposition of elements that had been deliberately disarticulated. An adult maxilla was recovered by Pengelly in 1867 (1872) and more recently, additional bones have been found amongst the faunal remains, including a cut-marked and deliberately fractured fragment of ulna (Chandler *et al.*, 2009). Both have been dated to the very start of the late Mesolithic, 8070 ± 90 (OxA-1786) and 8185 ± 38 (OxA-20588) and appear to be contemporary (Meiklejohn, n.d.). The location of the cut-marks suggests the deliberate disarticulation of the lower arm from the upper arm at the elbow and that the bone was deliberately fractured whilst fresh. The cave may have been an arena for these practices, with other elements subsequently removed from the site, or equally the remains may have been prepared and selected for deposition here. After the recent find, practices of cannibalism have inevitably been suggested and whilst this remains a possibility, on its own the fragment only indicates disarticulation and fragmentation.

Human remains have also been recorded from Ogof-yr-Ychen (Caldey Island, Pembrokeshire) (7), a swallet or sink hole consisting of several chambers with a vertical shaft/'blow-hole' and a separate entrance (Schulting and Richards, 2002). The skeletal material consists of six disarticulated elements (fragments of crania, mandible (2), pelvis (2) and tibia) from six different individuals, including adolescents and adults of both sexes. These had been deposited throughout the cave over a period of two millennia, from c. 7500-5500 cal. BC (*ibid*). There was some indication that at least one of the remains, a single tibia ('Ogof A'), had entered via the vertical shaft/blow-hole and had become distributed between the shaft and chambers 1 and 3 below it. One of the mandibles ('Ogof C') was also spread between two different chambers of the cave indicating some degree of mixing or movement of the elements (David, 2007). Although the evidence is scant it appears that disarticulated elements were deposited in the cave rather than whole bodies, and they became further fragmented and distributed around it.

Disarticulated remains have also been recovered from palaeochannel deposits at Staythorpe Borrow Pits (Nottinghamshire) (16) and may have been deliberately deposited into the water. A single adult femur, missing both articular ends, was recovered from stream deposits along with nearby cut-marked, presumably butchered, animal remains (of auroch, roe deer, otter and fish) (Davies *et al.,* 2001: 81, 83). The bone was dated to the late Mesolithic and both the human and animal bone was in good condition with little evidence of abrasion or erosion, indicating that they had not moved far in the water (*ibid*.). Therefore these remains are unlikely to have washed in from another context, and may have been deliberately deposited into the stream.

The remains from the Oronsay middens (Scotland) have already been discussed (see chapter 6) and appear to indicate the exposure of bodies on the midden along with the deliberate collection and grouping of elements. At Ferriter's Cove (Co. Kerry, Ireland) (1) human remains were recovered from a later Mesolithic settlement site consisting of midden deposits, hearths and post-hole structures, and may be part of the latest occupation of the site (Woodman *et al.,* 1999). The material consisted of the disarticulated and fragmented remains of the lower limbs which, along with the teeth from the upper and lower jaws were scattered across the site (Power, 1999: 102). This may be reminiscent of the practices at sites such as Hardinxveld and Noyen, but further information regarding context and the source of the remains is needed.

Whilst disarticulation is clearly a feature of many sites in the British Isles it was not the only form of mortuary treatment. At least two of the individuals at Aveline's Hole (21) were buried and it remains unclear whether the remaining individuals were disarticulated or simply laid out on the cave floor (Schulting 2005:243). A complete individual burial has also been recorded at Gough's Cave (Somerset) (22), dated to the early Mesolithic (Trinkhaus 2001; 2003) and secondary burials of cremated remains at Castleconnell (Co. Limerick) (3), which are late Mesolithic in date (Collins, 2009). Considering all this material together, where mortuary practices can be inferred they seem to show the same variability in body treatment as other areas of north-west Europe, with evidence for single and multiple inhumation, cremation, disarticulation of bodies and deposition of bodies or elements of them into caves and water. Furthermore, whilst disarticulation is a common theme of the British and Irish material it covers a wide range of different practices from exposure (Cnoc Coig), disarticulation through cutting and fracturing (Kent's cavern) and deposition of individual elements over long periods of time (Ogof-yr-Ychen) and should not be thought of as a single mortuary treatment.

A further feature of mortuary sites in Britain and Ireland is the emphasis on deposition in caves, especially in a cluster of sites in south-western Britain, in the Mendips (sites 19, 21, and 22) and in south Wales, and coastal areas. The emphasis on caves does not seem to solely be a factor of favourable preservation, as a recent study of human remains from caves in the Yorkshire Dales[14] and North York Moors, did not reveal any remains of Mesolithic date (Leach, 2006). The lack of skeletal material from other contexts may, however, be an issue of under-representation within the data. In Britain archaeologists have been slow to recognise that features such as pits may be Mesolithic in date but it is these features that account for much of the skeletal material from France for example. Many of the remains discussed here were also only recognised as Mesolithic after a programme of radiocarbon dating of remains of mixed date or were discovered later amongst faunal material. As such there is every possibility that Mesolithic mortuary sites remain to be discovered at inland, open air locations.

Parallels have been drawn between the assemblages of human remains recorded in British caves and the collective cave burials in Belgium, particularly Aveline's Hole (21) and the

[14] Though one bone (a phalanx) from Chapel Cave, North Yorkshire (14), has since been dated to the late Mesolithic (Meiklejohn, no date)

remains from Worm's Head Cave, Gough's Cave (22) and Badger Hole (19), which date to the same period (c. 8500-7500 cal BC) (e.g. Cauwe 2001; Conneller 2006). In particular, Cauwe has argued that these represent a form of burial practice common to these two regions. Aveline's Hole certainly parallels the Belgian sites in that multiple individuals were deposited in the cave at an early Mesolithic date. However, for Cauwe, it is the practice of manipulation of the dead body, a lack of concern for the conservation of the body and its individuality, that characterises the collective tombs and represents a dynamic relationship with the dead (2001: 160). Whilst evidence for these practices may not be lacking in this area in the early Mesolithic (e.g. Badger Hole, Worm's Head) it is unfortunate that, due to the date of the original excavations and the subsequent damage and losses suffered by the material, burial practice at Aveline's cannot be determined conclusively. It has not been possible to determine whether the cave contained successive individual burials or a collective burial like those in Belgium. The burial at Aveline's is on a larger scale than the Belgian sites, probably containing more than 50 individuals compared to an average of four individuals in the Belgian caves. There was no direct evidence of secondary burial (such as weathering or cut-marks) (*ibid*.), though these would not have been observed on the Autours material, for example. Undoubtedly there were scattered and disarticulated remains but whether these relate to secondary burials or disturbance of existing burials "cannot be determined on the basis of the available evidence" (Schulting, 2005: 243).

At a much wider level Cauwe has suggested that the manipulation of the dead and the assembling of remains in specific locations were a characteristic of Mesolithic funerary practices in Western Europe but were not as common in other European regions. For example, he states that, in contrast to the western European cemeteries, "Eastern Europe does not have superimposed burials nor graves in which earlier burials have been pushed aside" and that in Eastern and Central Europe disarticulated remains are rare outside of funerary contexts and collective tombs are generally filled on a single occasion (*ibid*.: 159). This he surmises, along with the prevalence of primary inhumation (in Sicily, the Danube gorges, the Alpine regions, Corsica, Germany and the cemeteries of Karelia in Russia) and the absence of collective burials, suggests that the integrity of the body was important in Central and Eastern Europe, in quite different tradition to Western Europe, where the decay process was known and engaged with through the manipulation of the corpse (*ibid*.: 159).

There is, however, increasing evidence for disarticulation in central and eastern Europe and, in particular, from the Iron Gates sites. At Vlasac, for example, men were more likely to be disarticulated and undergo secondary burial with males over the age of sixty only represented by their skulls. There is also evidence for disarticulation at Lepinski Vir. There men were also more likely to be disarticulated, but two female mandibles were associated with hearth constructions (Radovanovic 1996). It is also clear that within western Europe there are many sites where bodies were interred in graves and never subsequently disturbed. If the manipulation of the body was the norm then it still remains to understand why certain people were treated differently. Finally, whilst practices involving the disarticulation and manipulation of the body may have been a common theme in mortuary practice the means by which this was achieved varied considerably with exposure, dismemberment, burial and cremation all being undertaken in order to skeletonise a corpse. As I will discuss later these practices all involve different forms of engagement between living people and the corpse and may reflect cultural attitudes to death, decay and the body or aspects of the identity of the deceased. In other words, whilst manipulation of the body may have been a common theme in mortuary treatment it is the subtler differences in the way this was achieved that may be more important in terms of our understandings of Mesolithic funerary practice

7.3.1 Similarities in practice: cremation and the use of fire

As well as regional differences in mortuary practices there are some practices that occur all across north-west Europe. Amongst these fire seems to have a played a significant role with mortuary practice. Cremation for example, may not traditionally be associated with the Mesolithic but there is increasing evidence for the practice, now known from 11 sites in the study area[15]. Whilst very rare in the eastern part of the study area (at only one site, Coswig (86), in Germany) it is seen more frequently amongst the sites in the Low Countries and does also occur in central France and western Ireland. The deposition of cremated remains varies however. Cremated individuals were buried individually, usually in small pits (Hermitage (3), Loschbour (62)), but were sometimes also placed within containers (at Ruffey-sur-Seille (34)). Multiple individuals were deposited together in pits, probably after a multiple cremation, (Petit Marais (pit 1) (48), Dalfsen (67)), and again sometimes in organic containers (Concevreux (46)). Some were placed on the surface (Oirschot V (63)) or they were scattered over the inhumations of others, such as over a multiple inhumation at La Vergne (pit 7) (31) and over the collective burial at Abris des Autours (57).

[15] Cremations are also known from Denmark (Vedbaek), southern Sweden (Skateholm I, Tagerup), the Iron Gates (Vlasac), and Switzerland (Colombay-Vionnaz)

There is also evidence for the deliberate manipulation of a, later cremated, body at Loschbour (62) in Luxembourg. Cut-marks were observed on several fragments of the skull[16] and a long-bone fragment, and were shown to have occurred before cremation (Toussaint *et al.*, 2009: 248). Those on a fragment of the right parietal bone are described as parallel with the squamosal suture (the suture with the temporal bone) (*ibid*.), which is consistent with the origin of the temporalis muscle that articulates the mandible with the cranium. Removal of this muscle may be associated with the disarticulation of the mandible and/or the defleshing of the cranium, as has been observed at other sites, such as at Grottes des Perrats (32) (Boulestin, 1999), and on a right parietal from Abri des Cabônes (35) (Valentin, 1998b). The cut-marks on the long-bone fragment are not described, and so may have related either to disarticulation of the element or defleshing. The condition of the human bone, however, indicates that the body was cremated whilst fleshed (Toussaint *et al.*, 2009: 247), and therefore the cut-marks may have been associated with the removal of elements, rather than defleshing. Whilst the description of the remains is brief there is no mention of the mandible[17] and therefore the cut-marks could be seen as evidence for the deliberate removal of this element, as well as one of the long-bones (fragments of the tibia and ulna were also not recovered (*ibid*.: 245)). Cremation was usually not the only practice at a site as it often accompanied inhumation or other practices. At Loschbour for example the site was later used for inhumation, and at La Vergne and Autours it was contemporary with inhumation and collective burial respectively.

As well as the actual cremation of the body, the use of fire in mortuary ritual can also be seen as a general theme. Graves containing successive burials at the later Mesolithic sites of Téviec (29) and Hoëdic (30) (Morbihan, north-west France) frequently had one or more associated hearths, either directly on top of, or adjacent to, the burials, suggesting that this was part of the mortuary ritual, perhaps performed every time another individual was added to the grave (Péquart *et al.*, 1937, Péquart and Péquart, 1954). For example, the remains of two sub-adult individuals at Hoëdic, the latest additions to grave C, were locally burned by the overlying hearth. At Téviec, previous interments were moved aside to accommodate later burials in grave K, a total of six individuals were interred and the associated hearth was used repeatedly. The hearth was directly above the cranium of skeleton 4 which shows traces of light burning (Schulting, 1996). Graves with more

[16] It is not clear whether their use of the term 'skull' refers to the cranium only or, more properly, the cranium and mandible.

[17] "Twenty-four cranial fragments (one quarter of the total) belong primarily to the skullcap (mostly temporals and parietals). A fragment of the right maxilla represents the elements of the face." (Toussaint et al., 2009: 245)

interments seem to have associated hearths showing evidence of more intense or repeated burning, suggesting hearths were relit after each interment.

Burnt human remains have also been observed at other sites. The locally burned remains of at least one individual were found spread around a (late Mesolithic) hearth feature in the cave of Falkensteinhöhle (Baden-Württemberg, Germany) (101) (Newell *et al.*, 1979), and the remains in the Cnoc Coig (27) midden are also interspersed with hearths, bone group 3 lies directly beneath a hearth, though the remains are not charred, (Meiklejohn *et al.*, 2005: 99). There was also localised burning on the edges of a few of the remains from Hardinxveld-Polderweg (64), a cranium, humerus and a rib, and on the end of a femur from Noyen-sur-Seine (39), which occurred whilst the elements were disarticulated but probably still fleshed, perhaps caused by the proximity of fires used in funerary rituals or to aid defleshing of the remains. A small number of the heavily processed remains from Grottes des Perrats had been burnt after they had been defleshed and fragmented (Boulestin, 1999: 151), and the remains of six individuals from Abri des Cabônes, mostly fragments of crania and teeth, had also been burnt, probably as dry bones (Valentin, 1998b).

Several of the hearths at Téviec also included burnt animal remains, particularly mandibles from red deer and/or wild boar. This burning of animal bone, and lighting of fires after new interments, is also reminiscent of the large arrangement of animal bone that was burnt *in situ* above the fill of the final burial in the grave at Les Varennes (Eure, N. France) (45). Skulls of red deer, roe deer and auroch, complete with antlers and horns, and the front limb of a beaver, were piled up over the long bones and flat bones (also animal) and burned (Billard *et al.*, 2001).

In general fire appears to have played an important role in many aspects of Mesolithic mortuary treatment. It was used to transform fleshed bodies into skeletons, either whilst they were whole or once they had been deliberately dismembered and was used along with other actions to deflesh elements that had been partially skeletonised through exposure. Bodies that were cremated were often subsequently treated in the same way as those that had been subjected to other practices. Elements could be removed and taken away and cremated elements could be mixed together with unburnt bones in collective graves. As with the differences noted in other aspects of mortuary treatment, the decision to cremate a body may have been related to aspects of that person's identity or the circumstances surrounding their death. Fire was also associated other aspects of mortuary practice such as the burning of animal remains and the lighting of fires or hearths around graves. In some cases these may signify practices involving cooking or feasting or alternatively the remains of animals may have been transformed through burning reflecting the transformation of the human corpse from a fleshed body to a skeleton. As with other aspects of mortuary practices, however, differences in the way fire was used may reflect differing cultural attitudes to death and/or the identity of the deceased.

7.4 Mortuary practice over time

The variability in mortuary practice that we see in north-west Europe could also be the result of changes in practice occurring over time. A practice that has often been cited as temporally specific is inhumation in cemeteries. That cemeteries were a late Mesolithic phenomenon was an idea that had been in general acceptance since Robert Chapman concluded that "the earliest evidence for formal disposal areas in Western Europe occurs in the late Mesolithic" (1981: 74) and Clark and Neeley suggested that isolated Mesolithic burials were significantly earlier than those in cemeteries (1987: 122). This has only recently been disproved by a series of papers examining the chronology of Mesolithic burial practice using direct radiocarbon dates from human bone, initially from the whole of Europe, and later focusing on north-west Europe, (Meiklejohn and Babb, 2009, Meiklejohn *et al.*, 2009). Meiklejohn and colleagues confirmed that 'cemetery' sites are not restricted to the later Mesolithic, more specifically, that the number of burials at a site is not significantly correlated with the age of the site (Meiklejohn and Babb, 2009: 223).

This review of the data also shows that there was no overall change in mortuary practice over time throughout the Mesolithic and that there is no overall tendency for any one practice to disappear or to be replaced by another. Just as there are both early and late inhumations and both early and late cremation burials, disarticulation as a practice spans the whole Mesolithic. For example the evidence for exposure and disarticulation at the Grotte Margaux occurs in the early Mesolithic (between *c.* 9200 and 8500 cal BC) whilst at Hardinxveld and Cnoc Coig it is considerably later. Two general observations can be made, however. Firstly, that there was a tradition of treating and/or depositing multiple individuals together, irrespective of burial practice, throughout the Mesolithic, and secondly, that mortuary practice often did not end with the deposition of the body in a grave/feature.

Meiklejohn and Babb also state that "inhumation is the primary burial pattern extending evenly across the... seven millennia that this analysis encompasses" (*ibid.*: 228). Whilst this is partly true, in that primary inhumation as a practice *is* seen continuously throughout the whole of the Mesolithic, this statement is also misleading as it incorporates a range of practices including those not normally considered as ‘primary inhumation’. The secondary burial at Petit Marais, for example, was classed as an inhumation where as it is clearly different from burials such as Gough’s Cave, whilst the remains from Hardinxveld are simply classed as ‘loose’ human bone. As this project has already shown these so called ‘loose bone’ assemblages display evidence for a wide range of different practices that were taking place across Europe and throughout the Mesolithic. Given the prevalence of such practices it is hard to argue for the primacy of inhumation at all times during the period.

Whilst no Europe-wide changes in mortuary treatment were observed over time, for some regions there were temporally distinct practices. The regional practice of collective burial noted in the cluster of sites in southern Belgium (discussed above) is restricted to the early Mesolithic (between *c.* 9200 cal BC and 8200 cal BC). What replaced the practice of collective burial in the later Mesolithic is not known; only one late Mesolithic site with human remains has been identified in the same region, where a single fragment of cranium (and loose teeth) was recovered from stratified occupation deposits at the cave site of Trou Al’Wesse (55). Later burial practices either shifted away from this series of caves or were perhaps not as archaeologically visible. In the surrounding region (though the nearest known sites are at least 100km away) are a number of cremations of middle and late Mesolithic date (sites 48, 46, 62 and 63) and some fragmentary and disarticulated remains (sites 49 and 61), though the context of the latter two is not known. Cremation of the body and the removal of elements and fragments from the collective tombs have already been demonstrated, and perhaps these practices continued outside of the caves during the later Mesolithic.

Caves were certainly significant places for the deposition of human remains in south-west Britain and, in contrast to Belgium, this can be seen to continue into the later Mesolithic. Caves used in the early Mesolithic, such as Aveline’s Hole (21), Gough’s Cave (22) and Badger Hole (19) (dating to *c*. 8500-8100 cal BC), and the even earlier use of Worm’s Head (11), where dates cluster around 8600 cal BC (Schulting 2009), do not show evidence for continued used in the later Mesolithic. Instead, deposition continues in different locations within the same region, taking place from the early part of the late Mesolithic, for example at Totty Pot (20), Potter’s (8) and Daylight Cave (9), and similarly, at Ogof-yr-Ychen (7), where deposition also continues further into the later Mesolithic.

Caves also appear to be the location of the very earliest Mesolithic burials in north-west Europe. Very early Mesolithic remains are known from the British Isles, Belgium and

Germany, and the vast majority appear to have been deposited in caves. In contrast very few early Mesolithic burial sites are known in northern France, the earliest is La Vergne (31), dating to around 8500-8000 cal BC, and therefore these may be under-represented. There are also only a few examples of deposition in the cave-bearing areas of northern France from the whole of the Mesolithic[18]. Of course this may be due to a bias in the sites that have been excavated, many of the known sites from France have been discovered during rescue excavation, a scenario which is less likely to affect cave sites.

