Life and Death in Iron Age Orkney:

An osteoarchaeological examination of the human skeletal remains from the burial ground at Knowe of Skea, Westray.

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Abstract

Archaeological excavations were conducted by EASE Archaeology at the Knowe of Skea on the island of Westray between 2000 and 2009 and discovered a multi-phase site with evidence for activity dating from the Neolithic through to the Viking era. Excavations revealed that the site had been used as a burial ground for a prolonged period during the Iron Age. Human remains recovered during the first seasons of excavations were radiocarbon dated to the turn of the first millennium BC/AD. These dates highlighted the significance of this burial ground; burial evidence of Iron Age date is sparse in Atlantic Scotland and often overlooked due to the lack of a recognisable, dominant burial rite.

Burials of individuals of all ages, including a very high number of infants, were recovered and represent the largest known collection of burials of this date from Scotland. Iron Age research in Atlantic Scotland has traditionally been dominated by study and discussion of the impressive stone-built architecture of domestic buildings and working places of a population about which very little is actually known.

Examination of the burials from this site and comparisons with similar sites in the Orkney Islands is building a greater understanding of the treatment of the dead in this region during a period for which so little evidence exists. The burials had been placed in the rubble of earlier collapsed buildings which appears to be a common feature of many Iron Age burials in the Orkney Islands and north-eastern Scotland. Site records, photographs and views of excavators were consulted and combined with the results of the osteological analysis to determine burial patterns at the site according to age, sex or burial location.

The large volume of infant remains recovered from the site created the possibility to investigate such high infant mortality and the general health of infants and children. High numbers of infant burials can often lead to suggestions of infanticide; the likelihood of this is also discussed. The results of basic stable isotope analysis (^{13}C and ^{15}N) were examined to interpret breastfeeding and weaning practice. The evidence provided in the results of isotopic analysis was also used to interpret the diet of this population and compared with archaeological evidence of diet from excavation of domestic sites across Atlantic Scotland. Of particular interest was the extent to which the population of the islands may have exploited marine and other wild resources when compared with similar dietary studies in the rest of Scotland and Britain.

Results of osteoarchaeological analysis of the human skeletal remains from the Knowe of Skea allowed a deeper understanding of the lifestyle and health of a population for which there has been little evidence to date.

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1. Introduction

The paucity of evidence for burial in the Iron Age across Britain has led to the assumption that whatever the funerary rites of this period, disposal of the dead was of such a method as to be archaeologically invisible or undetectable (Megaw&Simpson, 1979; Hingley, 1999, Carr&Knüsel, 1997). Various methods of disposal of the dead have been suggested with excarnation the most commonly mentioned due to the occurrence of disarticulated human remains on domestic sites of the period (Wait, 1985; Carr & Knüsel, 1997; Carr, 2007; Shapland & Armit, 2012); though most agree that whatever the method of disposal of the dead it has left little visible evidence. This generally accepted state of the burial record for the Iron Age has led to the continued propagation of this theory for many years, even when the possibility of new discoveries in this area arose.

Excavations on the mound at Knowe of Skea in the western side of the island of Westray in the Orkney Islands revealed a multi-phase site with possible Neolithic origins. A small number of human burials were discovered in the first years of excavation which is not an uncommon occurrence on sites of any period across Orkney. However as the extent of the excavations widened and deepened the number of burials discovered, and the dating of these first burials to the Iron Age, suggested that this site was unusual for the region and the period. Burials were found in rubble deposits formed by the collapse of earlier structures and in some cases burials had been disturbed by the construction of later buildings. There were individuals of all ages present including a vast amount of infant remains which in some cases were found in large concentrations. There were no obvious grave goods identified though there were some animal bones recovered with human burials and a number of animal burials also discovered on the site.

The Knowe of Skea is the largest burial site of this period so far known of in Atlantic Scotland. In this region, encompassing the west and north-east of mainland Scotland, the Western Isles, Orkney and Shetland, research was traditionally firmly focused on the investigation of large-scale stone architecture of the period. Discovery of burials on such sites were assumed to be a departure from the norm, a hurried disposal of a dead body and often assigned to an earlier or later period without the aid of any radiocarbon dating.