Whilst the overall pattern of mortuary practice shows no clear temporal trends across the study area the cluster of recently excavated and radiocarbon dated sites in north-east France provides an opportunity to explore some of the chronological trends in Mesolithic mortuary practice within this specific region. The sites themselves display a wide range of different practices including single inhumation, secondary burial, group burial, cremation and the deliberate disarticulation of bodies, but the chronology of the sites exhibits some interesting patterns.

Overall, evidence for mortuary practice in this region spans most of the Mesolithic, with dated material ranging from 8533-7833 cal BC at Petit Marais (48) to 5479-5343 cal BC at Concevreux (46). Sites are distributed fairly evenly within this range with the exception of a small gap or hiatus between *c*. 6500 and 6000 cal BC. Although this could be an artefact of the data (in particular the small number of dates in relation to the time span in question) it has parallels with a hiatus in dated human bone recorded in Britain, though this occurs later, between *c*. 5500 and 4800 cal BC (Blockley, 2005: 509) (see below).

With the exception of the very earliest Mesolithic, and the slight hiatus in burials, the practice of single inhumation occurred throughout the period, ranging from 8282-7613 cal BC at Rueil-Malmaison (42), to 5730-5469 cal BC at Parc du Chateau à Auneau (37). Within this tradition there was some variation in the form of the inhumations, for example the seated burial at Parc du Chateau à Auneau (Grave 6) is broadly contemporary with the flexed burial at Rueil-Malmaison, but overall the practice of placing complete individuals in single graves was ubiquitous.

In contrast, multi-stage practices involving the manipulation of the body after decay, could be observed at two particular points within the period. The first is represented by the secondary burial at Petit Marais (48), which is dated to between 8533-7833 cal BC. This

[18] In contrast Mesolithic deposition in caves is more frequent in the cave-bearing regions of southern France, outside of the study area.

largely predates the inhumations, and may reflect an earlier tradition for re-arrangement of the skeletonised body before individual burial. A fragment of human femur recorded from Saleux (49) is also dated to around this time (8267-7956 cal BC) and may provide further evidence for practices of body manipulation. Whether this was the only burial practice in the region at this time is difficult to determine, due to the large error range of a number of the dates, and it may have occurred alongside single inhumation. The disarticulated remains at Les Varennes may also belong to this period though the large error range for this material makes it difficult to prove the association.

The second example of body manipulation occurred in roughly the first half of the 7th millennium BC (between *c*. 7200-6500 cal BC) and is best demonstrated by the material from Noyen-sur-Seine (39). This represented practices of exposure and disarticulation, including the removal of certain elements and the deposition of others at the site itself. The scatter of fragmentary human remains at Petit Marais also dates to this period and may represent similar acts of disarticulation and deposition. The treatment of the body at these sites contrasts with the earlier practice of secondary burial at Petit Marais, where the complete body was placed into a pit, and may form a distinct burial tradition in its own right. It is clear, however, that this was not the only form of mortuary treatment taking place. The inhumation at Maisons-Alfort (41) occurs at around the same time (7121-6708 cal BC) and the burial at Neuilly-sur-Marne (43) is only slightly later (6643-6477 cal BC).

Another trend in the treatment of the dead that occurred throughout the period was the burial of groups of individuals. The cremated remains of several individuals were deposited into Pit 1 at Petit Marais (dated to 7597-7355 cal BC) and the pit at Concevreux (5479-5343 cal BC), whilst a group burial of four individuals was recorded at Villeneuve-la-Guyard (5870-5476 cal BC) (38). The disarticulated material at Les Varennes also represents a group burial, though this it is difficult to relate this chronologically to the other sites.

A number of other observations can be made regarding change in mortuary practice over time. The practice of skull or head burial which appears to be specific to southern Germany, is confined to the late Mesolithic based on the rough contemporaneity of the two directly dated examples, Ofnet and Hohlenstein-Stadel. However, it was not the only form of mortuary treatment being carried out at that time. At Falkensteinhöhle (101), for example, the disarticulated remains of at least one individual (an adult male) were recorded around a hearth. Although the bones have not been directly dated, radiocarbon dates on the samples from the deposit show that the remains are likely to be contemporary with both Ofnet and Hohlenstein-Stadel.

Practices that can be shown to precede head burial in this area include a burial at Höhlesbuckel (96) dated to 9181-8638 cal BC (9520 ± 80 ETH-6668) and the disarticulated remains of several individuals at Hohler Fels (97), one of which is dated to 8227-7482 cal BC (8655 ± 150 Hv-14894). The burial of a child in a stone-lined grave is known from a third site in the area, Felsställe-Mühlen (99), and a skeleton of a child and several other sub-adult skulls from Nassenfells (93), all of which are only dated as Mesolithic.

The hiatus in radiocarbon dates on human bone observed between c. 5500 and 4800 cal BC in Britain has been interpreted as indicating a change in burial practice. According to Blockley this may be related to sea-level rise and the resulting loss of the land-bridge with Europe, and that the resulting evolution in indigenous burial practices causes the temporary invisibility/non-recovery of human remains (Blockley, 2005: 509). Whilst the hiatus may reflect a change in funerary practice it is difficult to see how it could have been related to the north sea inundation given that the ways in which the dead bodies were treated appears to be related to local rather than regional/European traditions. It is also difficult to see why the practices such as exposure and the manipulation of the body should stop only to start again towards the end of the period. This is not to say that the hiatus does not reflect a real discontinuity in mortuary practice simply that explanations need to consider local as well as broader regional events.

Overall the discussion of chronological variation in mortuary treatment has shown that there was no broad trend or succession from one form of practice to another. Instead many of the ways in which dead bodies were treated continued throughout the period. Where these did change through time it appears to have been on a local scale. The Belgium caves, for example reflect a practice that was both chronological and spatially discrete as was the practice of skull or head burials in southern Germany/eastern France. For the remainder of this chapter I will investigate variation in terms of the different ways in which people engaged with the dead and how this can be related to understandings of identity and the body.

7.5 The physicality of mortuary practice

In the previous chapters I have demonstrated that the manipulation of the body and body parts was a common feature in Mesolithic mortuary practices. In many cases these practices involved a direct engagement with bodies at different stages of decay, such as manipulating skeletonised and cremated corpses at Abri des Autours, processing and consuming fleshed bodies at Grotte des Perrats and defleshing partially exposed bodies at Hardinxveld. It follows then that the variation we see in mortuary practice also reflects differences in the way the living engaged with the physical remains of the dead and this may be bound up with attitudes to death, decay and the body. In particular, engagement with, and even harnessing of, processes of bodily decay and decomposition was a key feature of Mesolithic mortuary practice. This directly contradicts previous work which suggests that the intact, uncorrupted body was the preferred ritual focus (Nilsson Stutz 2000).

At Hardinxveld for example the body was subject to a range of transformations, carried out by the living, resulting in its ultimate disarticulation. In at least one case, the head was deliberately removed by cutting the muscles and ligaments at the front and back of the neck whilst the body was still fleshed, either shortly after death or sometime later. Other bodies were disarticulated, either through careful dismemberment or by exposure. Following their disarticulation, some elements were taken away and others remained in circulation on the site, possibly being curated for some time or scattered across the dune slope and wetland deposits, along with other disarticulated animals and artefacts. These physical interactions with the body engaged the sensations, through the sights and smells of exposed, decomposing bodies. These tasks involved the employment of bodily strength and technical skill in the dismemberment of a corpse, skills which were perhaps analogous to the treatment of dogs and other animal bodies. These tasks, as well as the circulation and deposition of remains within the occupation site would invoke emotional responses or summon memories both of the dead and other places involved in their mortuary ritual.

Other practices involved very different forms of physical engagement between the living and the dead. For example, inhumation appears to prevent any engagement with the decay process, where the body gradually skeletonises, unobserved, and without the direct intervention of living people. Nilsson Stutz suggests that this practice reflects a denial of the decay process and a respect for the integrity of the body (and maybe the individual) that is dominant in practices in the south Scandinavian cemeteries, such as Skateholm (2008: 24). However, the exceptions that she cites to this dominant program, a burial from which elements have been retrieved at a later date leaving the remainder of the body undisturbed (grave 28), and the burial of a partially disarticulated or dismembered body (grave 13), suggest that decomposition was not only known about but that it was a component part of burial practice. It may have been accelerated or slowed, or occurred out of sight, but it was never denied. I would argue that all practices, including inhumation, were intimately connected to the temporality of decay, as demonstrated by the need to wait for the body to skeletonise before removing specific elements from grave 28 at Skateholm.

These practices are also seen at Hardinxveld, where, as well as the exposed and dismembered corpses one body was buried, possibly after being wrapped, and the corpse left undisturbed in the ground. In contrast to the other bodies there was no engagement with the remains of this individual and the processes of decay remained hidden from view. These differences in the treatment of contemporary individuals at the same site may be associated with the identity of the deceased. Strassburg (2000) sees those that were set aside and buried, rather than the subject of practices focused on disarticulation, as dangerous or powerful people for whom burial had the effect of removing them from circulation amongst the living. However, the lack of involvement in other rituals need not always have negative connotations for the deceased. For the Toba Batak of Indonesia, who practice reburial rituals, only the remains of those who have living descendants, specifically grandchildren, are exhumed and transferred to a reburial tomb several years after death (Ikegami, 1997). Perhaps at sites such as Hardinxveld or Autours, the dead were only manipulated by the living when there was a familial relationship between them and this ended for some when their familial link with the community ended, and their bodies were no longer circulated. Futhermore this study demonstrates that, *contra* Strassburg (2000), burial and disarticulation are not discrete or separate choices in mortuary practice, but rather can be part of the mortuary treatment of the same body.

At other times different practices may represent cultural differences in the ways in which the dead body was encountered. As shown by the example from Skateholm (grave 28), people do return to burials; perhaps the intention was to engage with the person's remains but only at a certain stage, with their bones rather than their decomposition. At Autours for example bodies were defleshed by exposure. Here, the living let natural processes, or the dead themselves, remove the flesh from the body and only once they were skeletonised were the remains moved around, curated, and removed. This is also reminiscent of the burial at Petit Marais, where the body was probably shallowly buried before the disarticulated and skeletal remains were collected together and deliberately arranged. Remains, or fragments of them, removed from graves may also have been carried around. Here perhaps we can consider the relationship between the fleshed body and the clean bone: did bone retain a sense of the individual from which it derived, circulating as a relic of a family member or an ancestor; alternatively did it become something else entirely, as the bone points made from human bone (Woodman pers. comm.) found in Irish Mesolithic contexts? Cremation would also make a body easily transportable, and could be suggested for the individual who was cremated before burial in the Autours cave, perhaps reflecting the fact they died some distance from the burial site. The tightly arranged nature of the secondary burial at Petit Marais, for example, could also indicate that it had been bundled, and possibly carried, before burial.

In contrast, a completely different engagement with the body may have taken place at the Ofnet cave. Whilst Orschiedt has argued against the interpretation of Ofnet as the remains of a massacre (2005), this does not mean that the individuals did not meet violent deaths. In particular it is feasible that the individuals without cranial trauma suffered fatal post-cranial injuries, and that the perforated teeth and shells were personal ornamentation worn in life, in the hair, ears or around the neck, rather than grave goods. While repeated deposition might discount a single massacre, it does not discount repeated acts of violence against other groups, such as blood feuds for example. Furthermore, the cranial trauma does appear to be fairly uniform – the majority of injuries were to the back of skull – perhaps indicating ritualised killing of at least five of the individuals. In this case people may have been killed in violent encounters and their fleshed heads, complete with personal ornamentation, brought to the cave for deposition. Alternatively, the cave may have been the scene of their execution, and the remainder of their decapitated body was taken away.

The consumption of human bodies that may have taken place at Grotte des Perrats is perhaps an extreme example of the way in which the treatment of the dead involved a physical engagement with their remains. Here bodies of adults and children were disarticulated, their arms were removed from the shoulder and their legs from the hips, and each individual bone was separated at the joint, including their fingers and toes. Their heads were removed from their bodies, and their facial features, eyes, tongue and ears were removed. Their shoulders, ribs, vertebrae and pelvis, were completely disarticulated. The flesh was removed and the bones were scraped and then fractured, pounded and pulled apart. Presumably the internal organs and the soft tissues removed from the bones were eaten, along with the brain which may have been removed from the deliberately fractured skull. Whilst practices of cannibalism, or anthropophagy, have been identified as the most likely explanation for the condition of the remains, ethnographically there is much variation in people's experience of this practice. The motivations for consumption can range from nutritional, as in survival cannibalism, to the denigration of enemies (usually exo-cannibalism, the consumption of flesh from outsiders) to funerary practices (usually endo-cannibalism, the consumption of one's 'insider' group), and we must therefore acknowledge that the experience of the practice may vary. Sometimes no flesh is actually consumed, and ritual defleshing and disarticulation, including the breakage of bones to remove marrow is part of the flesh disposal process, as has been recounted in the Mary River area of Queensland, Australia (Pickering, 1999: 66). Conklin has described that for the Wari' of western Brazil consumption of their relatives after death forms a part of their funerary practices (2001). Parts of the body are cooked and eaten by the deceased's in-laws and the close family watch. They often have to force themselves to eat the flesh but they do so knowing that it is an important aspect of the process of healing (*ibid*.). Along with other practices (the deceased's name is not spoken and their house is burned) it serves to erase reminders of the dead so that the family can move on and not become overtaken by grief (*ibid*.). This funerary cannibalism is concerned with compassion, cycles of renewal, and its purpose is emotional healing; the living are literally "consuming grief" (*ibid*.).

We may also consider, conversely, that some practices were concerned with negotiating the way that the dead may engage with the living. At Grotte des Perrats the head was also defleshed, as part of the processing of the rest of the body, but cut-marks suggested a specific pattern of treatment consistent with the removal of the tongue, the eyes and the ears, and possibly the nose. The bones of the face had also been removed by carefully positioned percussive blows. Whilst the destruction of the facial bones has often been interpreted as the deliberate destruction of the identity of the victim (as has been suggested at the Neolithic site of Herxheim (Germany), by, for example, Thorpe (2003)) I would like to offer an alternative explanation. Whilst the face may be one of the most individual and recognisable features of a person, I suggest that it may have been over-emphasised as a result of modern views of personhood, focused as they are on *individual* identity and the physical appearance of the body (Fowler, 2004: 16). As well as distinctive facial characteristics, a person may be recognised by the sound of their voice, their smell, or their way of walking, characteristics that, I think, hunter-gatherers may have had a much heightened awareness of, especially in comparison to our own visually-orientated interaction with the world. Removing these parts (eyes, ears, nose, and tongue) then, is rather removing a person's capacity to act in the world – through speech, sight, a sense of hearing and smell. This practice may have ensured that the dead could no longer do these things (see, hear or speak) or, alternatively that the dead were not disturbed by sounds and smells.

There may be hints of similar practices at other sites where similar cut-marks have been observed, such as on a cranium and mandible from Grotte Margaux (France) (Toussaint, 2011), a parietal bone from Abri des Cabônes (France) (Valentin, 1998b), a parietal bone from Loschbour (Luxembourg) (Toussaint *et al.*, 2009), and a cranium at Hardinxveld-Polderweg (Netherlands) (see chapter 3, above).

It is the differences within and between sites that are significant in understanding Mesolithic beliefs, as these different engagements with different types of body reflect differences in attitudes to the body. Where we see regional variation (for example in southern Belgium) these may reflect cultural differences in the way in which regionally distinct groups perceived the body and the decay process. It is worth noting, however, that these differences may also have been highly localised, as demonstrated by differences in practice between the neighbouring Autours and Margaux caves.

7.6 Place-making and time-keeping

Another major aspect of Mesolithic mortuary practice that has been highlighted by this review is that it was often carried out in multiple stages and at multiple locations, extending mortuary practice across space and time.

The fact that different components of mortuary practices were carried out in different locations had the effect of extending Mesolithic bodies over space. For example, at Hardinxveld we know that the body was probably exposed at another location, perhaps in a tree or on a purpose-built structure, where the small bones of the hands and feet and the majority of the torso may have been left behind. Selected elements were taken to Hardinxveld and cleaned and processed in other ways, eventually being deposited amongst the occupation debris on the dune top and the wetlands edge. Linked to this site was another place, or places, where fragments of deliberately broken bones and possibly other elements, such as the mandible, were taken to after they were processed at Hardinxveld.

After bodies were exposed on the midden at Cnoc Coig, the majority of the body was taken elsewhere, leaving only small bones and other fragments on the midden. These, however, were collected up and involved in other acts of manipulation on the midden, such as deposition with analogous animal bones. Several places in the landscape may also have been involved in the practices carried out in the Autours cave. One body was cremated at another location before being brought to the cave, presumably leaving traces of the fire and cremation debris, including stray human and animal bone. After exposure in the cave some fragments and elements were selected and either deposited in groups in the cave or taken away, possibly to numerous locations. Some places were used consistently for dealing with dead for the same practices, as demonstrated by successive episodes of bone deposition at Cnoc Coig for example, and were even reused when practices changed over time, such as at Petit Marais where secondary burial, cremation and the scattering of remains took place over several hundred years.

In this way the remains of bodies were scattered across a number of different locations, such as an original exposure site and the site of final deposition, and, in addition, there were often indications that single elements or parts of them had also been taken away, representing further possible sites. What happened to these latter remains was more difficult to determine, but there are some hints within the isolated material. Caves appear to have been a favoured location for the deposition of isolated elements. One of the two bones recovered from Kent's Cavern (Devon, England) for example, had been deliberately disarticulated and fractured, representing part of a fractured element very similar to those that were missing from Hardinxveld or Petit Marais. Several isolated elements were also deposited into the swallet hole of Ogof-yr-Ychen at several points over a period spanning around two millennia. Perhaps these elements had been carried with people and used and deposited as part of other social practices. These may have been specific places that were suitable for the deposition of curated body parts, perhaps after a certain amount of time had passed.

There are also some rare and intriguing examples where human remains have been transformed into objects. A number of perforated human teeth have been recovered from sites in north-west Europe (e.g. Les Fieux cave (Lot, France), Abri des Cabônes rock shelter (Jura, France), Vedbaek (Denmark)). It is likely that at least some of them were deliberately removed from a dead individual and they were presumably worn, possibly strung together with other human and animal teeth. A child's rib had been engraved with hundreds of parallel markings and included with the remains of two individuals in the cemetery at Téviec (Marshack, 1972). Recently, at least two bone points recovered from the river Bann in Ireland have also been identified as having been made from human bones. These were deposited in the river along with other bone points made from different materials. When parts of persons were made into objects they may have still articulated aspects of that person's identity. As well as being a literal part of a person, the object was perhaps still carried an association with death and the transformation of the body from a person to a material. In the case of bones used to make tools, it is particularly interesting to think that they may have retained some of the personal qualities of the body that it belonged to, such as luck or expertise in hunting or fishing.

In this way, bodies and parts of them made connections with multiple places across the landscape, and with the remains of animals, other objects and materials. After death, personhood was distributed across the landscape, perhaps reflecting the relational nature of identity. It was certainly not necessary in most cases to keep the body complete or undisturbed. The disarticulation of the body may have served to disarticulate the constituent parts of the person's identity, reincorporating them figuratively and literally, into the world of the living.

A multi-stage and multi-locational mortuary rite also varies the time over which persons die and are transformed from a living body to one that is considered dead. This may be extended by mortuary practices which conserve and curate the body, or parts of it, or be hastened by those which effect a quick transformation, such as funerary cannibalism. In either case it is clear that mortuary practices had a temporality that was intimately connected to an understating of the body and its transformation in death, from a cadaver to separate bony elements. In fact the temporality of mortuary practices was frequently measured by this decay: knowledge of how long it took for a body's flesh to decay either through excarnation, or through shallow burial, produced the temporality of different stages of mortuary practice.

The majority of practices outlined here appear to extend the process of bodily death over both space and time. This multi-stage process raises interesting implications for understanding the nature of death and the dissolution of the living individual. At what stage did people become fully dead? Nilsson Stutz (2009) has argued that the furnishing of the dead with some of their own possessions and the desire not to disturb graves at Skateholm indicates a lingering understanding of living identity; however, on the few occasions that the dead were accidentally disturbed by the cutting of new graves, their bones were tossed aside. She suggests that by the time they were fully skeletonised they had thus lost their living identity. If this holds true also amongst the disarticulated remains then the decomposition of soft tissue may have marked the length of time it took for the 'person' to leave the remains and for them to be fully dead.

What these mortuary rites (with their secondary and even tertiary stages) do though in contrast to the cemetery situations is to extend this process of dying and becoming an ancestor (or at least something other than a living individual) in a very visible fashion, and one that is marked by the corruption and deterioration of the human body. In many ways then, the process of dying – of becoming fully skeletonised – held parallels with living. Both the living and the dead body went through different material changes or stages. each presumably marked by ritual actions. The decay of the dead body was paralleled by the aging of the living body; both material processes of bodily change marked time. Similarly different phases of both life and death took place in different parts of the landscape; the dead may have had their own rhythms of seasonal movement, as did the living.

7.7 Conclusions: Towards an understanding of Mesolithic mortuary practice

This study makes clear that the disarticulation and manipulation of human remains, as a significant element in Mesolithic mortuary practices, can no longer be ignored. The focus on cemeteries has been detrimental to the understanding of the full parameters of Mesolithic mortuary variability. The cemeteries and disarticulated remains have often been seen as diametrically opposed practices, focused on different types of individual (e.g. Strassburg 2000); this is clearly not the case. As this work highlights, bodily manipulation and burial are not exclusive, but can be part of a single mortuary *chaîne opératoire*. Just as Nilsson Stutz has revealed body manipulation and body part removal in the Scandinavian cemeteries, so this study has revealed that some disarticulated remains were once buried. Thus attempting to understand one without the other would paint an incomplete picture. Further work is needed to trace the connections between disarticulated material and inhumations more closely.

This thesis has also highlighted the variability present in body manipulation practices. Some of this variability has chronological and regional specificity, but much of it may represent different stages of a similar set of temporally and spatially extended processes. In particular the study has suggested a complementarity between assemblages focused on bones of the hands and feet and the axial skeleton (which seem to have been left behind on excarnation sites) and assemblages primarily focused on skulls and long bones which seem to been the products of secondary deposition/reburial. Beyond this human bone seems to have been circulated as relics or made into other things such as beads and tools. There may also be variability in treatment depending on the identity of the deceased; however, due to the problems of aging and sexing disarticulated material, such patterns are difficult to discern. Perhaps more important though is a consideration of the process of mortuary practice. This seems to have been a messy business, where the processes of bodily decay were engaged with by the living; the timing of processes of decay seem to have played an important part in the temporal stages of the mortuary ritual and were manipulated by the living through process of disarticulation, excarnation, wrapping and shallow burial.

My osteological study focused on recently excavated sites with relatively large collections of disarticulated material. Such sites are rare, however; the more usual situation is that found in Britain, where human bone is the product of early excavation, often poorly preserved and lacking contextual information, and where frequently only a single bone per site was recovered. Similarly in southern Scandinavia isolated bones are a common feature of Mesolithic sites. Such assemblages offer much greater methodological challenges. It is hoped, however, that my focus on richer, well-excavated assemblages can be used to provide a reliable indicator of some of the different signatures that can be found and a more solid interpretation of the processes that generated them. These may be used as a guide to interpret some of the smaller assemblages. However, undoubtedly more work needs to be done on this material to fully understand where these isolated bones fit within the varied sequences of Mesolithic mortuary practices.

8 References

ALBRETHSEN, S. E. & BRINCH PETERSEN, E. (1977) Excavation of a Mesolithic cemetery at Vedbaek, Denmark. *Acta Archaeologica,* 47, 1-28.

ANDREWS, P. & BELLO, S. (2006) Pattern in Human Burial Practice. IN GOWLAND, R. & KNÜSEL, C. J. (Eds.) *The Social Archaeology of Funerary Remains.* Oxford, Oxbow.

AUBOIRE, G. (1991) Les restes humaines Mésolithique de Noyen-sur-Seine (Seine-et-Marne, France). *L'Anthropologie,* 95, 229-236.

BARHAM, L., PRIESTLY, P. & TARGETT, A. (1999) *In search of Cheddar Man.* Stroud, Tempus.

BASS, W. M. (1995) *Human Osteology: a laboratory and field manual.* Columbia, Mo., Missouri Archaeological Society Special Paper 2.

BECKETT, J. & ROBB, J. (2006) Neolithic burial taphonomy, ritual, and intepretation in Britain and Ireland: a review. IN GOWLAND, R. & KNÜSEL, C. (Eds.) *The Social Archaeology of Funerary Remains.* Oxford, Oxbow.

BEHRENSMEYER, A. K. (1978) Taphonomic and Ecological Information from Bone Weathering. *Palaeobiology,* 4, 150-162.

BEHRENSMEYER, A. K., GORDON, K. D. & YANAGI, G. T. (1986) Trampling as a cause of bone surface damage and pseudo-cutmarks. *Nature,* 319, 768-771.

BELLO, S. & ANDREWS, P. (2006) The Intrinsic Pattern of Preservation of Human Skeletons and its Influence on the Interpretation of Funerary Behaviours. IN GOWLAND, R. & KNÜSEL, C. (Eds.) *The Social Archaeology of Funerary Remains.* Oxford, Oxbow.

BELLO, S. M., PARFITT, S. A. & STRINGER, C. B. (2011) Earliest Directly-Dated Human Skull-Cups. *PLoS ONE* 6 (2), e17026. doi:10.1371/journal.pone.0017026.

BILLARD, C., ARBOGAST, R.-M. & VALENTIN, F. (2001) La sépulture mésolithique des Varennes à Val-de-Reuil (Eure). *Bulletin de la Société Préhistorique Française,* 98, 25-52.

BILLARD, C., GUILLON, M., SUNDER, F., ARBOGAST, R.-M. & COLLABORATEURS (1995) Le sépulture collective néolithique des Varennes à Val-de-Reuil (Eure) et ses structures funéraires associées de l'Âge du Bronze. *Revue Archéologie Ouest,* Supplément no. 7, 155-182.

BINFORD, L. R. (1981) *Bones: ancient men and modern myths.* New York, Academic Press.

BLOCKLEY, S. M. (2005) Two hiatuses in human bone radiocarbon dates in Britain (17 000 to 5000 cal BP). *Antiquity,* 79, 505-513.

BOCHERENS, H., POLET, C. & TOUSSAINT, M. (2007) Palaeodiet of Mesolithic and Neolithic populations of Meuse Basin (Belgium): evidence from stable isotopes. *Journal of Archaeological Science*, 34, 10-27.

BORIĆ, D. & ROBB, J. (Eds.) (2008) *Past Bodies: Body-Centred Research in Archaeology.* Oxford, Oxbow Books.

BOULESTIN, B. (1999) *Approche taphonomique des restes humains: le cas des Mésolithiques de la grotte des Perrats et le problème du cannibalisme en préhistoire récente européenne*. Oxford, Archaeopress.

BOULESTIN, B. & GOMEZ DE SOTO, J. (2008) Grotte des Perrats (Agirs, Charente): Rapport de Synthèse, Fouilles Programmées 2006-2008. *Unpublished interim report.*

BRADLEY, R. (1997) Domestication as a state of mind. *Analecta Praehistorica Leidensia,* 29, 13-17.

BRONK RAMSEY, C. (2009) Bayesian analysis of radiocarbon dates. *Radiocarbon, 51*(1), 337-360.

BROTHWELL, D. & ZAKRZEWSKI, S. (2003) Metric and non-metric studies of archaeological human bone. IN BRICKLEY, M. & MCKINLEY, J. I. (Eds.) *Guidelines to the Standards for Recording Human Remains.* British Association for Biological Anthropology and Osteoarchaeology/Institute of Field Archaeologists.

BUIKSTRA, J. E. & SWEGLE, M. (1989) Bone Modification Due to Burning: Experimental evidence. IN BONNICHSEN, R. & SORG, M. H. (Eds.) *Bone modification.* Orono, Maine, Center for the Study of the First Americans, Institute for Quaternary Studies, University of Maine.

BUIKSTRA, J. E. & UBELAKER, D. H. (Eds.) (1994) *Standards for Data Collection from Human Skeletal Remains.* Arkansas, Arkansas Archeological Survey.

CARR, G. C. & KNÜSEL, C. (1997) The ritual framework of excarnation by exposure as the mortuary practice of the early and middle Iron Ages of central southern Britain. IN GWILT, A. & HASELGROVE, C. (Eds.) *Reconstructing Iron Age Societies.* Oxford, Oxbow Monograph.

CAUWE, N. (1995) Chronologie des sépultures de l'abri des Autours à Anseremme-Dinant. *Notae Praehistoricae,* 15, 51-60.

CAUWE, N. (2001) Skeletons in motion, ancestors in action: Early Mesolithic collective tombs in southern Belgium. *Cambridge Archaeological Journal* 11, 147-63.

CAUWE, N., BELLEFROID, B., CAMMAERT, L., LACROIX, P., MARCHAL, A. & STEENHOUDT, F. (1994) De l'individuel au collectif : les sépultures de l'abri des Autours à Dinant (Namur). *Notae Praehistoricae*, 13, 101-107.

CAUWE, N., TOUSSAINT, M., QUINIF, Y. & HOUSLEY, R. A. (1998) *La grotte Margaux à Anseremme-Dinant: étude d'une sépultre collective du Mésolithique ancien.* Liège, Université de Liège, Service de Préhistoire.

CHANDLER, B., SCHULTING, R. & HIGHAM, T. (2009) Cannibals in the Cavern? New Research on the Black Mould Layer of Kent's Cavern. *Transactions and Proceedings 2008-09 of the Torquay Museum Society*, 24, 164-75.

CHAPMAN, R. (1981) The Emergence of Formal Disposal Areas and the 'Problems' of Megalithic Tombs in Prehistoric Europe. IN CHAPMAN, R., KINNES, I. & RANDSBORG, K. (Eds.) *The Archaeology of Death.* Cambridge, New York, Cambridge University Press.

CHURCH, S. E., HOLLIDAY, T. W., POPOV, L. E., COCKS, L. R. M. & NIKITIN, I. F. (2002) Gough's Cave 1 (Somerset, England): a study of the axial skeleton. *Bulletin of The Natural History Museum,* 58.

CLARK, G. & NEELEY, M. (1987) Social Differentiation in European Mesolithic Burial Data. IN ROWLEY-CONWY, P., ZVELEBIL, M. & BLANKHOLM, H. P. (Eds.) *Mesolithic Northwest Europe: Recent Trends.* Sheffield, Department of Archaeology and Prehistory, Sheffield University.

CLARK, M. A., WORRELL, M. B. & PLESS, J. E. (1997) Postmortem Changes in Soft Tissues. IN HAGLUND, W. D. & SORG, M. H. (Eds.) *Forensic Taphonomy: The Postmortem Fate of Human Remains.* Boca Raton, CRC Press.

CONKLIN, B. A. (2001) *Consuming grief: compassionate cannibalism in an Amazonian society.* Austin, Texas, University of Texas Press.

CONNELLER, C. (2006) Death. IN CONNELLER, C. & WARREN, G. (Eds.) *Mesolithic Britain and Ireland: New approaches.* Stroud, Tempus.

DAVID, A. (2007) *Palaeolithic and Mesolithic Settlement on Wales with special reference to Dyfed. British Archaeological Reports 448.* Oxford, Archaeopress.

DAVIES, G., BIRCH, P., CHAMBERLAIN, A. T., RICHARDS, M. P., TWEEDLE, J. & TYERS, I. (2001) A palaeoenvironmental study and watching brief on borrrow pits at Staythorpe power station, Staythorpe, Notts. Sheffield, ARCUS Unpublished client report.

DOBNEY, K. & RIELLY, K. (1988) A method for recording archaeological animal bones: the use of diagnostic zones. *Circaea,* 5, 79-96.

DUCROCQ, T. & KETTERER, I. (1995) Le gisement mésolithique du 'Petit Marais', La Chaussée-Tirancourt (Somme). *Bulletin de la Société Préhistorique Française,* 92, 249-59.

DUCROCQ, T., LE GOFF, I. & VALENTIN, F. (1996) La sépulture secondaire Mésolithique de la Chaussée-Tirancourt (Somme). *Bulletin de la Société Préhistorique Française,* 93, 211-216.

DUDAY, H. (2006) L'archéothanatologie ou l'archéologie de la mort (Archaeothanatology or the Archaeology of Death). IN GOWLAND, R. & KNÜSEL, C. (Eds.) *The Social Archaeology of Funerary Remains.* Oxford, Oxbow.

DUDAY, H. (2009) *The Archaeology of the Dead: Lectures in Archaeothanatology.* Oxford, Oxbow Books.

DUDAY, H., COURTAUD, P., CRUBÉZY, É., SELLIER, P. & TILLIER, A.-M. (1990) L'anthropologie de terrain: reconnaissance et interprétation des gestes funéraires. *Bulletin et Mémoires de la Société d'Anthropologie de Paris*, 29-50.

EFREMOV, I. A. (1940) Taphonomy: a new branch of paleontology. *Pan-American Geologist*, 74, 81-93.

FIORILLO, A. R. (1989) An experimental study of trampling: implications for the fossil record. IN BONNICHSEN, R. & SORG, M. H. (Eds.) *Bone modification.* Orono, Maine, Center for the Study of the First Americans, Institute for Quaternary Studies, University of Maine.

FORMICOLA, V. & GIANNECCHINI, M. (1999) Evolutionary trends of stature in Upper Palaeolithic and Mesolithic Europe. *Journal of Human Evolution,* 36, 319-333.

FOWLER, C. (2001) Personhood and social relations in the British Neolithic, with a study from the Isle of Man. *Journal of Material Culture*, 6, 137-163.

FOWLER, C. (2004) *The Archaeology of Personhood: An anthropological approach.* London, Routledge.

FRAYER, D. (1997) Ofnet: evidence for a mesolithic massacre. IN MARTIN, D. & FRAYER, D. (Eds.) *Troubled times: violence and warfare in the past.* London, Routledge.

GALLOWAY, A. (1997) The process of decomposition: a model from Arizona-Sonoran Desert. IN HAGLUND, W. D. & SORG, M. H. (Eds.) *Forensic Taphonomy: The Postmortem Fate of Human Remains.* Boca Raton, CRC Press.

GALLOWAY, A., WILLEY, P. & SNYDER, L. (1997) Human Bone Mineral Densities and Survival of Bone Elements: A contemporary Sample. IN HAGLUND, W. D. & SORG, M. H. (Eds.) *Forensic Taphonomy: The Postmortem Fate of Human Remains.*

GRÜNBERG, J. M. (2000a) Mesolithische Bestattungen in Europa: Ein Beitrag zur vergleichenden Graberkunde. Teil I: Auswertung. *Internationale Archaologie,* 40.

GRÜNBERG, J. M. (2000b) Mesolithische Bestattungen in Europa: Ein Beitrag zur vergleichenden Graberkunde. Teil II: Katalog. *Internationale Archaologie,* 40.

GUSTAFSON, G. & KOCH, G. (1974) Age estimation up to 16 years of age based on dental development. *Odontologisk Revy,* 25, 297-306.

HAGLUND, W. D. (1997a) Dogs and Coyotes: Postmortem involvement with human remains. IN HAGLUND, W. D. & SORG, M. H. (Eds.) *Forensic Taphonomy: The Postmortem Fate of Human Remains.* Boca Raton, CRC Press.

HAGLUND, W. D. (1997b) Rodents and Human Remains. IN HAGLUND, W. D. & SORG, M. H. (Eds.) *Forensic Taphonomy: The Postmortem Fate of Human Remains.* Boca Raton, CRC Press.

HAGLUND, W. D. & SORG, M. H. (1997a) Introduction to Forensic Taphonomy. IN HAGLUND, W. D. & SORG, M. H. (Eds.) *Forensic Taphonomy: The Postmortem Fate of Human Remains.* Boca Raton, CRC Press.

HAGLUND, W. D. & SORG, M. H. (1997b) Method and Theory of Forensic Taphonomy Research. IN HAGLUND, W. D. & SORG, M. H. (Eds.) *Forensic Taphonomy: The Postmortem Fate of Human Remains.* Boca Raton, CRC Press.

HALLAM, E., HOWARTH, G. & HOCKEY, J. L. (1999) *Beyond the body: death and social identity.* London Routledge.

HAMILAKIS, Y., PLUCIENNIK, M. & TARLOW, S. (Eds.) (2002) *Thinking through the Body: Archaeologies of Corporeality.* New York, Kleuwer Academic Press.

HOFMANN, D. (2005) The Emotional Mesolithic: Past and present ambiguities of Ofnet cave. IN MILNER, N. & WOODMAN, P. (Eds.) *Mesolithic Studies at the beginning of the 21st century.* Oxford, Oxbow books.

HOLLIDAY, T. W. & CHURCHILL, S. E. (2003) Gough's Cave 1 (Somerset, England): an assessment of body size and shape. *Bulletin of The Natural History Museum,* 58.

IKEGAMI, S. (1997) Historical Changes of Toba Batak Reburial Tombs: A case study of a rural community in the Central Highland of North Sumatra. *Southeast Asian Studies,* 34, 643-675.

JONES, A. (2005) Lives in fragments?: Personhood and the European Neolithic. *Journal of Social Archaeology,* 5, 193-224.

JOYCE, R. A. (2005) Archaeology of the Body. *Annual Review of Anthropology,* 34, 139-158.

KING, M. (2003) *Unparalleled Behaviour: Britain and Ireland during the 'Mesolithic' and 'Neolithic'.* Oxford, Archaeopress.

KNÜSEL, C. & OUTRAM, A. K. (2004) Fragmentation: the zonation method applied to fragmented human remains from archaeological and forensic contexts. *Environmental Archaeology,* 9, 85-97.

KNÜSEL, C. J. & OUTRAM, A. K. (2006) Fragmentation of the Body: Comestibles, Compost, or Customary Rite? IN GOWLAND, R. & KNÜSEL, C. J. (Eds.) *The Social Archaeology of Funerary Remains.* Oxford, Oxbow.

KUS, S. (1992) Toward an archaeology of body and soul. IN GARDIN, J.-C. & PEEBLES, C. (Eds.) *Representations in Archaeology.* Bloomington, Indiana University Press.