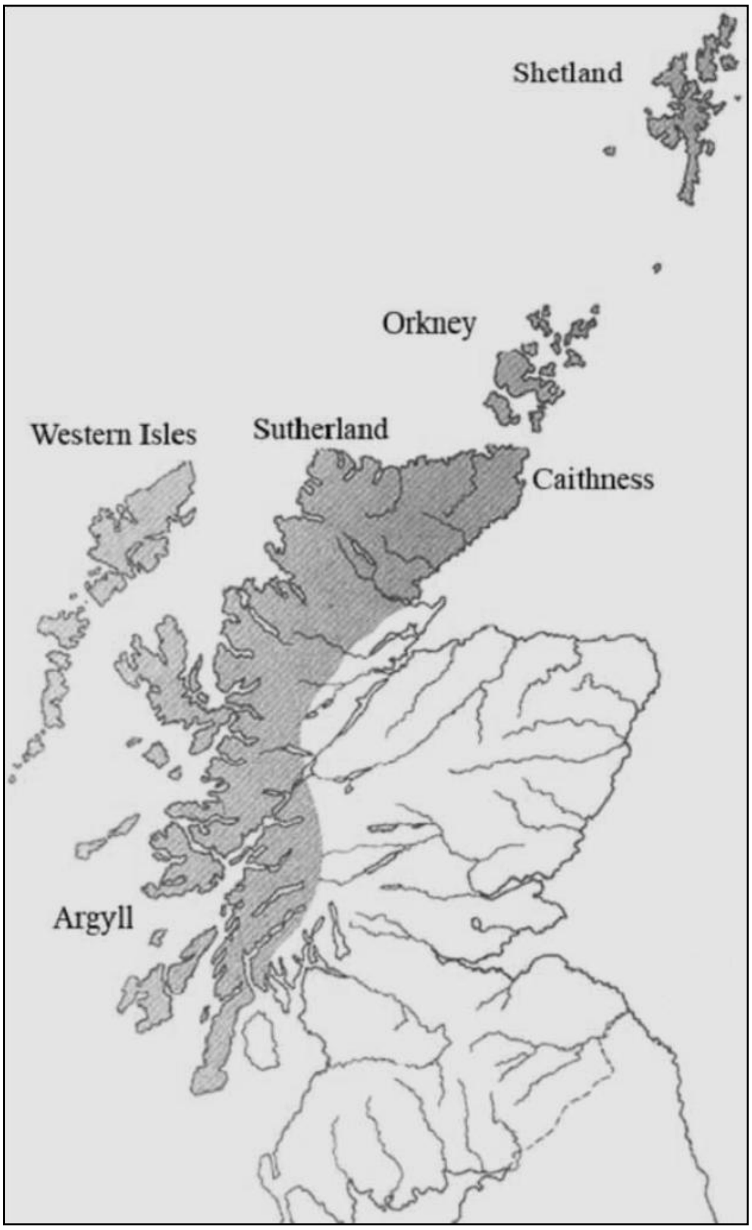


Figure 1: Map of Atlantic Scotland, (Armit & Shapland, 2012).

Aims of research and structure

As the significance of the site at the Knowe of Skea and the burials became clear, the potential of the site to further our knowledge of Iron Age Orkney was recognised by the excavation team and by osteologists and archaeologists working in the region. What could these remains tell us about the population of the islands during a period for which we have had so little evidence until now? Was this the burial location for a nearby community? What was the general health of this community? Were individuals chosen specially for burial at the site? Given the high numbers of infants represented, is there any evidence for infanticide? Do any of the remains display signs of exposure which might suggest excarnation was taking place? What would biochemical analysis tell us of the diet and how would the results compare to those of similar studies in the islands? These questions will be dealt with in discussion of the results of the skeletal analysis; however the human remains are only part of the significance of the phase of activity at the Knowe of Skea which was dominated by burial.

This study comprises both an osteological and archaeological investigation of the Iron Age burial site at Knowe of Skea. The significance of the site can only be fully understood when seen in the light of what is currently understood about Iron Age funerary practice in Scotland. What becomes obvious in investigating burial practices in Iron Age Scotland is the variation which exists both geographically and temporally. An overview of Iron Age burial practices is provided in the second chapter of this paper (all dates mentioned are as reported in original papers and publications).

The burials at Knowe of Skea form a single phase of activity at the site which was recognised after the first few seasons of excavation as the sequence of building construction became clear. Chapter 3 outlines the phasing of activities on the site as identified by the excavators. The location, body position and orientation of the burials were interpreted from the site records and photography. This examination also revealed the degree of disturbance to burials by the construction of later buildings on the mound. The human remains were excavated over several seasons of excavation; the presence of both articulated burials and large concentrations of mixed bones saw the development of a numbering and recording system which is described in Chapter 4. This section also includes an overview of the analytical methods used during the analysis of the human remains.