LARSSON, L. (1984) The Skateholm Project. A Late Mesolithic Settlement and Cemetery Complex at a Southern Swedish Bay. *Papers from the Archaeological Institute University of Lund 1983-4,* 5, 5-38.

LARSSON, L. (1988) *The Skateholm project.* Stockholm, Almqvist & Wiksell International.

LARSSON, L. (1989a) Big Dog and Poor Man. Mortuary Practices in Mesolithic Societies in Southern Sweden. IN LUNDMARK, H. & LARSSON, T. B. (Eds.) *Approaches to Swedish Prehistory.* Oxford, British Archaeological Reports.

LARSSON, L. (1989b) Late Mesolithic Settlements and Cemeteries at Skateholm, Southern Sweden. IN BONSALL, C. (Ed.) *The Mesolithic in Europe.* Edinburgh, J. Donald.

LARSSON, L. (1990) Dogs in fraction-Symbols in Action. IN VERMEERSCH, P. M. & VAN PEER, P. (Eds.) *Contributions to the Mesolithic in Europe.*, Leuven University Press.

LARSSON, L. (1993) The Skateholm Project: Late Mesolithic Coastal Settlement in Southern Sweden. IN BOGUCKI, P. (Ed.) *Case Studies in European Prehistory.* London, CRC Press.

LARSSON, L., MEIKLEJOHN, C. & NEWELL, R. R. (1981) Human skeletal material from the Mesolithic site of Agerod I:HC, Scania, southern Sweden. *Fornvannen,* 76, 161-8.

LE GOFF, I. (2000) Une incinération mésolithique à la Chaussée-Tirancourt 'Le Petit Marais' (Somme). IN CROTTI, P. (Ed.) *Actes de la Table ronde 'Epipalaeolithique et Mésolithique' Lausanne, 21-23 novembre 1997.* Lausanne, Cahiers d'archéologie romande

LEACH, S. (2006) Going Underground: An anthropological and taphonomic study of human skeletal remains from caves and rock shelters in Yorkshire. Unpublished Ph.D. thesis, University of Winchester.

LOE, L. (2009) Perimortem Trauma. IN BLAU, S. & UBELAKER, D. H. (Eds.) *Handbook of Forensic Anthropology and Archaeology.* Walnut Creek, California, Left Coast Press.

LOUWE KOOIJMANS, L. P. (Ed.) (2001a) *Archeologie in de Betuweroute: Hardinxveld-Giessendam De Bruin: een mesolithisch jachtkamp in het rivierengebied (5500 - 5000 v. Chr.).* Amersfoort Rijksdienst voor het Oudheidkundig Bodemonderzoek

LOUWE KOOIJMANS, L. P. (Ed.) (2001b) *Archeologie in de Betuweroute: Hardinxveld-Giessendam Polderweg: een mesolithisch jachtkamp in het rivierengebied (5500 - 5000 v. Chr.).* Amersfoort Rijksdienst voor het Oudheidkundig Bodemonderzoek

LOUWE KOOIJMANS, L. P. (2003) The Hardinxveld sites in the Rhine/Meuse Delta, the Netherlands, 5500-4500 cal BC. IN LARSSON, L., KINDGREN, H., KNUTSSON, L., D. & ÅKERLUND, A. (Eds.) *Mesolithic on the Move* Stockholm, Oxbow Books.

LYMAN, R. L. (1994) *Vertebrate Taphonomy.* Cambridge, Cambridge University Press.

LYMAN, R. L. & FOX, G. L. (1997) A Critical Evaluation of Bone Weathering as an Indication of Bone Assemblage Formation. IN HAGLUND, W. D. & SORG, M. H. (Eds.) *Forensic Taphonomy: The Postmortem Fate of Human Remains.* Boca Raton, CRC Press.

MARINVAL-VIGNE, M.-C., MORDANT, D., AUBOIRE, G., AUGEREAU, A., BAILON, S., DAUPHIN, C., DELIBRIAS, G., KRIER, V., LECLERC, A.-S., LEROYER, C., MARINVAL, P., MORDANT, C., RODRIGUEZ, P., VILETTE, P. & VIGNE, J.-D. (1989) Noyen-sur-Seine, site stratifié en milieu fluviatile: une étude multidisciplinaire intégrée. *Bulletin de la Société Préhistorique Française,* 86, 370-379.

MARSHACK, A. (1972) *The roots of civilization; the cognitive beginnings of man's first art, symbol, and notation.* New York, McGraw-Hill.

MARSHALL, L. G. (1989) Bone Modification and 'The Laws of Burial'. IN BONNICHSEN, R. & SORG, M. H. (Eds.) *Bone Modification.* Orono, University of Maine.

MAYS, S. & COX, M. (2000) Sex determination in skeletal remains. IN COX, M. & MAYS, S. (Eds.) *Human Osteology in Archaeology and Forensic Science.* London Greenwich Medical Media.

MCGUIRE, R. H. & VAN DYKE, R. M. (2008) Dismembering the Trope. IN NICHOLS, D. L. & CROWN, P. L. (Eds.) *Social Violence in the Prehispanic American Southwest.* Tucson (AZ), The University of Arizona Press.

MCKINLEY, J. I. (2003) Compiling a skeletal inventory: disarticulated and co-mingled remains. IN BRICKLEY, M. & MCKINLEY, J. I. (Eds.) *Guidelines to the Standards for Recording Human Remains.* British Association for Biological Anthropology and Osteoarchaeology/Institute of Field Archaeologists.

MEIKLEJOHN, C. (no date) The Dating and Diet of European Mesolithic Human Remains. *Unpublished personal catalogue.*

MEIKLEJOHN, C. & BABB, J. (2009) Issues in burial chronology in the Mesolithic of Northwestern Europe. IN CROMBÉ, F., VAN STRYDONCK, M., SERGANT, J., BOUDIN, M. & BATS, M. (Eds.) *Chronology and evolution within the Mesolithic of North-Western Europe.* Cambridge, Cambridge Scholars Publishing.

MEIKLEJOHN, C., BRINCH PETERSEN, E. & BABB, J. (2009) From single graves to cemeteries: an initial look at chronology in Mesolithic burial practice. IN MCCARTAN, S., SCHULTING, R. J., WARREN, G. & WOODMAN, P. (Eds.) *Mesolithic Horizons.* Oxford, Oxbow Books.

MEIKLEJOHN, C. & DENSTON, B. (1987) The Human Skeletal Material: Inventory and Initial Interpretation. IN MELLARS, P. A. (Ed.) *Excavations on Oronsay: Prehistoric Human Ecology on a Small Island.* Edinburgh, Edinburgh University Press.

MEIKLEJOHN, C., MERRETT, D. C., NOLAN, R. W., RICHARDS, M. P. & MELLARS, P. A. (2005) Spatial Relationships, Dating and Taphonomy of the Human

Bone from the Mesolithic site of Cnoc Coig, Oronsay, Argyll, Scotland. . *Proceedings of the Prehistoric Society,* 71, 85-105.

METCALF, P. & HUNTINGTON, R. (1991) *Celebrations of Death: The Anthropology of Mortuary Ritual.* Cambridge, Cambridge University Press.

MICOZZI, M. S. (1991) *Postmortem Change in Human and Animal Remains.* Springfield, Il., Charles S. Thomas.

MOL, J. & ZIJVERDEN, W. K. V. (2007) Prehistorische woonplaatsen in de dynamische landschappen van de Rijn-Maasdelta/Prehistoric settlements in the dynamic landscapes of the Rhine-Meuse delta. IN JANSEN, R. & LOUWE KOOIJMANS, L. P. (Eds.) *Van contract tot wetenschap: Tien jaar archeologisch onderzoek door Archol BV, 1997-2007/From contract to science: Ten years of archaeological investigations by Archol BV, 1997-2007.* Leiden, Archol.

MOOREES, C. F. A., FANNING, E. A. & HUNT, E. E. J. (1963a) Age variation of formation stages for ten permanent teeth. *Journal of Dental Research,* 42, 1490-502.

MOOREES, C. F. A., FANNING, E. A. & HUNT, E. E. J. (1963b) Formation and resorption of three deciduous teeth in children. *American Journal of Physical Anthropology,* 21, 205-13.

MORDANT, C. & MORDANT, D. (1992) Noyen-sur-Seine: A Mesolithic waterside settlement. IN COLES, B. (Ed.) *The Wetland Revolution in Prehistory.* Exeter, The Prehistoric Society.

MORLAN, R. E. (1984) Toward a Definition of Criteria for the Recognition of Artificial Bone Alterations. *Journal of Quarternary Research,* 22, 160-71.

NAWROCKI, S. P., PLESS, J. E., HAWLEY, D. A. & WAGNER, S. A. (1997) Fluvial transport of human crania. IN HAGLUND, W. D. & SORG, M. H. (Eds.) *Forensic Taphonomy: The Postmortem Fate of Human Remains.* Boca Raton, CRC Press.

NEWELL, R., CONSTANDSE-WESTERMANN, T. & MEIKLEJOHN, C. (1979) The skeletal remains of Mesolithic man in Western Europe: An evaluative catalogue. *Journal of Human Evolution,* 8, 1-205.

NILSSON STUTZ, L. (2003) *Embodied rituals & ritualized bodies: tracing ritual practices in late Mesolithic burials.* Stockhom, Almqvist & Wiksell International.

NILSSON STUTZ, L. (2008) More than Metaphor: Approaching the Human Cadaver in Archaeology. IN FAHLANDER, F. & OESTIGAARD, T. (Eds.) *The materiality of death: bodies, burials, beliefs. BAR International Series 1768.* Oxford, Archaeopress.

NILSSON STUTZ, L. (2009) Coping with cadavers: ritual practices in mesolithic cemeteries. IN MCCARTAN, S., SCHULTING, R., WARREN, G. & WOODMAN, P. (Eds.) *Mesolithic Horizons.* Oxford, Oxbow Books.

NOLAN, R. W. (1986) Cnoc Coig; the Spatial Analysis of a Late Mesolithic Shell Midden in Western Scotland. Unpublished Ph.D. thesis, University of Sheffield.

O'CONNELL, L. (2003) Guidance on recording age at death in adults. IN BRICKLEY, M. & MCKINLEY, J. I. (Eds.) *Guidelines to the Standards for Recording Human Remains.* British Association for Biological Anthropology and Osteoarchaeology/Institute of Field Archaeologists.

OLSEN, S. L. & SHIPMAN, P. (1994) Cutmarks and Perimortem Treatment of Skeletal Remains on the Northern Plains. IN OWSLEY, D. W. & JANTZ, R. L. (Eds.) *Skeletal Biology of the Great Plains: Migration, Warfare, Health and Subsistence.* Washington D.C.

OLSON, E. C. (1980) Taphonomy: its history and role in community evolution. IN BEHRENSMEYER, A. K. & HILL, A. P. (Eds.) *Fossils in the making.* Chicago University of Chicage Press.

ORME, B. (1981) *Anthropology for Archaeologists.* London, Duckworth.

ORSCHIEDT, J. (1998) Ergebnisse einer neuen Untersuchung der spätmesolithischen Kopfbestattungen aus Süddeutschland. IN CONARD, N. & KIND, C.-J. (Eds.) *Aktuelle Forschungen zum Mesolithikum/Current Mesolithic Research.* Tübingen, Urgeschichtliche Materialhelfte 12.

ORSCHIEDT, J. (1999) Manipulationen an menschlichen Skelettresten. Taphonomische Prozesse, Sekundarbestattungen oder Kannibalismus? *Urgeschichtliche Materialhefte* 13.

ORSCHIEDT, J. (2005) The head burials from Ofnet cave: an example of warlike conflict in the Mesolithic. IN PARKER PEARSON, M. & THORPE, I. J. N. (Eds.) *Warfare, Violence and Slavery in Prehistory. British Archaeological Reports, International Series 1374.* Oxford, Archaeopress.

OTTE, M. & STRAUS, L. G. (1997) *La grotte du Bois Laiterie: Recolonisation magdalenienne de la Belgique. Magdalanien resettlement of Belgium.* . Liege, Universite de Liege.

OUTRAM, A. K. (2001) A new approach to identifying bone marrow and grease exploitation: why the "indeterminate" fragments should not be ignored. *Journal of Archaeological Science,* 28, 401-410.

OUTRAM, A. K. (2002) Bone fracture and within-bone nutrients: an experimentally based method for investigating levels of marrow extraction. IN MIRACLE, P. & MILNER, N. (Eds.) *Consuming Passions and Patterns of Consumption.* Cambridge, McDonald Institute Monograph Series.

OUTRAM, A. K., KNUSEL, C. J., KNIGHT, S. & HARDING, A. F. (2005) Understanding complex fragmented assemblages of human and animal remains: a fully integrated approach. *Journal of Archaeological Science,* 32, 1699-1710.

PENGELLY, W. (1872) The literature of the Oreston Caves near Plymouth. *Transactions of the Devonshire Association,* 5, 249-361.

PÉQUART, M. & PÉQUART, S.-J. (1954) *Hoëdic, deuxième station-nécropole du mésolithique côtier Armoricain.* De Sikkel, Anvers.

PÉQUART, M., PÉQUART, S.-J., BOULE, M. & VALLOIS, H. (1937) *Téviec, station-nécropole du Mésolithique du Morbihan.* Paris, Archives de L'Institut de Paléontologie Humaine XVIII.

PICKERING, M. (1999) Consuming Doubts: What Some People Ate? Or What Some People Swallowed? IN GOLDMAN, L. R. (Ed.) *The Anthropology of Cannibalism.* London, Bergin and Garvey.

PINHEIRO, J. (2006) Decay Process of a Cadaver. IN SCHMITT, A., CUNHA, E. & PINHEIRO, J. (Eds.) *Forensic Anthropology and Medicine: Complementary Sciences From Recovery to Cause of Death.* Totowa, NJ, Humana Press.

POLET, C. & CAUWE, N. (2007) Étude anthropologique des sépultures préhistoriques de l'abri des Autours (Province de Namur, Belgique). *Anthropologica et Præhistorica,* 118, 71-110.

POLLARD, A. (1996) Time and Tide: coastal environments, cosmology and ritual practice in early prehistoric Scotland. IN POLLARD, A. & MORRISON, A. (Eds.) *The Early Prehistory of Scotland.* Edinburgh, Edinburgh University Press.

POWER, C. (1999) Human Remains. IN WOODMAN, P., ANDERSON, E. & FINLAY, N. (Eds.) *Excavations at Ferriter's cove 1983-1995: last foragers first farmers in the Dingle Peninsula.* Bray, Co. Wicklow, Wordwell.

REDFERN, R. (2008) New evidence for Iron Age secondary burial practice and bone modification from Gussage All Saints and Maiden Castle (Dorset, England). *Oxford Journal of Archaeology,* 27, 281-301.

REIMER, P. J., BAILLIE, M. G. L., BARD, E., BAYLISS, A., BECK, J. W., BLACKWELL, P. G., BRONK RAMSEY, C., BUCK, C. E., BURR, G. S., EDWARDS, R. L., FRIEDRICH, M., GROOTES, P. M., GUILDERSON, T. P., HAJDAS, I., HEATON, T. J., HOGG, A. G., HUGHEN, K. A., KAISER, K. F., KROMER, B., MCCORMAC, F. G., MANNING, S. W., REIMER, R. W., RICHARDS, D. A., SOUTHON, J. R., TALAMO, S., TURNEY, C. S. M., VAN DER PLICHT, J. & WEYHENMEYER, C. E. (2009) IntCal09 and Marine09 radiocarbon age calibration curves, 0-50,000 years cal BP. *Radiocarbon,* 51**,** 1111-1150.

RICHARDS, M. P. (1998) Palaeodietary studies of european human populations using bone stable isotopes. Unpublished D. Phil. thesis, University of Oxford.

RICHARDS, M. P. & SHERIDAN, J. A. (2000) New AMS dates on human bone from Mesolithic Oronsay. *Antiquity*, 313-315.

RODRIGUEZ, W. C. (1997) Decomposition of Buried and Submerged bodies. IN HAGLUND, W. D. & SORG, M. H. (Eds.) *Forensic Taphonomy: The Postmortem Fate of Human Remains.* Boca Raton, CRC Press.

ROKSANDIC, M. (2002) Position of skeletal remains as key to understanding mortuary behaviour. IN HAGLUND, W. D. & SORG, M. H. (Eds.) *Advances in forensic taphonomy: method, theory, and archaeological perspectives.* Boca Raton, Fla, CRC Press.

SCALES, R. (2007) Footprint-tracks of people and animals. IN BELL, M. (Ed.) *Prehistoric Coastal Communities: The Mesolithic in western Britain.* York, Council for British Archaeology.

SCHEUER, L. & BLACK, S. (2000) *Developmental Juvenile Osteology.* London, Elsevier Academic Press.

SCHROEDER, S. (2001) Secondary disposal of the dead: cross cultural codes. *World Cultures,* 12, 77-93.

SCHULTING, R. J. (1996) Antlers, bone pins and flint blades: the Mesolithic cemeteries of Téviec and Hoëdic, Brittany. *Antiquity,* 70, 335-350.

SCHULTING, R. J. (1998) Slighting the sea: the mesolithic-neolithic transition in Northwest Europe. Unpublished Ph.D. thesis, University of Reading.

SCHULTING, R. J. (2005) '….pursuing a rabbit in Burrington Combe': new research on the early Mesolithic burial cave of Aveline's Hole'. *Proceedings of the University of Bristol Spelaeological Society,* 23, 171-266.

SCHULTING, R. J. & RICHARDS, M. P. (2002) Finding the coastal Mesolithic in southwest Britain: AMS dates and stable isotope results on human remains from Caldey Island, south Wales. *Antiquity,* 76, 1011-1025.

SHILLING, C. (1993) *The Body and Social Theory.* London, Sage Publications.

SMITS, E. & LOUWE KOOIJMANS, L. P. (2001) Menselijke skeletresten. IN LOUWE KOOIJMANS, L. P. (Ed.) *Archeologie in de Betuweroute: Hardinxveld-Giessendam Polderweg: een mesolithisch jachtkamp in het rivierengebied (5500 - 5000 v. Chr.).* Amersfoort Rijksdienst voor het Oudheidkundig Bodemonderzoek

SMITS, L. & VAN DER PLICHT, H. (2009) Mesolithic and Neolithic human remains in the Netherlands: physical anthropological and stable isotope investigations. *Journal of Archaeology in the Low Countries,* 1-1, 55-85.

STONE, R. J. & STONE, J. A. (2000) *Atlas of Skeletal Muscles.* Boston, McGraw Hill.

STRASSBURG, J. (2000) *Shamanic Shadows. One hundred generations of Undead Subversion in Southern Scandinavia 7000-4000BC.* Stockholm, Studies in Archaeology 20.

STRATHERN, A. J. (1996) *Body thoughts.* Ann Arbor, University of Michigan Press.

TELFORD, D. (2002) The Mesolithic inheritance: contrasting Neolithic monumentality in eastern and western Scotland. *Proceedings of the Prehistoric Society,* 68, 289-315.

THÉVENIN, A. (1978) Circonscription d'Alsace. *Gallia Préhistoire,* 21, 547-572.

THOMAS, J. (2000) Death, Identity and the Body in Neolithic Britain. *The Journal of the Royal Anthropological Institute,* 6, 653-668.

THORPE, I. J. N. (2003) Anthropology, archaeology and the origin of warfare. *World Archaeology,* 35, 145-165.

TILLEY, C. (1996) *An Ethnography of the Neolithic. Early Prehistoric Societies in Southern Scandinavia.* Cambridge, Cambridge University Press.

TOUSSAINT, M. (2011) Intentional Cutmarks on an Early Mesolithic Human Calvaria from Margaux Cave (Dinant, Belgium). *American Journal of Physical Anthropology,* 144, 100-107.

TOUSSAINT, M., BROU, L., LE BRUN-RICALENS, F. & SPIER, F. (2009) The Mesolithic site of Heffingen-Loschbour (Grand Duchy of Luxembourg). A yet undescribed human cremation possibly from the Rhine-Meuse-Schelde culture: anthropological, radiometric and archaeological implications. IN CROMBÉ, P., VAN STRYDONCK, M., SERGANT, J., BOUDIN, M. & BATS, M. (Eds.) *Chronology and evolution within the Mesolithic of North-West Europe.* Cambridge, Cambridge Scholars Publishing.

TRINKAUS, E. (2001) Gough's Cave 1 (Somerset, England): a study of the hand bones. *Bulletin of the Natural History Museum : Geology Series,* 57, 25-28.

TRINKAUS, E. (2003) Gough's Cave 1 (Somerset, England): a study of the pelvis and lower limbs. *Bulletin of The Natural History Museum,* 58.

TRINKAUS, E., HUMPHREY, L., STRINGER, C., CHURCHILL, S. E. & TAGUE, R. G. (2003) Gough’s Cave 1 (Somerset, England): an Assessment of the Sex and Age at Death. *Bulletin of The Natural History Museum,* 58, 45-50.

TROTTER, M. (1970) Estimation of stature from intact limb bones. IN STEWART, T. D. (Ed.) *Personal identification in mass disasters.* Washington, D.C., Smithsonian Institution.

TURNER, C. G. I. & TURNER, J. A. (1999) *Man Corn: Cannibalism and Violence in the American Southwest.* Salt Lake City, University of Utah Press.

VALDEYRON, N. (2008) The Mesolithic in France. IN BAILEY, G. & SPIKINS, P. (Eds.) *Mesolithic Europe.* Cambridge, Cambridge University Press.

VALENTIN, F. (1995) Le squelette mésolithique du Petit Marais de La Chaussée-Tirancourt (Somme, France). *Comptes Rendus de l'Académie des Sciences - Series II a,* 321, 1063-1067.

VALENTIN, F. (1998a) La sépulture mésolithique des Varennes à Val-de-Reuil (Eure): Etude anthropologique. *Unpublished specialist report.*

VALENTIN, F. (1998b) Les restes humains de l’abri des Cabônes à Ranchot (Jura). IN CUPILLARD, C. & RICHARD, A. (Eds.) *Les derniers chasseurs-cueilleurs du massif jurassien et de ses marges (13000-5500 avant Jésus-Christ).* Lons-le-Saunier, Centre Jurassien du Patrimoine.

VALENTIN, F. & LE GOFF, I. (1998) La sépulture secondaire Mésolithique de La Chaussée-Tirancourt: fractures sur os frais ou sur os secs? *L’Anthropologie,* 102, 91-95.

VALENTIN, F., ROTH, H. & SIMON, C. (1999) Situation des squelettes de la Chaussée-Tirancourt (Somme, France) et du Bichon (Neuchâtel, Suisse) dans le cadre des populations épipaléolithiques et mésolithiques d'Europe: analyse préliminaire. IN

THÉVENIN, A. & BINTZ, P. (Eds.) *L'Europe des derniers chasseurs: Épipaléolithique et Mésolithique*. Paris, Éditions du CTHS.

VILLA, P. & MAHIEU, E. (1991) Breakage patterns of human long bones. *Journal of Human Evolution,* 21, 27-48.

WHITE, T. D. & FOLKENS, P. A. (2000) *Human Osteology (2nd edition)*. London, Academic Press.

WOODMAN, P., ANDERSON, E. & FINLAY, N. (1999) *Excavations at Ferriter's cove 1983-1995: last foragers first farmers in the Dingle Peninsula*. Bray, Co. Wicklow, Wordwell.

WOODMAN, P. & MCCARTAN, S. (2008) Re-investigating the bone industry from the River Bann. *Paper presented at 'Palaeolithic Mesolithic Conference', British Museum, 2008*. Unpublished abstract.

9 Catalogue of sites in north-west Europe

9.1 A note regarding the catalogue

The following table is a summary of the catalogue of sites with human bone of Mesolithic date in north-west Europe which was compiled as part of this thesis. Each site is numbered, as shown on the location map in Chapter 2 (see Figure 2.3, and the accompanying key in Table 2.4) and quoted throughout the text. The site name is followed by a broad description of the type of site (e.g. cave, midden, etc.) and the condition of human remains deposited there (e.g. disarticulated, cremated, inhumation, etc.). Sources are cited and full references are given at the end of the catalogue. Direct dates on human bone are shown to the right-hand side of each entry. These are given as raw dates (uncalibrated radiocarbon years BP) followed by the lab number and the specific bone/individual sampled, where known. Unless otherwise stated, all dates derive from the main sources cited, and, are as utilised by Meiklejohn and colleagues in their recent series reviewing the chronology of Mesolithic human remains (see Meiklejohn, *et al.* (2010) for France and Meiklejohn, *et al.* (2011) for Britain, both of which are recently published collections of data deriving from Meiklejohn's personal catalogue (Meiklejohn, n.d.), to which I was very kindly provided access).

1 Ferriter's Cove, Co.Kerry — Open — Disarticulated

The fragmented and disarticulated remains of at least one individual (adult, aged c. 20-30) were recorded from an area of Mesolithic occupation. The remains consist of a mandible, femur, metacarpal, fibula, metatarsal, ulna, tibia, humerus and seven teeth all found close together. Based on the site stratigraphy Woodman suggested that the remains could belong to a later phase of activity on the site.	5545 ± 65 OxA-4918

(Woodman *et al.*, 1999)

2 River Bann — Open — Artefact

Bone artefacts dredged from the River Bann include at least one bone point made from a human ulna with a number of other points possibly made from human bone (including one possible tibia).

(Woodman and McCartan, 2008)

3 Hermitage, Castleconnell, Co.Limerick — Open — Cremation

Three cremations, each buried in a pit, were found on a Mesolithic occupation site. One of the cremations (Pit A) had been placed around a post and was accompanied by a polished stone axe and several microliths all of which had been burnt. The remains may have been pounded or crushed prior to deposition. The cremation in Pit B was incomplete (i.e. it was not a whole body) and was accompanied by a scatter of burnt stone and fired clay. Cremated skeletal material was also recorded in a third pit (Pit C) but was too small for a positive identification. This was dated to the late Mesolithic. An area of burning on the natural subsoil was thought to represent the location of the pyre.	8350 ± 40 Beta-214236 (Pit A - tibia) 8070 ± 40 Beta-214237 (Pit B - skull)

(Collins and Coyne, 2003, Collins, 2009)

4 Killuragh Cave, Co.Limerick — Cave — Disarticulated

The remains of at least four individuals (two adults and two sub-adults including one infant) were recorded from deposits within a cave.	5455 ± 50 OxA-6749 5700 ± 40 GrA-27180 5725 ± 55 OxA-6752 7880 ± 60 GrA-2433 7955 ± 45 GrA-27215 8030 ± 60 GrA-2434

(O'Shaughnessy, 1994)

5	**Sramore Cave, Leitrim**	**Cave**	**Disarticulated**	

Three disarticulated human bones were discovered in a small hollow in the floor of a tunnel within the cave. The remains consist of a mandible, a right humerus and a fragment of the diaphysis of a right femur and represent at least one adult (over the age of 20), possibly male.

5202±39 UB-6407

(Dowd, 2008, forthcoming)

6	**Rockmarshall, Co.Louth**	**Midden**	**Disarticulated**	

A fragment of a shaft of human femur recorded from a shell midden.

5705 ± 75 OxA-4604

(Mitchell, 1947, Woodman *et al.*, 1997)

7	**Ogof yr Ychen, Caldey, Dyfed**	**Cave**	**Disarticulated**	

The disarticulated remains of six individuals were recorded from the chambers of a swallet hole and all date to the late Mesolithic. The assemblage consists of two os coxa, a tibia, two mandibles and two fragments of crania. Conneller suggests that they were deliberately dropped into the swallet hole, a point that is demonstrated by the spatial separation of one of the mandibles, half of which was found in the shaft and the other half within a lower chamber.

7020 ± 100 OxA-2574
7880 ± 55 OxA-7742
8210 ± 55 OxA-7691
8280 ± 55 OxA-7690
8415 ± 65 OxA-7741
8760 ± 55 OxA-1061

(David, 1990, Hedges *et al.*, 1994, Schulting and Richards, 2002a, Conneller, 2006)

8	**Potter's Cave, Caldey, Dyfed**	**Cave**	**Disarticulated**	

Two human bones (and ulna and a metacarpal) from this site have been recovered during excavations in the cave and dated to the late Mesolithic. Based on their dates these represent the remains of two individuals. Several late/post Roman bones have also been recorded.

8580 ± 60 OxA-7688
7880 ± 55 OxA-7687

(Schulting and Richards, 2002a)

9 Daylight Rock, Caldey, Dyfed **Cave**

Human remains recovered from a cave excavated in the 1950s. A human mandible has been dated to the end of the Early Mesolithic/start of the late Mesolithic but another mandible was dated to the late-post Roman period.

8655 ± 60 OxA-7686

(Schulting and Richards, 2002a)

10 Foxhole cave, Glamorgan **Cave** **Disarticulated**

A human tooth was dated to the late Mesolithic. Other human remains have been recorded from the cave though the only direct other dates are Neolithic.

6785 ± 50 OxA-8316

(Meiklejohn, no date)

11 Worm's Head, Gower, W. Glamorgan **Cave** **Disarticulated**

The remains of at least four individuals have been recorded during various excavations in the cave. Excavations in 1996 recorded an ulna, two scapulae, a male pelvis, a fibula, a metacarpal, a femur and fragments of a child's cranium. Further work in 2004 recovered an adult tibia, vertebra and a molar. According to Schulting (2009) all four individuals date to the early Mesolithic with three being interred very close together (temporally) whilst the other was a few centuries earlier. Two mandibles, which were reportedly found at another cave, are also thought to have been recovered from this site and have a similar date.

8800 ± 80 OxA-4024 (Superceded by OxA-11128)
9360 ± 50 OxA-11129
9420 ± 55 OxA-11083
9450 ± 50 OxA-11128
9920 ± 160 OxA-13131
9235 ± 50 OxA-11018 (Mandible-reportedly from Mewslade Bay)
9385 ± 45 OxA-11017 (Mandible-reportedly from Mewslade Bay)

(Hedges *et al.*, 1996, Schulting and Richards, 2002a, Schulting, 2009)

12 Paviland, Gower, W. Glamorgan **Cave** **Disarticulated**

Two fragments of human bone (part of a humerus and a metatarsal) have been recorded from the Mesolithic deposits in the cave. One of these has been dated to the late Mesolithic.

7190 ± 80 OxA-681

(Trinkaus and Holliday, 2000)

13 Pontnewydd, St. Asaph, Clwyd **Cave** **Disarticulated**

Two fragments of bone (part of a mandible and a thoracic vertebra) and a tooth have been recorded from this site. The mandible and tooth both came from material that had been redeposited from the cave during the 1940's and are thought to belong to the same individual. These have been dated to the late Mesolithic. The vertebra is assumed to be Mesolithic but has not been directly dated.

7420 ± 90 OxA-5819

(Green, 1981, 1984, Aldhouse-Green *et al.*, 1996)

14 Chapel Cave, Yorkshire **Cave** **Disarticulated**

The remains of at least three individuals have been recorded from this cave though some of this material has been dated to the Neolithic.

6580 ± 45 OxA-V2138-08

(Meiklejohn, no date)

15 Kilham long barrow, Yorkshire **Open** **In features**

A human tibia was recovered from a Mesolithic pit during the excavation of the Kilham long barrow by Terry Manby. The bone is undated and as the reworking of Mesolithic material during the construction of barrows is well-known (McFadyen 2003) it has been thought Neolithic (Conneller 2006). Manby's excavation records, however, show that a layer of buried soil lay between the upper fills of the pit and the barrow, indicating that the feature was undisturbed and that the bone is probably Mesolithic (Manby 1976).

(Manby, 1976, Newell *et al.*, 1979, McFadyen, 2003, Conneller, 2006)

16 Staythorpe, Notts. **Open** **Disarticulated**

An isolated find of an adult human femur (shaft) was recovered from a palaeo-channel along with the butchered remains of other animals. The context of their deposition is unknown, but the fact that the bones were in good condition and not heavily abraded suggests that they had not been transported far by the river.

6720 ± 40 Beta-144016
6785 ± 35 OxA-813

(Davies *et al.*, 2001)

17	**Bower Farm, Rugely, Staffordshire**	**Cave**	**Disarticulated**	

A small assemblage of human bone discovered in this cave. A cranium was dated to the late Mesolithic but several other bones (a cranium and a rib) have been dated to the Neolithic. The rest of the assemblage consists of three femora and a vertebra and is undated. — 8170 ± 45 OxA-V2137-26

(Meiklejohn, no date)

18	**Thatcham, Berks.**	**Open**	**Disarticulated**

A fragment of humerus was recovered from a deposit of marl close to the area of early Mesolithic occupation. The context has been interpreted as a flood deposit suggesting that the material it contained may have been redeposited. The bone has been dated on the basis of a boreal assemblage recorded from a sample of sediment from its cavity.

(Churchill, 1962, Wymer, 1962)

19	**Badger Hole, Wookey, Somerset**	**Cave**	**Disarticulated**

Two fragments of human mandible excavated from two locations in the cave (BH1 and BH2) during the late 40s and early 50s. Both have been dated to the early Mesolithic. Other skeletal elements have been recorded from this cave but are early Medieval.

9060 ± 130 OxA-679 (Site 1)
9360 ± 100 OxA-1459 (Site 2)

(Oakley, 1971, Hedges *et al.*, 1989: 210)

20	**Totty Pot, Cheddar, Somerset**	**Cave**	**Disarticulated**

A mixed assemblage of human skeletal material recorded from at least two locations within a swallet hole. The material was thought to be largely Mesolithic but only two elements, a humerus and a femur, have been dated to the period and recent dating has shown that much of the assemblage is Neolithic.

8180 ± 70 BM-2973 (Humerus)
8245 ± 45 OxA-16457 (Femur)

(Ambers and Bowman, 2003, Murray, 2007, Gardiner *et al.*, 2010)

21	**Avelines Hole, Burrington Combe, Somerset**	**Cave**	**Disarticulated**	

The largest Mesolithic cemetery in Britain. The site was originally discovered in 1797 and excavated on several occasions during the early half of the 20th century. The collection suffered substantial damage during the Second World War but has been the subject of recent re-analysis. Original reports describe approximately 50 individuals but on the basis of the surviving material 21 individuals are represented by c.860 elements. The assemblage represents largely complete skeletons and body parts do not appear to have been removed. Two burials were recorded during the excavations; a double burial of two adults accompanied with grave goods and a collection of skeletal material also with accompanying artefacts including deer antler. It is unclear whether the remaining skeletal material was intentionally disarticulated and/or moved within the cave.

8890 ± 45 GrA-22421 (M1.13/38 ulna)
8925 ± 45 GrA-22431 (M1.13/161 ulna)
8960 ± 50 GrA-22938 (M1.13/329 ulna)
8980 ± 50 GrA-22605 (M1.13/144 ulna)
9020 ± 50 GrA-22555 (M1.13/159 ulna)
9060 ± 50 GrA-22546 (M1.13/166 ulna)
9075 ± 45 GrA-22428 (M1.13/154 ulna)
9090 ± 45 GrA-22433 (M1.13/164 ulna)
9095 ± 45 GrA-22422 (M1.13/152 ulna)
9100 ± 45 GrA-22429 (M1.13/160 ulna)
9120 ± 50 GrA-22557 (M1.13/172 ulna)
9130 ± 60 GrA-22621 (M1.13/302 ulna)
9155 ± 45 GrA-22432 (M1.13/163 ulna)
9170 ± 50 GrA-22547 (M1.13/300 ulna)
9170 ± 50 GrA-22548 (M1.13/301 ulna)
9180 ± 50 GrA-22607 (M1.13/307 cranium)
9200 ± 50 GrA-22552 (M1.11/118 ulna)
92 10 ± 70 GrA-22558 (M1.14/99 ulna)
8740 ± 100 OxA-1070 (M1.13/146 humerus)
8860 ± 100 OxA-800 (M1.13/24 humerus)
9100 ± 100 OxA-799 (M1.13/23 humerus)
8100 ± 100 Grn-5393 (Stalagmite inside skull "O")
9090 ± 110 Q-1458 (Not stated)
9114 ± 110 BM-471 (Femur (number not known))

(Wansey, 1805, Skinner, 1824, Davies, 1921, 1923, 1924, 1925, Schulting, 2005)

22	**Goughs Cave, Cheddar, Somerset**	**Cave**	**Inhumation**

An almost complete skeleton, probably of an adult male between 18-23 years, was recovered from a fissure or pit in the cave floor. This has been dated to the late Mesolithic.

9080 ± 150 BM-525
9100 ± 100 OxA-81

(Trinkaus, 2001, 2003, Trinkaus *et al.*, 2003)

23	**Kent’s Cavern, nr Torbay, Devon**	**Cave**	**Disarticulated**	

Two fragments of disarticulated human bone (a maxilla and the proximal third of an ulna) representing a minimum of one individual have been dated to the Mesolithic. Cut marks were recorded on the ulna - two groups of several short cut-marks on the posterior aspect of the olecranon process - at the insertion of the triceps brachii muscle. The ulna was deliberately fractured whilst fresh. Two other fragments of the bone were dated to the Upper Palaeolithic and Bronze Age.

8070 ± 90 OxA-1786
8185 ± 38 OxA-20588

(Duckworth, 1913, Newell *et al.*, 1979)

24	**Oreston (third bone cave), Plymouth, Devon**	**Cave**	**Disarticulated**

A single human clavicle was recorded from an assemblage of animal bone recovered during quarrying at the site in 1882. It has been suggested that this cave had a 'chimney' through which the bones were deposited but it is unclear whether this was the only way the material could have come into the cave. The bone has been dated to the end of the early Mesolithic.

8615 ± 75 OxA-4777

(Pengelly, 1872, Chamberlain, 1996)

25	**Priory Midden, Oronsay**	**Midden**	**Disarticulated**

A human phalanx was recorded from the midden deposit. It has not been directly dated but comes from a secure late Mesolithic context.

(Meiklejohn and Denston, 1987)

26	**Caisteal nan Gillian II, Oronsay**	**Midden**	**Disarticulated**

Five fragments of human bone (a fragment of vertebra and bones of the hands and feet) were recorded within the shell midden. One bone was directly dated to the late Mesolithic and the rest of the assemblage came from a secure late Mesolithic context.

5480 ± 55 OxA-8005

(Meiklejohn and Denston, 1987)

27 Cnoc Coig, Oronsay | **Midden** | **Disarticulated**

Skeletal material recovered from a midden. 40 elements were recorded (19 hand bones, 11 foot bones, 3 skull fragments, a patella, clavicle, maxilla, vertebra, fibula, 2 os coxa, and several teeth) and represent at least five individuals. Spatial analysis identified five concentrations or groups of bones, along with some isolated elements which were considered to represent at least eight individuals and a number of different depositional processes. Two of these groups were dominated by the bones of the hands and feet, with very few other parts of the body represented, and anatomical links or fits could be made within both of these groups.