The results of the skeletal analysis are provided in detail in Chapter 5. The sex, age and stature of individual burials were assessed. Some problems were encountered during analysis by the degree of fragmentation of bones caused by the rubble and by disturbance to the burials on site by later construction. The skeletal assemblage included high amounts of infant remains, most often in collections containing the mixed bones of a number of infants. Analysis revealed the age of these infants and any signs of illness or trauma that might help explain such a high death rate among the very young. More detailed information of the skeletal analysis is available in the Appendix: Skeletal Examination Notes which records the results of examination for each context, individual and group of bones in the assemblage.

The results of radiocarbon dating and stable isotope analysis are outlined and discussed in Chapter 6. The diet of this population is investigated using the ^{13}C and ^{15}N isotopic results obtained during the radiocarbon dating of bone samples of individuals of a range ages.

Chapter 7 is divided into sections which relate to topics of particular interest which arose during analysis. The results of the analysis, impressions of the excavators and the site archive were combined to determine any patterning or organisation in the burials at Knowe of Skea. The health of this population or community is assessed from their skeletal remains. The high number of infants gave rise to the suggestion that infanticide was practiced at Knowe of Skea, this and the overall health and mortality among the infants is discussed.

Though the results of the skeletal analysis allow for this investigation into the burials at the Knowe of Skea, there is much potential for further research which this project has helped to identify and some of which is suggested in the final section. The Knowe of Skea holds an important position in ongoing research into Iron Age burial practices in Scotland and in understanding the society to which these individuals belonged.

2. Literature Review

"... it is notable that during the first few centuries AD, when there seems to have been abundant building of grand domestic structures, implying relatively substantial and prosperous populations, formal burial remains seem to be absent from Orkney." (Ashmore, 2003).

The low number of Iron Age burials found in Atlantic Scotland has prompted some debate. Scholarly research has been dominated by the study of the remains of impressive stone built structures or domestic dwellings, there has been little in the way of study into the burial rites and traditions of the Iron Age people who built and occupied these structures. Though now somewhat dated, the most comprehensive study of Iron Age burial practices in Britain by Whimster, (1981), remains the launching point for any investigation into this subject. This in depth study, however, accorded just a few pages to Scotland, due in no small part to the lack of evidence there was available at that time. The following chapter will outline the various types of Iron Age burial practice identified across Scotland and suggests evidence for a possible, only recently recognised, burial rite in Orkney and the Northeast.

Scottish Iron Age burial research to date

In Southern regions of Britain, the beginnings of Roman influence on society and the changes in archaeology which arise from those events allow for a convenient dating of the end of the Iron Age in the first century AD (Haselgrove, 1999). Without such a historical demarcation in the north, the period spanning the first millennium BC and first millennium AD can be considered Iron Age. The idea of a 'long Iron Age' has long been used in Scotland, in studies of the North and West in particular, though the beginning and end dates used are often arbitrary. This long period can be split into early and late phases, the late phase coinciding with everything after the Roman era in Southern Britain until the Norse settlements in the late first millennium AD (Harding, 2004). In Atlantic Scotland, architectural developments of the period spanning the few centuries at the end of the first millennium BC and the first centuries AD have prompted a further phasing of this era: Early, Middle and Late whereby the Middle stage represents this period of monumental architecture. The debate and date ranges used are discussed in depth elsewhere and much more proficiently than the current study can allow (see ScARF Iron Age Document for a detailed outlining of chronological issues for this period).

Recent studies into the area of Late Iron Age/ Early Christian burial practices (Maldonado, 2011) and the treatment of human remains across Atlantic Scotland (Tucker, 2010) employed the three stage system. For this project, a large number of samples of human bone from the site at Knowe of Skea were radiocarbon dated and revealed that the site was in use singularly for burials in the last few centuries of the first millennium BC and first centuries AD. This placed the cemetery phase of the Knowe of Skea firmly within the 'Middle Iron Age'.

Unfortunately the dating of unexpected discoveries of human remains from archaeological excavations has been sporadic until recent years. Ralston recognised that this was an issue when identifying burials of Iron Age date and advised that "advances in sub-dividing the rather diffuse assemblage of burials in the iron age will require the use of carbon dating on suspected cases"(Ralston, 1979, 477). It has also suggested that many burials lacking grave goods and excavated in the past were interpreted as Bronze Age merely due to body position or location. In a discussion of the evidence from southern Scotland, Davies (2007) suggested that it is possible that many cists and cremations dug until now with no radiocarbon dating evidence have been wrongly assumed to be Bronze Age and many cists in south-east Scotland may prove to be early or middle Iron Age in date. In some cases, where the main focus of excavation was concerned with structural remains, those burials which were discovered were often discounted as intrusions and radiocarbon dating was most often reserved for attaining information about the structures themselves. The lack of radiocarbon dating evidence from many early discoveries has deprived the archaeological record of important evidence for Iron Age burial practices in

Scotland. In recent years however, development and rescue led excavation and a greater number of radiocarbon dates have lead to new research and advanced our knowledge of Iron Age burial practices. It can now be seen that a tradition or traditions of inhumation burial did exist in Scotland during the Iron Age.