5495 ± 55 OxA-8014
5615 ± 45 OxA-8019
5740 ± 65 OxA-8004

(Nolan, 1986, Meiklejohn and Denston, 1987, Schulting and Richards, 2002b, Meiklejohn *et al.*, 2005)

28 Beg-er-Vil, Morbihan | **Midden** | **Disarticulated**

A clavicle and mandible recorded from a Mesolithic shell midden. There are no dates on the bones but shell and bone from the midden has been dated to 6020 ± 80 (Gif-7180) and 7450 ± 45 (OxA-10962) respectively.

(Meiklejohn, no date)

29 Téviec, Morbihan | **Midden** | **Multiple Inhumation, Secondary burial**

A total of 10 graves, containing the remains of 23 individuals were recorded from the lower deposits of a shell midden. An empty grave was also recorded at the site and thought to represent a cenotaph. Seven of the graves contained multiple burials with one, grave K, containing six individuals. The bodies in the group burials were not contemporary and the remains of the earlier interments were moved aside for the later ones. The exception was the burial of a young adult male in grave K that had been placed in a stone-lined depression and was undisturbed by later interments. This individual had two microlith projectile points in his thoracic vertebrae (T6 and T11 both peri-mortem) and a healed fracture of the mandible. Bodies were laid out in a range of positions including flexed, supine and seated. An incised rib, from a child, was recorded from one of the graves and other artefacts, red ochre and deer antler were also present in the graves. The graves had one or more hearths either on top or adjacent to them, several of which contained burnt animal remains (usually red deer and/or wild boar mandibles).

6322 ± 40 OxA-12895 (Burial B 2)
6440 ± 55 OxA-6663 (Burial K1 8)
6500 ± 65 OxA-6703 (Burial K6 16)
6510 ± 50 OxA-6664 (Burial K4 10)
6515 ± 45 OxA-10963 (Burial H1 14)
6515 ± 65 OxA-6704 (Burial L 20)
6530 ± 60 OxA-6702 (Burial H3 15)
6740 ± 60 OxA-6665 (Burial M 13)

(Péquart and Péquart, 1929, Péquart *et al.*, 1937, Schulting, 1996)

30	**Hoëdic, Morbihan**	**Midden**	**Multiple Inhumation**

The burials of 14 individuals (nine adults and five sub adults) in nine graves recorded from a depression beneath a midden. The group burials contained successive rather than contemporary interments as the remains of the earlier bodies had been moved to make way for the later ones. Burning is evident on the remains of two individuals (both sub-adults). Artefacts including red ochre and deer antler accompanied several of the burials.

5750 ± 35 OxA-11776 (Burial B 1)
5755 ± 55 OxA-6710 (Burial K 9)
6080 ± 60 OxA-6707 (Burial H 8)
6280 ± 60 OxA-6706 (Burial C1 2)
6645 ± 60 OxA-6709 (Burial F1 5)
7165 ± 60 OxA-6708 (Burial A 12)

(Péquart and Péquart, 1934, 1954, Schulting, 1996)

31	**La Vergne, Charente-Maritime**	**Open**	**Multiple Inhumation, Cremation, Disarticulated**

The remains of at least ten individuals were recorded from three burial pits whilst the remains of a further five individuals may have been deposited into one or more graves that were disturbed by later activity. The burials included adults, sub-adults and infants buried together and exhibit a range of different burial practices. Pit 3: two adults buried in a seated position with the incomplete disarticulated remains of two sub-adults (a juvenile and a neonate). Pit 7: the partial skeletal remains of two adults and a sub-adult. The cremated remains of a third adult were scattered over the infant. Pit 10: An adult and sub-adult. These were buried with an assemblage of animal (auroch) bone and perforated shells.

9070 ± 70 Ly-369/OxA-6699 (Pit 7 adult ulna)
~9070 ± 70 Ly-369/OxA-6699 (Pit 7 adult femur)
9075 ± 65 Ly-368/OxA-6698 (Pit 3 adult femur)
~9075 ± 65 Ly-368/OxA-6698 (Pit 3 adult cranium)
~9075 ± 65 Ly-368/OxA-6698 (Pit 3 adult tibia)
9215 ± 65 Ly-370/OxA-6700 (Pit 10 adult tibia)

(Duday and Courtaud, 1998, Meiklejohn *et al.*, 2010)

32	**Grotte des Perrats, Agris, Charente**	**Cave**	**Disarticulated**

Over 500 fragments of human skeletal material were recorded during the excavation of deposits within the entrance of a cave. The material represents the remains of at least eight individuals, including five adults (of both sexes) and three children. The assemblage was disarticulated but all parts of the body were present. 45% of the elements had cut marks (including the remains of adults and children) and resulted from a range of disarticulation, defleshing, and skinning practices. 17% showed signs of scraping and a small proportion (<5%) had evidence for burning. Large quantities of animal bone were also recorded from the deposits.

8100±90 Gif-95476 (Tibia 291)

(Boulestin, 1999)

33 Culoz sous Balme, Ain Cave Inhumation, Disarticulated

The graves of two adult males from a cave. One was radiocarbon dated to the middle Mesolithic; the other is undated but comes from a secure Mesolithic horizon. A child's tooth was discovered in one of the graves (# 1). 8640 ± 380 Ly-1688 (Burial 2)

(Newell *et al.*, 1979, Grünberg, 2000a, Grünberg, 2000b, Meiklejohn *et al.*, 2010)

34 Ruffey-sur-Seill, À Daupharde, Jura Open Cremation

The cremated/burnt remains of a single individual were recorded from an area of Mesolithic settlement activity. The assemblage is incomplete, the vertebrae and peripheral skeletal elements are under-represented but fragments of the long bones and cranium are present, suggesting some selection of elements. It was deposited together and located close to the main hearth (a fragment of vertebra was associated with the hearth) and in close association with an ochre ball and a flint flake. The skeletal material has not been radiocarbon dated but a middle Mesolithic date was obtained on the hearth (8735 ± 85 (Ly-238)). The site was also occupied during both the earlier and later parts of the period.

(Séara *et al.*, 2002, Valdeyron, 2008, Meiklejohn *et al.*, 2010)

35 L'abri des Cabones à Ranchot, Jura Cave Disarticulated, Artefact

The disarticulated remains of five individuals (two adults and three sub adults, 1 year, 6-7years and 12 years) were recorded during excavations at a small cave. The assemblage consisted of 12 teeth, 31 cranial fragments and 6 bones of the hands and feet and is described as being fragmented and dispersed and deriving from a non-funerary context. There are several groups of cut marks on the ectocranial surface of the right parietal and one of the teeth (a molar) has been perforated. Some of the material has been burnt, though not cremated, and is thought to have occurred once the remains were dry. There are no dates on the bones but samples from the Mesolithic deposits have been dated and range from 7820 ± 60 (Gif-8397) to 8910 ± 300 (Ly-2810).

(Valentin, 1998b)

36 Mannlefelsen I, Haut-Rhin Cave Head/Skull burial

The burial of an adult male skull (incomplete but with the atlas vertebrae) on top of 74 stone blocks arranged into an elliptical feature. There are cut marks on posterior body and ramus of the mandible and possible cut marks on the basi-occiput. There are no dates on the skeletal material but the deposits above and below the layer containing the burial have been radiocarbon dated to the Mesolithic (7810±170 (Ly-10105) and 8230 ± 300 (Ly-1297) respectively.

(Thévenin, 1978, Newell *et al.*, 1979, Grünberg, 2000a, Grünberg, 2000b, Hofmann, 2005)

37	**Parc du Chateau à Auneau, Eure-et-Loir**	**Open**	**Inhumation**	

Burials of three adult males were recorded from an area of Mesolithic settlement/occupation. The earliest burial (grave 6) was seated in a stone filled/lined pit and dated to the Middle Mesolithic. The others (graves 3 and 7) were both buried in flexed positions, one prone and on an area of stone paving the other supine. Both are late Mesolithic (LY-4731 and LY-7097). Single auroch skulls were also deposited in three pits, one of which had deer antler placed on to it. The dating of two of these suggests that they may be related to the earlier burial (8710±80 (OxA-5644) and 9010±90 (OxA-5643)).

6650± 90 LY-4731 (Grave 3)
6825 ± 105 LY-7097 (Grave 7)
8350 ± 105 LY-5606 (Grave 6)

(Verjux and Dubois, 1997, Verjux, 1999, 2003)

38	**Villeneuve-la-Guyard, Falaises de Prépoux, Yonne**	**Open**	**Multiple Inhumation**

Mesolithic group burial containing the articulated remains of two adult males, an adult female and a sub-adult. The burial was recorded during the excavations of a later prehistoric site and the Mesolithic date obtained on the burial has been rejected. However, Meiklejohn points out that the burial does not relate to the position or orientation of the later graves on the site and a Mesolithic date is still a possibility.

6730 ± 110 Ly-4503

(Prestreau, 1992, Meiklejohn *et al.*, 2010)

39	**Noyen-sur-Seine, Seine-et-Marne**	**Open**	**Disarticulated**

Human skeletal remains recorded from an area of Mesolithic occupation on a gravel promontory on the edge of the river Seine. The remains represent at least four individuals and consist of four skulls and a mandible, the upper and lower limbs and a small quantity of vertebra and foot bones. Cut marks were present on several bones (the mandible, left radius and left ulna) and traces of burning were also recorded. The bones are undated but samples from the Mesolithic occupation material have been radiocarbon dated to the middle Mesolithic.

8000 ± 100 Gif-6633

(Auboire, 1991, Mordant and Mordant, 1992)

40	**Melun, Seine-et-Marne**	**Open**	**Inhumation**

Burial of an adult female.

8540 ± 100 GrN-29284

(Valentin *et al.*, 2008)

41	**Maisons-Alfort, Val-de-Marne**	**Open**	**Inhumation**	
A single adult inhumation recorded during excavations in the late 90s. (Valentin *et al.*, 2008)				8030 ± 50 LY-9817
42	**Rueil-Malmaison 'Les Closeaux', Hauts-de-Seine, Paris**	**Open**	**Inhumation, Cremation**	
The burial of an adult female and a cremation were discovered during excavations in the mid 90s. The burial was laid out in a flexed position and dated to the middle Mesolithic. The cremation is also thought to belong to this period but has not been scientifically dated. (Verjux, 2003, Valentin *et al.*, 2008)				8870 ± 130 OxA-7109/Lyon-612
43	**Neuilly-sur-Marne, Seine-Saint-Denis**	**Open**	**Inhumation**	
The burial of an unsexed adult discovered during excavations at the site. The burial appears to be very tightly crouched/bound. (Valentin *et al.*, 2008)				7735 ± 45 Ly-3066/OxA-17360
44	**Mareuil-lès-Meaux, Seine-et-Marne**	**Open**	**Inhumation**	
Burial of an unsexed adult. (Valentin *et al.*, 2008)				8320 ± 90 GrN-27225

45 Les Varennes, Val de Reuil, Eure — Open — Inhumation, Multiple Inhumation, Disarticulated

A pit containing the remains of at least three individuals, all adults, though of differing ages. Two of the skeletons were incomplete and were thought to have been disturbed by the insertion of the third, later burial. The upper fills of the pit included large quantities of burnt animal bone (including the skulls of deer and auroch) and charcoal that are thought to have been burnt in-situ as part of the burial rites. The radiocarbon date is from one of the earlier burials.

8715 ± 310 Ly-6239

(Duday *et al.*, 1990, Valentin, 1998a, Billard *et al.*, 2001)

46 Concevreux, Aisne — Open — Cremation

A ‘structure cinéraire’ excavated in 2006 and radiocarbon dated to the late Mesolithic. The cremated remains of at least two individuals were recorded from a small pit along with two concentrations of artefacts, some of which may have accompanied the bodies as they were cremated and others of which have been carefully laid out. The remains are thought to have been placed in an organic container that has since decayed.

6440 ± 30 GrA-37623

(Robert *et al.*, 2007, Robert, 2008, Le Goff, 2010)

47 Verberie, Le Buisson Campin, Oise — Open — Inhumation

The grave of a child buried in a 'contracted and seated position'.

8740 ± 50 GrA-34097

(Meiklejohn *et al.*, 2010)

48 Petit Marais, La Chaussee-Tirancourt, Somme — Open — Cremation, Disarticulated

Skeletal material was recorded from two pits within an area of Mesolithic activity. In one (pit 4) the disarticulated remains of an adult male had been carefully arranged within the pit. There is no evidence for cut marks (though the bones are heavily root etched) and it is thought that the body was exposed and then the remains brought to the pit for secondary burial. Several of the bones fractured some time after death but whilst they were still quite fresh. The cremated remains of several individuals were recorded from a second pit (pit 1) and was dated to 8460 ± 70 based on burnt hazelnut shell (Gif-9329). A small amount of human bone was also recovered from the later Mesolithic layers.

7800 ± 100 GifA-97521 (Pit 1)
9020 ± 100 GifA-92523 (Pit 4)

(Ducrocq and Ketterer, 1995, Valentin, 1995, Ducrocq *et al.*, 1996, Valentin and Le Goff, 1998, Valentin *et al.*, 1999, Le Goff, 2000)

49 Saleux, Les Baquets, Somme **Open**

A fragment of femur recorded from an assemblage of Mesolithic material. 8930 ± 50 GrA-21032/Ly-1923

(Meiklejohn *et al.*, 2010)

50 Grotte Lombeau at Mont-sur-Marchienne, Charleroi, Hainault **Cave** **Disarticulated**

Collective burial of five individuals (three adults and two children), some covered with ochre (Toussaint 2011).

9015 ± 80 OxA-6445
9360 ± 75 OxA-6440
9410 ± 70 OxA-6441

(Toussaint, 2011)

51 Loverval / Grotte des Sarrasins, Hainaut **Cave** **Multiple Inhumation**

The burial of two adults, both dated to the early Mesolithic.

9090 ± 100 Lv-1506
9640 ± 100 GifA-94536

(Toussaint, 2011)

52 Grotte de Claminforge at Sambreville, Namur **Cave** **Disarticulated**

Collective burial of five individuals (three adults and two children).

9320 ± 75 OxA-5451
9525 ± 60 OxA-1055 (or 6)

(Toussaint, 2011)

53	**Petit Ri at Malonne, Namur**	**?**	**Disarticulated**	
The remains of four individuals (all adults) were recorded from an area of Mesolithic activity. The original context of the skeletal material is uncertain.				9270 ± 90 OxA-5042
(Toussaint, 2011)				
54	**Faille du Burin at Thon, Andenne, Namur**	**Cave**	**Disarticulated**	
Collective burial of six individuals (four adults and two children).				9315 ± 50 OxA-10564 9335 ± 75 OxA-10595 9345 ± 75 OxA-8938 9520 ± 75 OxA-19585
(Toussaint, 2011)				
55	**Trou Al'Wesse, Modave**	**Cave**	**Disarticulated**	
A fragment of human cranium recorded from an area of Mesolithic occupation.				6540 ± 45 OxA-10561
(Toussaint, 2011)				
56	**Bois Laiterie, Namur**	**Cave**	**Disarticulated**	
The scattered remains of at least four individuals (two adults and two subadults). The context of this material is uncertain.				9235 ± 85 GX-21380G 9420 ± 65 OxA-8911 9445 ± 60 OxA-8878 9515 ± 65 OxA-8910
(Otte and Straus, 1997, Toussaint, 2011)				

57	**Abri des Autours, Namur**	**Cave**	**Inhumation, Disarticulated**	
A collective burial within a rock shelter containing a single inhumation and the scattered disarticulated remains of at least12 individuals including 6 adults and 6 children. The inhumation and the collective burials were both dated to the early Mesolithic though the collective burials are slightly later. None of the material showed evidence of cut-marks and one of the adults had been cremated. Most of the assemblage was scattered across the cave floor though some material was deposited into a small pit and several more elements (mostly the bones of the hand) were placed in a small crevice. The excavators believe that complete, fleshed, bodies were brought into the cave where they skeletonised, after which the elements were dispersed. A single inhumation was also present and was earlier than the collective/disarticulated material.				9090 ± 140 OxA-5838 9500 ± 75 OxA-4917
(Cauwe, 2001)				
58	**Grotte Margaux, Namur**	**Cave**	**Disarticulated**	
A collective burial with the disarticulated remains of ten individuals deposited within a pit and across a 'paved' area.				9190 ± 100 Lv-1709 9260 ± 120 GifA-92362 9350 ± 120 OxA-3534 9530 ± 120 OxA-3533 9530 ± 110 GifA-92355 9590 ± 110 GifA-92354
(Cauwe, 2001)				
59	**Trou Magrite, Namur**	**Cave**	**Disarticulated**	
A single early Mesolithic date from a collection of human bone.				8645 ± 70 OxA-5841
(Toussaint, 2011)				
60	**Trou de Chaleux, Namur**	**Cave**	**Disarticulated**	
The remains of at least two individuals were recorded during excavations in 1865. One bone has been dated to the early Mesolithic.				8730 ± 80 OxA-5679
(Toussaint, 2011)				

61	**Abri Astebach, Reuland**	**Cave**	**Disarticulated**	

Human remains and cultural material dating to both the Mesolithic and Neolithic were recorded from a deposit of gravel outside of a cave. A fragment of cranium was dated to the late Mesolithic or early Neolithic but the remaining skeletal and cultural material was mixed up and there is no indication that the human remains only belonged to one period.

5010 ± 80 OxA-3579

(Meiklejohn, no date)

62	**Abri du Loschbour, Reuland**	**Cave**	**Inhumation, Cremation**	

A burial and a cremation were recorded from a rock shelter during excavations in the 1930's. The burial was an adult male and is described as being supine and partly flexed. The cremation consisted of the remains of a single adult, possibly female. The vertebrae and hand and feet bones were very poorly represented and may have either been lost or deliberately ignored when the material was collected after cremation. Cut marks were also recorded on several fragments of crania and one of the long bones and occurred before the body was cremated, though the body is thought to have been fleshed when burnt. Toussaint et al. do also state that this under-representation may be a result of excavation and recovery. The pit also contained a small quantity of cremated animal bone and a perforated shell (also burnt).

7205 ± 50 OxA-7338 Inhumation
7960 ± 40 Beta-132067 Cremation

(Toussaint *et al.*, 2009)

63	**Oirschot V (site 21), North Brabant**	**?**	**Cremation**	

199 burnt fragments of human bone representing at least 113 elements. The main concentration of material came from a pit containing the fragmentary cremated remains of a child aged 10-13 along with several worked flints (also burnt) and charcoal. The charcoal was dated to 7790 ± 130 (GrN-14506).

8320 ±40 GrN-13390

(Toussaint *et al.*, 2009)

64 Hardinxveld, Giessendam **Open** **Inhumation, Disarticulated**

Two small islands (Polderweg and De Bruin) formed by glacial dunes or donks in the wetlands of the Rhine/Meuse delta. At the site of Polderweg a relatively large assemblage of human skeletal material was associated with an area of Mesolithic occupation on the top of the donk/dune. 76 fragments of human bone were recorded across the surface of the donk and in the adjacent wetland deposits, and a further 17 disarticulated elements were recorded in a small cluster roughly 2m across (grave 2). The scattered material included fragments of crania, long bones and small numbers of hand and foot bones whilst the material from grave 2 consisted of the lower leg bones, vertebrae, ribs, a scapula and lower arm bones. Cut marks and areas of burning were recorded on several bones. The burial of an adult female was also recorded (grave 1) and is broadly contemporary with the other skeletal material. Three dog burials (graves 3-5) (one complete, one a cluster of material) and a large quantity of disarticulated canid bone were also recorded and their treatment directly parallels that of the human remains.
At De Bruin a smaller assemblage of material was recovered, though this was also from an occupation area. The skeletal material consisted of 10 disarticulated elements and two burials.

6530 ± 50 GrA-11815 (Grave 2 De Bruin)
6710 ± 50 GrA-11816 (Grave 1 De Bruin)
6820 ± 50 GrA-9804 (Grave 1 Polderweg)
6170 ± 60 GrA-11830 (Disarticulated human skull Polderweg)

(Louwe Kooijmans, 2001a, 2001b, Smits and Louwe Kooijmans, 2001b, 2001a, Louwe Kooijmans, 2003, Smits and van der Plicht, 2009)

65 North Hinder Bank, North Sea Basin **Sea** **Disarticulated**

A calotte recovered during fishing at the North Hinder bank.

9640 ± 400 UtC-3750

(Meiklejohn, no date)

66 Marienberg, Overijssel **Open?** **Inhumation**

Six pits containing a range of artefacts and red ochre were recorded on a site with Mesolithic and later activity. The excavator argued that the character of the artefacts and the presence of the ochre suggested that these were originally burials (probably seated) and that the skeletal material had not survived.

(Grünberg, 2000a, Grünberg, 2000b)

67 Dalfsen (Welsumer Maan), Overjissel ? Cremation

The cremated remains of two individuals (an adult female and an infant) were recorded from a pit in an area of Mesolithic occupation. The dating of the bone is thought to be unreliable but charcoal from the pit was radiocarbon dated to 7685 ± 130 (GrN-7283B) though Meiklejohn says that this has been corrected to 7760 ± 130 (GrN-7283B) (?Late Mesolithic).

(Toussaint *et al.*, 2009)

68 Rees, Nordrhein-Westfalen Unknown Disarticulated

Six fragments of bone (three cranial and three post cranial) were recovered during dredging. As Meiklejohn states, the radiocarbon date obtained on one of the bones could be either Mesolithic or Neolithic.

5160 ± 80 OxA-668

(Newell *et al.*, 1979, Meiklejohn, no date)

69 Blätterhöhle bei Hagen, Nordrhein-Westphalen Cave Disarticulated

Cave site with the human remains dating to both the Mesolithic and Neolithic. The remains of at least seven individuals have been recorded, one of which (a young adult male) has been radiocarbon dated to the Mesolithic whilst one other has been dated to the Neolithic. A Mesolithic date has also been obtained on a rib, though it is not clear if this is from a separate individual.

9390 ± 35 KIA-24689a (skull, individual 2)
9405 ± 60 KIA-24689b (skull, individual 2)
9435 ± 40 KIA-26265 (rib)
9470 ± 45 OxA-14463 (skull, individual 2)
9475 ± 50 OxA-14466 (rib)

(Meiklejohn, no date)

70 Balver Höhle, Nordrhein-Westfalen Cave Disarticulated

A fragment of cranium from a cave site dated to the early Mesolithic.

9160 ± 50 GrA-19538

(Meiklejohn, no date)

71 Steinhagen, Mecklenburg-Vorpommern ? Disarticulated

Human skeletal material (not specified) associated with several pierced auroch teeth. 6550 ± 90 OxA-2921

(Grünberg, 2000a, 2000b, Meiklejohn, no date)

72 Bottendorf Sachsen-Anhalt ? Multiple Inhumation

Three graves containing five individuals (two adults and three infants). The remains from two burials have been radiocarbon dated to the late Mesolithic.

5950 ± 80 (4000 BC) OxA-2922 (burial 1 - male)
6160 ± 80 (4200 BC) OxA-2919 (burial 3 - child)

(Newell *et al.*, 1979, Meiklejohn, no date)

73 Rhünda, Hessen ? Disarticulated

A fragment of cranium dated to the early Mesolithic. 10200 ± 100 GrA-15947

(Newell *et al.*, 1979, Meiklejohn, no date)

74 Abri Bettenroder Berg IX, Gottingen ? Inhumation, Disarticulated

Two child burials, one of which was dated to the early Mesolithic. Meiklejohn mentions two isolated tooth finds from the site. 9980 ± 90 ETH-4670 (Burial 1)

(Grünberg, 2000a, Grünberg, 2000b, Meiklejohn, no date)

75	**Hahnöfersand, Niedersachsen**	**?**	**Disarticulated**	

Isolated cranial fragment with no cultural context. This was originally dated to the mid/upper Paleolithic but has been re-dated to the late Mesolithic. — 7470 ± 100 P-11493; 7500 ± 55 OxA-10306

(Meiklejohn, no date)

76	**Plau, Mecklenburg-Vorpommern**	**?**	**Inhumation**	

A crouched burial disovered in the mid 19th century. The dating places this at the boundary between the Mesolithic and Neolithic. — 5290 ± 90 OxA-2917

(Newell *et al.*, 1979, Meiklejohn, no date)

77	**Drigge, Wiek, Rügen**	**?**	**Disarticulated**	

A fragment of a male cranium with cut (scalping) marks was found in an assemblage of bone and antler recovered during dredging near Drigge. — 6250 ± 80 UZ-4093

(Terberger, 2006, Meiklejohn, no date)

78	**Ralswiek-Augustenhof, Mecklenberg**	**Open**	**Disarticulated**	

Several fragments of cranium (calotte, frontal bone and a cranial fragment) were found associated with worked lithics, bone and antler sealed beneath a layer of peat. — 5471 ± 71 UtC-7452

(Newell *et al.*, 1979, Meiklejohn, no date)

79	**Rothenklempenow, Mecklenburg-Vorpommern**	**?**	**Inhumation**	

A crouched burial excavated in the late 1980s. There are no dates on the bones themselves but dated charcoal samples span 7370 ± 50 (Bln-3872) to 7640 ± 80 (Bln-3874).

(Meiklejohn, no date)

80	**Berlin (Scmöckwitz)**	**Open**	**Inhumation**	

Four graves from an area of Mesolithic and Neolithic activity. Bones from two of these have been dated to the Mesolithic.	6900 ± 100 OxA-615 (burial 1) 8200 ± 100 OxA-725 (burial 2)

(Newell *et al.*, 1979, Meiklejohn, no date)

81	**Grosse Fredenwalde, Brandenburg**	**?**	**Multiple Inhumation**	

The remains of up to eight individuals (two adults, male and female, and between four and six children) were recorded from two 'flat graves'. The remains are accompanied by artefacts.	7390 ± 80 OxA-3698 (Komplex II) 7660 ± 80 OxA-3697 (Komplex I)

(Terberger, 2006, Meiklejohn, no date)

82	**Kolberg, Brandenburg**	**?**	**Inhumation**	

A grave containing a single skeleton. Radiocarbon dated to the late Mesolithic.	5880 ± 80 OxA-2920

(Newell *et al.*, 1979, Meiklejohn, no date)

83 Schopsdorf (Fundstelle 14 & 2), Sachsen-Anhalt ? Multiple Inhumation

Double grave of an adult female and child covered (?) with ochre. There are no dates on the burial but charcoal from the grave (?) has been dated to 6270 ± 100 (Bln-3214).

(Grünberg, 2000a, Grünberg, 2000b, Meiklejohn, no date)

84 Unseburg, Sachsen-Anhalt ? Inhumation

Burial of an almost complete skeleton with grave goods. 7670 ± 90 OxA-2918 (rib)

(Grünberg, 2000a, Grünberg, 2000b, Meiklejohn, no date)

85 Bad Dürrenburg, Sachsen-Anhalt Open Multiple Inhumation

The burial of an adult female (25-35) with the skeleton of an infant/neonate (4-6 months) between the femora. The burial was seated within a pit with flexed arms and legs, covered with ochre and accompanied by artefacts. Possible damage to the foramen magnum & occipital condyle was thought to be evidence of decapitation but recent analysis (Porr & Alt 2006) indicates that this is a congenital abnormality.	7580 ± 80 Bln-2130 7730 ± 80 Bln-2221 7930 ± 90 OxA-3136

(Newell *et al.*, 1979, Grünberg, 2000a, Grünberg, 2000b, Porr and Alt, 2006)

86 Coswig, Sachsen-Anhalt ? Cremation

Cremation, dated to the Late Mesolithic. 7920 ± 45 OxA-13472

(Meiklejohn, no date)

87 Niederkaina, Ostsachsen ? Inhumation

Described as a Mesolithic burial.

(Grünberg, 2000a, Grünberg, 2000b)

88 Ranis, Ilsenhöhle, Thüringen ? Disarticulated

The mandible of a sub-adult (infant). 8305 ± 40 OxA-13282

(Meiklejohn, no date)

89 Urdhöhle, Döbritz, Thuringen ? Disarticulated

Human skeletal material (calvarium and post cranial) were recorded from this site. One fragment has been dated to the Mesolithic but one other was medieval in date. 8400 ± 50 OxA-10828

(Meiklejohn, no date)

90 Büttnerloch, Thuisbrunn, Bayern Cave? ?

Described as a human skeleton and radiocarbon dated to the Mesolithic. 8575 ± 215 Hv-15657

(Meiklejohn, no date)

91 Ensdorf, Steinbergwand, Bayern **Cave** **Disarticulated**

A fragmentary human phalanx ('pedis', pedal?) was recorded from Mesolithic deposits in the area of a shallow rock shelter. There are no direct dates for this find.

(Newell *et al.*, 1979)

92 Schellnecker Wänd, Bayern **Cave** **Multiple Inhumation**

A double burial of an adult female and child (aged *c.*2 years) in an oval pit in a rock shelter. The bodies lay facing each other, microliths had been placed on the adult's body and bird bones had been scattered over the grave. The date on the bone places it at the end of the Mesolithic or very early Neolithic. 5175 ± 90 OxA-3699

(Newell *et al.*, 1979, Grünberg, 2000a, Grünberg, 2000b, Meiklejohn, no date)

93 Nassenfells, Bayern **?** **Disarticulated**

The skeleton of a child (inhumation?) and several sub adult skulls. The remains are from a Mesolithic context but have no direct dates.

(Grünberg, 2000a, Grünberg, 2000b, Meiklejohn, no date)

94 Hexenküche by Kaufertsberg, Bayern **Cave** **Head/Skull burial**

The skull (cranium and mandible) of a young adult male with the first two cervical vertebrae. The site is not dated but is thought to be Mesolithic. The skull was found in a slight depression and had been covered with ochre.

(Orschiedt, 2005)

95	**Grosse Ofnet-Höhle, Bayern**	**Cave**	**Head/Skull burial**

Within the cave, two pits containing 35 human skulls (28 in one pit, 6 in the other). Each consisted of cranium and mandible and up to four cervical vertebrae. Cut marks consistent with decapitation were recorded on the vertebrae of nine individuals and six of the skulls showed signs of peri-mortem trauma (probably from an axe) that had not healed. In addition two of the skulls showed evidence for older cranial injuries. Over half of the skulls (27) were from sub-adults, including 17 children between the ages of one and six. The skulls were all orientated in the same direction, covered with red ochre and were accompanied by over 200 perforated red deer teeth and large quantities (thousands) of shell ornaments.

7360 ± 80 OxA-1571 (Skull 8)
7450 ± 80 OxA-1572 (Skull 10)
7480 ± 80 OxA-1574 (Skull 34)
7520 ± 80 OxA-1573 (Skull 3)
7530 ± 120 UCLA (infant bone)
7560 ± 110 OxA-1575 (Skull 32)
7720 ± 80 KN-2034 (Specimen not stated)
13100 ± 100 UCLA-1783(R) (infant bone)

(Schmidt, 1908, 1913, Frayer, 1997, Orschiedt, 1999, 2002, 2005)

96	**Höhlesbuckel, Blaubeuren-Altental, Württemberg**	**?**	**?**

Described as a 'skeleton with calotte' by Meiklejohn. The find was recorded from beneath a Mesolithic deposit.

9520 ± 80 ETH-6668

(Meiklejohn, no date)

97	**Hohler Fels, Happurg, Bayern**	**Cave**	**Disarticulated**

The remains of at least five individuals have been recorded from a site with both Mesolithic and Palaeolithic material. One bone (a cranial fragment) has been dated to the Mesolithic.

8655 ± 150 Hv-14894

(Meiklejohn, no date)

98	**Hohlenstein or Hohlenstein-Stadel, Baden-Württemberg**	**Cave**	**Head/Skull burial**

A collection of three skulls (two adults, male and female and a sub-adult) placed on stone slabs within a pit. The skulls showed signs of trauma (possibly from a blunt axe shaped object) and, from the presence of cut marks on the neck vertebrae, they had been removed from the body whilst the mandible and neck vertebrae were still articulated (i.e. they were decapitated) (Orschiedt 1998). Red ochre was found in the pit and several fish teeth were found close to the female skull. Hofmann states that the child was suffering from encephalitis.

7835 ± 80 ETH-5732

(Orschiedt, 1998, Hofmann, 2005)

99 Felsställe-Mühlen, Baden-Württemberg Cave Inhumation

The burial of a child within a stone-lined grave. The body was extended and complete except for the pelvis and vertebral column. There are no direct dates on the bone but it is associated with Mesolithic occupation deposits.

(Newell *et al.*, 1979, Meiklejohn, no date)

100 Felsdach Inzigkofen, Baden-Württemberg ? Disarticulated

A single tooth (L M3) was recorded in a deposit containing large quantities of Mesolithic material. No other skeletal material is mentioned and it may have been lost during life. There are no radiocarbon dates on the tooth but samples above and below the deposit have been dated to 7770 ± 120 (B-932) and 8720 ± 120 (B-935).

(Newell *et al.*, 1979, Meiklejohn, no date)

101 Falkensteinhöhle, Baden-Württemberg Cave Disarticulated

Human skeletal material scattered around a hearth was recorded from a Mesolithic occupation (?) layer. The remains include at least one individual (adult male) and include cranium, mandible, radius, fibula, fragments of cranium and a phalanx. The bone is not dated but Mesolithic dates have been obtained on other cultural material (7540 ± 120 B-767 and 7820 ± 120 B-768). Meiklejohn states that these dates 'bracket' the Mesolithic levels at the site.

(Newell *et al.*, 1979, Meiklejohn, no date)

102 Jagerhaus Höhle Cave Disarticulated

Two human teeth (right I1 and lower deciduous C) were recorded from a late Mesolithic deposit. There are no direct dates on the teeth and no other records of human remains.

(Newell *et al.*, 1979, Meiklejohn, no date)

103 Bockstein Höhle, Baden-Württemberg **Cave** **Multiple Inhumation**

Burial of an adult (?) female and a sub adult. 7350 ± 70 UtC-7887
7460 ± 60 UtC-6796

(Meiklejohn, no date)

References cited in catalogue of sites

ALDHOUSE-GREEN, S., PETTITT, P. & STRINGER, C. (1996) Holocene humans at Pontnewydd and Cae Gronw caves. *Antiquity,* 70**,** 444-447.

AMBERS, J. & BOWMAN, S. (2003) Radiocarbon dates from the British Museum: Datelist XXVI. *Archaeometry,* 45**,** 531-40.

AUBOIRE, G. (1991) Les restes humaines Mésolithique de Noyen-sur-Seine (Seine-et-Marne, France). *L'Anthropologie,* 95**,** 229-236.

BILLARD, C., ARBOGAST, R.-M. & VALENTIN, F. (2001) La sépulture mésolithique des Varennes à Val-de-Reuil (Eure). *Bulletin de la Société Préhistorique Française,* 98**,** 25-52.

BOULESTIN, B. (1999) *Approche taphonomique des restes humains: le cas des Mésolithiques de la grotte des Perrats et le problème du cannibalisme en préhistoire récente européenne*. Oxford, Archaeopress.

CAUWE, N. (2001) Skeletons in motion, ancestors in action: Early Mesolithic collective tombs in southern Belgium. *Cambridge Archaeological Journal* 11**,** 147-63.

CHAMBERLAIN, A. T. (1996) More dating evidence for human remains in British caves. *Antiquity* 70**,** 950-953.

CHURCHILL, D. (1962) The stratigraphy of the Mesolithic sites III and V at Thatcham, Berkshire, England. *Proceedings of the Prehistoric Society,* 28**,** 362-70.

COLLINS, T. (2009) Hermitage, Ireland: life and death on the western edge of Europe. IN MCCARTAN, S., SCHULTING, R., WARREN, G. & WOODMAN, P. (Eds.) *Mesolithic Horizons: papers presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005.* Oxford, Oxbow.

COLLINS, T. & COYNE, F. (2003) Fire and water...Early Mesolithic cremations at Castleconnell, co. Limerick. *Archaeology Ireland*, 17**,** 24-7.

CONNELLER, C. (2006) Death. IN CONNELLER, C. & WARREN, G. (Eds.) *Mesolithic Britain and Ireland: New approaches.* Stroud, Tempus.

DAVID, A. (1990) Palaeolithic and Mesolithic settlement in Wales. Unpublished Ph.D. thesis, University of Lancaster.

DAVIES, G., BIRCH, P., CHAMBERLAIN, A. T., RICHARDS, M. P., TWEEDLE, J. & TYERS, I. (2001) A palaeoenvironmental study and watching brief on borrrow pits at Staythorpe power station, Staythorpe, Notts. Sheffield, ARCUS Unpublished client report.

DAVIES, J. A. (1921) Avelines's Hole, Burrington Combe, an Upper Palaeolithic station. *Proceedings of the University of Bristol Spelaeological Society* 1**,** 61-72.

DAVIES, J. A. (1923) Second report on Avelines's Hole. *Proceedings of the University of Bristol Spelaeological Society* 1**,** 113-118.

DAVIES, J. A. (1924) Third report on Avelines's Hole. *Proceedings of the University of Bristol Spelaeological Society* 2**,** 5-15.

DAVIES, J. A. (1925) Fourth report on Avelines's Hole. *Proceedings of the University of Bristol Spelaeological Society* 2**,** 107-112.

DOWD, M. A. (2008) The use of caves for funerary and ritual practices in Neolithic Ireland. *Antiquity,* 82**,** 305-317.

DOWD, M. A. (forthcoming) *The archaeology of caves in Ireland.* Oxford, Oxbow Books.

DUCKWORTH, W. L. H. (1913) Notes on some points connected with the excavation of Kent's Cavern, Torquay, with a report on the fragmentary human upper jaw from the granular stalagmite. *Journal of the Torquay Natural History Society,* 1**,** 215-220.

DUCROCQ, T. & KETTERER, I. (1995) Le gisement mésolithique du 'Petit Marais', La Chaussée-Tirancourt (Somme). *Bulletin de la Société Préhistorique Française,* 92**,** 249-59.

DUCROCQ, T., LE GOFF, I. & VALENTIN, F. (1996) La sépulture secondaire Mésolithique de la Chaussée-Tirancourt (Somme). *Bulletin de la Société Préhistorique Française,* 93**,** 211-216.

DUDAY, H. & COURTAUD, P. (1998) La nécropole Mésolithique de La Vergne (Charente-Maritime) IN GUILAINE, J. (Ed.) *Sépultures d'Occident et genèses des mégalithismes (9000-3500 avant notre ère).* Paris, Editions Errance.

DUDAY, H., COURTAUD, P., CRUBÉZY, É., SELLIER, P. & TILLIER, A.-M. (1990) L'anthropologie de terrain: reconnaissance et interprétation des gestes funéraires. *Bulletin et Mémoires de la Société d'Anthropologie de Paris***,** 29-50.

FRAYER, D. (1997) Ofnet: evidence for a mesolithic massacre. IN MARTIN, D. & FRAYER, D. (Eds.) *Troubled times: violence and warfare in the past.* London, Routledge.

GARDINER, P. J., HAWKES, C. J., MURRAY, E. & SCHULTING, R. (2010) The Mesolithic-Neolithic human bone assemblage from Totty Pot. *Proceedings of the University of Bristol Speleological Society,* 25**,** 75-95.

GREEN, H. S. (1981) The first Welshman: excavations at Pontnewydd. *Antiquity,* 55**,** 184-194.

GREEN, H. S. (1984) *Pontnewydd Cave: a lower Palaeolithic hominid site in Wales - the first report.* Cardiff, National Museum of Wales.

GRÜNBERG, J. M. (2000a) Mesolithische Bestattungen in Europa: Ein Beitrag zur vergleichenden Graberkunde. Teil I: Auswertung. *Internationale Archaologie*, 40.

GRÜNBERG, J. M. (2000b) Mesolithische Bestattungen in Europa: Ein Beitrag zur vergleichenden Graberkunde. Teil II: Katalog. *Internationale Archaologie*, 40.

HEDGES, R. E. M., HOUSELY, R. A., RAMSEY, C. B. & KLINKEN, G. J. V. (1994) Radiocarbon dates from the Oxford AMS system: Archaeometry datelist 18. *Archaeometry,* 36**,** 337-374.

HEDGES, R. E. M., HOUSLEY, R. A., LAW, I. A. & BRONK RAMSEY, C. (1989) Radiocarbon dates from the Oxford AMS system: Archaeometry datelist 9. *Archaeometry,* 31**,** 207-234.

HEDGES, R. E. M., HOUSLEY, R. A., PETTITT, P. B., BRONK RAMSEY, C. & VAN KLINKEN, G. J. (1996) Radiocarbon dates from the Oxford AMS system: Archaeometry datelist 21. *Archaeometry* 38**,** 181-207.

HOFMANN, D. (2005) The Emotional Mesolithic: Past and present ambiguities of Ofnet cave. IN MILNER, N. & WOODMAN, P. (Eds.) *Mesolithic Studies at the beginning of the 21st century.* Oxford, Oxbow books.

LE GOFF, I. (2000) Une incinération mésolithique à la Chaussée-Tirancourt 'Le Petit Marais' (Somme). IN CROTTI, P. (Ed.) *Actes de la Table ronde 'Epipalaeolithique et Mésolithique' Lausanne, 21-23 novembre 1997.* Lausanne, Cahiers d'archéologie romande

LE GOFF, I. (2010) Brûler les défunts et ensevelir les os. IN GHESQUIERE, E. & MARCHAND, G. (Eds.) *Le Mésolithique en France: archéologie des derniers chasseurs-cueilleurs.* Paris, La Découverte.

LOUWE KOOIJMANS, L. P. (Ed.) (2001a) *Archeologie in de Betuweroute: Hardinxveld-Giessendam De Bruin: een mesolithisch jachtkamp in het rivierengebied (5500 - 5000 v. Chr.).* Amersfoort Rijksdienst voor het Oudheidkundig Bodemonderzoek

LOUWE KOOIJMANS, L. P. (Ed.) (2001b) *Archeologie in de Betuweroute: Hardinxveld-Giessendam Polderweg: een mesolithisch jachtkamp in het rivierengebied (5500 - 5000 v. Chr.).* Amersfoort Rijksdienst voor het Oudheidkundig Bodemonderzoek

LOUWE KOOIJMANS, L. P. (2003) The Hardinxveld sites in the Rhine/Meuse Delta, the Netherlands, 5500-4500 cal BC. IN LARSSON, L., KINDGREN, H., KNUTSSON, L., D. & ÅKERLUND, A. (Eds.) *Mesolithic on the Move* Stockholm, Oxbow Books.

MANBY, T. G. (1976) The excavation of the Kilham Long Barrow, East Riding of Yorkshire. *Proceedings of the Prehistoric Society,* 42**,** 111-160.

MCFADYEN, L. (2003) A revision of the materiality of architecture: the significance of neolithic long mound and chambered monument building practice, with particular reference to the Cotswold-Severn group. *Unpublished Ph.D. thesis.* University of Wales, Newport.

MEIKLEJOHN, C. (no date) The Dating and Diet of European Mesolithic Human Remains. *Unpublished personal catalogue.*

MEIKLEJOHN, C., BOSSET, G. & VALENTIN, F. (2010) Radiocarbon dating of Mesolithic human remains in France *Mesolithic Miscellany,* 21:1, 10-56.

MEIKLEJOHN, C., CHAMBERLAIN, A. T. & SCHULTING, R. J. (2011) Radiocarbon dating of Mesolithic human remains in Great Britain *Mesolithic Miscellany,* 21:2, 20-58.

MEIKLEJOHN, C. & DENSTON, B. (1987) The Human Skeletal Material: Inventory and Initial Interpretation. IN MELLARS, P. A. (Ed.) *Excavations on Oronsay: Prehistoric Human Ecology on a Small Island.* Edinburgh, Edinburgh University Press.

MEIKLEJOHN, C., MERRETT, D. C., NOLAN, R. W., RICHARDS, M. P. & MELLARS, P. A. (2005) Spatial Relationships, Dating and Taphonomy of the Human Bone from the Mesolithic site of Cnoc Coig, Oronsay, Argyll, Scotland. . *Proceedings of the Prehistoric Society,* 71**,** 85-105.

MITCHELL, G. F. (1947) An early kitchen midden in County Louth. *Journal of County Louth Archaeological & Historical Society,* XI**,** 169-174.

MORDANT, C. & MORDANT, D. (1992) Noyen-sur-Seine: A Mesolithic waterside settlement. IN COLES, B. (Ed.) *The Wetland Revolution in Prehistory.* Exeter, The Prehistoric Society.

MURRAY, E. (2007) The faunal remains from Totty Pot, Somerset. *PAST, The Newsletter of The Prehistoric Society,* 55, 2-3.

NEWELL, R., CONSTANDSE-WESTERMANN, T. & MEIKLEJOHN, C. (1979) The skeletal remains of Mesolithic man in Western Europe: An evaluative catalogue. *Journal of Human Evolution,* 8**,** 1-205.

NOLAN, R. W. (1986) Cnoc Coig; the Spatial Analysis of a Late Mesolithic Shell Midden in Western Scotland. Unpublished Ph.D. thesis, University of Sheffield.

O'SHAUGHNESSY, J. (1994) Killuragh, Co. Limerick. IN BENNETT, I. (Ed.) *Excavations 1993.* Bray, Wordwell Ltd.

OAKLEY, K. P. (1971) British Isles. IN OAKLEY, K. P., CAMPBELL, B. G. & MOLLESON, T. I. (Eds.) *Catalogue of Fossil Hominids, Part II: Europe.* London, British Museum (Natural History).

ORSCHIEDT, J. (1998) Ergebnisse einer neuen Untersuchung der spätmesolithischen Kopfbestattungen aus Süddeutschland. IN CONARD, N. & KIND, C.-J. (Eds.) *Aktuelle Forschungen zum Mesolithikum/Current Mesolithic Research.* Tübingen, Urgeschichtliche Materialhelfte 12.

ORSCHIEDT, J. (1999) Manipulationen an menschlichen Skelettresten. Taphonomische Prozesse, Sekundarbestattungen oder Kannibalismus? *Urgeschichtliche Materialhefte* 13.

ORSCHIEDT, J. (2002) Die Kopfbestattungen der Ofnet-Höhle: Ein Beleg für kriegerische Auseinandersetzungen im Mesolithikum. *Archäologische Informationen,* 24**,** 199-207.

ORSCHIEDT, J. (2005) The head burials from Ofnet cave: an example of warlike conflict in the Mesolithic. IN PARKER PEARSON, M. & THORPE, I. J. N. (Eds.) *Warfare, Violence and Slavery in Prehistory. British Archaeological Reports, International Series 1374.* Oxford, Archaeopress.

OTTE, M. & STRAUS, L. G. (1997) *La grotte du Bois Laiterie: Recolonisation magdalenienne de la Belgique. Magdalanien resettlement of Belgium.* . Liege, Universite de Liege.

PENGELLY, W. (1872) The literature of the Oreston Caves near Plymouth. *Transactions of the Devonshire Association,* 5**,** 249-361.

PÉQUART, M. & PÉQUART, S.-J. (1929) La nécropole Mésolithique de Téviec (Morbihan): Nouvelles découvertes. *L'Anthropologie,* 39**,** 373-400.

PÉQUART, M. & PÉQUART, S.-J. (1934) La nécropole mésolithique de l'Ile d'Hoëdic (Morbihan). *L'Anthropologie,* 44.

PÉQUART, M. & PÉQUART, S.-J. (1954) *Hoëdic, deuxième station-nécropole du mésolithique côtier Armoricain.* De Sikkel, Anvers.

PÉQUART, M., PÉQUART, S.-J., BOULE, M. & VALLOIS, H. (1937) *Téviec, station-nécropole du Mésolithique du Morbihan.* Paris, Archives de L'Institut de Paléontologie Humaine XVIII.

PORR, M. & ALT, K. W. (2006) The burial of Bad Dürrenberg, Central Germany: osteopathology and osteoarchaeology of a Late Mesolithic shaman's grave. *International Journal of Osteoarchaeology,* 16**,** 395-406.

PRESTREAU, M. (1992) Le site néolithique et protohistorique des Falaises de Prépoux à Villeneuve-la-Guyard (Yonne). *Gallia Préhistoire,* 34**,** 171-207.

ROBERT, B. (2008) *Concevreux (Aisne) "les jombras", "les rambles", "les russembaux".* Amiens, INRAP.

ROBERT, B., ALLARD, P., BONNARDIN, S., BOULEN, M., COUBRAIS, S., HACHEM, L., MAIGROT, Y., NAZE, Y. & THEVENET, C. (2007) Une tombe mésolithique à Concevreux (Aisne, France). *Poster in "Chronology and Evolution in the Mesolithic of NW Europe", Brussels.*

SCHMIDT, R. R. (1908) Die vorgeschichtlichen Kulturen der Ofnet. *Bericht des Naturwissenschaften Vereins für Schwäben und Neuburg,* 38**,** 87-107.

SCHMIDT, R. R. (1913) *Die altsteinzeitlichen Schädelgraber der Ofnet und der Bestattungsritus de Diluvialzeit.* Stuttgart.

SCHULTING, R. J. (1996) Antlers, bone pins and flint blades: the Mesolithic cemeteries of Téviec and Hoëdic, Brittany. *Antiquity,* 70**,** 335-350.

SCHULTING, R. J. (2005) '….pursuing a rabbit in Burrington Combe': new research on the early Mesolithic burial cave of Aveline's Hole'. *Proceedings of the University of Bristol Spelaeological Society,* 23**,** 171-266.

SCHULTING, R. J. (2009) Worm's Head and Caldey Island (south Wales, UK) and the questions of Mesolithic territories. IN MCCARTAN, S., SCHULTING, R., WARREN, G. & WOODMAN, P. (Eds.) *Mesolithic Horizons.* Oxford, Oxbow Books.

SCHULTING, R. J. & RICHARDS, M. P. (2002a) Finding the coastal Mesolithic in southwest Britain: AMS dates and stable isotope results on human remains from Caldey Island, south Wales. *Antiquity,* 76**,** 1011-1025.

SCHULTING, R. J. & RICHARDS, M. P. (2002b) The wet, the wild and the domesticated: the Mesolithic-Neolithic transition on the West Coast of Scotland. *European Journal of Archaeology,* 5**,** 147-189.

SÉARA, F. D. R., ROTILLON, S. & CUPILLARD, C. (2002) *Campements mésolithiques en Bresse jurassienne: Choisey, Ruffey-sur-Seille, Jura.* Paris, Maison des sciences de l'homme.

SKINNER, J. (1824) Journal of Tours in Somerset 1824. British Library, Additional manuscripts 33,677. London.

SMITS, E. & LOUWE KOOIJMANS, L. P. (2001a) Menselijke skeletresten. IN LOUWE KOOIJMANS, L. P. (Ed.) *Archeologie in de Betuweroute: Hardinxveld-Giessendam De Bruin: een mesolithisch jachtkamp in het rivierengebied (5500 - 5000 v. Chr.).* Amersfoort Rijksdienst voor het Oudheidkundig Bodemonderzoek

SMITS, E. & LOUWE KOOIJMANS, L. P. (2001b) Menselijke skeletresten. IN LOUWE KOOIJMANS, L. P. (Ed.) *Archeologie in de Betuweroute: Hardinxveld-Giessendam Polderweg: een mesolithisch jachtkamp in het rivierengebied (5500 - 5000 v. Chr.).* Amersfoort Rijksdienst voor het Oudheidkundig Bodemonderzoek

SMITS, L. & VAN DER PLICHT, H. (2009) Mesolithic and Neolithic human remains in the Netherlands: physical anthropological and stable isotope investigations. *Journal of Archaeology in the Low Countries,* 1-1**,** 55-85.

TERBERGER, T. (2006) The Mesolithic Hunter-Fisher-Gatherers on the Northern German Plain. IN HANSEN, K. M. & PEDERSEN, K. B. (Eds.) *Across the Western Baltic.* Vordingborg, Sydsjællands Museum.

THÉVENIN, A. (1978) Circonscription d'Alsace. *Gallia Préhistoire,* 21**,** 547-572.

TOUSSAINT, M. (2011) Intentional Cutmarks on an Early Mesolithic Human Calvaria from Margaux Cave (Dinant, Belgium). *American Journal of Physical Anthropology,* 144**,** 100-107.

TOUSSAINT, M., BROU, L., LE BRUN-RICALENS, F. & SPIER, F. (2009) The Mesolithic site of Heffingen-Loschbour (Grand Duchy of Luxembourg). A yet undescribed human cremation possibly from the Rhine-Meuse-Schelde culture: anthropological, radiometric and archaeological implications. IN CROMBÉ, P., VAN STRYDONCK, M., SERGANT, J., BOUDIN, M. & BATS, M. (Eds.) *Chronology and evolution within the Mesolithic of North-West Europe.* Cambridge, Cambridge Scholars Publishing.

TRINKAUS, E. (2001) Gough's Cave 1 (Somerset, England): a study of the hand bones. *Bulletin of the Natural History Museum : Geology Series,* 57**,** 25-28.

TRINKAUS, E. (2003) Gough's Cave 1 (Somerset, England): a study of the pelvis and lower limbs. *Bulletin of The Natural History Museum,* 58.

TRINKAUS, E. & HOLLIDAY, T. W. (2000) The human remains from Paviland Cave. IN ALDHOUSE-GREEN, S. (Ed.) *Paviland Cave and the Red Lady: a definitive report.* Bristol, Western Academic Press.

TRINKAUS, E., HUMPHREY, L., STRINGER, C., CHURCHILL, S. E. & TAGUE, R. G. (2003) Gough's Cave 1 (Somerset, England): an Assessment of the Sex and Age at Death. *Bulletin of The Natural History Museum,* 58**,** 45-50.

VALDEYRON, N. (2008) The Mesolithic in France. IN BAILEY, G. & SPIKINS, P. (Eds.) *Mesolithic Europe.* Cambridge, Cambridge University Press.

VALENTIN, F. (1995) Le squelette mésolithique du Petit Marais de La Chaussée-Tirancourt (Somme, France). *Comptes Rendus de l'Académie des Sciences - Series II a,* 321**,** 1063-1067.

VALENTIN, F. (1998a) La sépulture mésolithique des Varennes à Val-de-Reuil (Eure): Etude anthropologique. *Unpublished specialist report.*

VALENTIN, F. (1998b) Les restes humains de l'abri des Cabônes à Ranchot (Jura). IN CUPILLARD, C. & RICHARD, A. (Eds.) *Les derniers chasseurs-cueilleurs du massif jurassien et de ses marges (13000-5500 avant Jésus-Christ).* Lons-le-Saunier, Centre Jurassien du Patrimoine.

VALENTIN, F., COTTIAUX, R., BUQUET-MARCON, C., CONFALONIÉRI, J., DELATTRE, V., LANG, L., LE GOFF, I., LAWRENCE-DUBOVAC, P. & VERJUX, C. (2008) Découvertes récentes d'inhumations et d'une incineration datées du mésolithique en Île-de-France. *Revue Archéologique d'Île-de-France,* 1**,** 21-42.

VALENTIN, F. & LE GOFF, I. (1998) La sépulture secondaire Mésolithique de La Chaussée-Tirancourt: fractures sur os frais ou sur os secs? *L'Anthropologie,* 102**,** 91-95.

VALENTIN, F., ROTH, H. & SIMON, C. (1999) Situation des squelettes de la Chaussée-Tirancourt (Somme, France) et du Bichon (Neuchâtel, Suisse) dans le cadre des populations épipaléolithiques et mésolithiques d'Europe: analyse préliminaire. IN THÉVENIN, A. & BINTZ, P. (Eds.) *L'Europe des derniers chasseurs: Épipaléolithique et Mésolithique*. Paris, Éditions du CTHS.

VERJUX, C. (1999) Chronologie des rites funéraires Mésolithiques a Auneau (Eure-et-Loir, France)/Chronology of Mesolithic funeral rites in Auneau (Eure-et-Loir, France). IN THÉVENIN, A. & BINTZ, P. (Eds.) *L'Europe des derniers chasseurs: Épipaléolithique et Mésolithique.* Paris, Éditions du CTHS.

VERJUX, C. (2003) The function of the Mesolithic sites in the Paris basin (France). New data. IN LARSSON, L., KINDGREN, H., KNUTSSON, L., D. & ÅKERLUND, A. (Eds.) *Mesolithic on the Move.* Stockholm, Oxbow Books.

VERJUX, C. & DUBOIS, J.-P. (1997) Rites funeraires Mesolithiques originaux a Auneau (Eure-et-Loir). IN FAGNART, J.-P. & THEVENIN, A. (Eds.) *Le Tardiglaciaire en Europe du Nord-Ouest.* Paris, CTHS.

WANSEY, H. (1805) Untitled letter to the editor. *The Gentleman's Magazine.*

WOODMAN, P., ANDERSON, E. & FINLAY, N. (1999) *Excavations at Ferriter's cove 1983-1995: last foragers first farmers in the Dingle Peninsula.* Bray, Co. Wicklow, Wordwell.

WOODMAN, P. & MCCARTAN, S. (2008) Re-investigating the bone industry from the River Bann. *Paper presented at 'Palaeolithic Mesolithic Conference', British Museum, 2008.* Unpublished abstract.

WOODMAN, P., MCCARTHY, M. & MONAGHAN, M. (1997) The Irish Quaternerary Fauna Project. *Quaternerary Science Reviews,* 16**,** 129-159.

WYMER, J. (1962) Excavations at the Maglemosian site at Thatcham, Berkshire. *Proceedings of the Prehistoric Society,* 28**,** 329-370.