The prevailing funerary rite in this period is assumed to have been one that left little physical evidence and so is "archaeologically undetectable" (Ralston, 1979, 477). Those burials which do occur therefore have often been labelled as non-normative, rushed or even haphazard. The treatment of the dead is a fundamental part of most human societies, however, the apparent lack of 'formality' to many of the burials attributed to the Iron Age has caused many to avoid closer examination of many such burials across Scotland.

The terminology used in many studies even suggests an almost disregard among Iron Age communities for these individuals apparently buried outside of the normal, though as yet still unknown, rite. Terms such as 'disposal' of the dead, 'non-normative' and 'informal' have all been used in connection with burials from across Atlantic Scotland in this period. For many years, the results of osteological analysis have been reported almost independently of the archaeological evidence. Many of the old suppositions regarding the rushed and haphazard burial of certain individuals were based on the visual observations of excavators with little knowledge of the complicated taphonomic processes which can take place after burial (Tracey, 2013). In a funerary context the burial is a deliberate act with a degree of preparation involved which in some cases may appear minimal or simple and yet was most likely significant to the living (Leclerc, 1990; Duday, 2009). Was the body prepared for burial? Was the body laid in any particular position? Was the ground prepared in advance or altered after the burial? The approach taken in 'l'anthropologie du terrain' or archaeothanatology uses knowledge of the human skeleton, taphonomic processes and natural occurrences together with archaeological observations to establish cultural phenomena and funerary practices (Duday, 2009). Duday proposes that a number of observations must be made for all burials which can be used to determine funerary practice – pre-burial treatment of the corpse, funerary practice such as position of the body or the grave type and post-burial practices such as reopening the grave, manipulation of the bones or secondary burial. These observations must be differentiated from taphonomic processes during decomposition and natural disturbances, such as animals or flooding (Duday, 2006).

In a recent re-examination of the human remains from six sites in Britain, Tracey (2013) attempted to see beyond these earlier descriptions of burials. By employing the examination methods of archaeothanatology Tracey has shown that many such burials were in fact less haphazard than previously believed. This is fast becoming more widely adopted in Britain as the need for more osteological experts to be more aware of archaeological processes and indeed for archaeologists to be more aware of the need for greater scope and detail in on-site recording methods. Many excavations in Atlantic Scotland, Orkney in particular, were conducted before the development of such ideas and accurate recording methods which leave modern researchers to rely on often poor records.

The location of many of the burials of this period in or close to sites of otherwise domestic character have led to their interpretation as intrusive, non-normative and informal burials. The skeleton of a young adult female was found under the floor of a metal working workshop and an adult male with a number of perimortem injuries was uncovered from midden deposits during excavations at Minehowe (Ewens, 2005; Lawrence, 2005;), Orkney. At Hornish Point, South Uist in the Western Isles, the divided and partial remains of a child along with the remains of a number of young animals were placed in pits below the floor of the house (Barber et al, 1989). Radiocarbon dates for both the child and the animal remains revealed similar results within the first century BC (Tucker & Armit, 2010, 215). There were indications that the child may have died violently which may account for the unconventional burial (Barber, et al, 1989). At Crosskirk in Caithness, an adult male was buried in a seated position within a cist in an outbuilding associated with a roundhouse. This burial was radiocarbon dated - 1645+/-35BP (330-540AD) (Tucker & Armit, 2010, 215). The position of the body in this burial is unconventional for this region, seated burials are found in mainland Europe during this period but rarely in Scotland; however, the location and date are not unusual. Few other burials in the region can be seen to have been placed within domestic spaces that were still in use. Burial beneath the floor of a structure still in use, unusual body position, violent death and burial in midden deposits rather than rubble or stone deposits suggest that these were individuals whose remains were disposed of in a manner that was not common, and perhaps held more symbolic meaning for those that lay them there.

In an extensive study of the treatment of the dead and of human remains from across Atlantic Scotland during the Iron Age, Tucker (2010) examined the changes in burial practice over the 'long Iron Age'. "For most of the long Iron Age, as in the rest of Britain, 'normative' burial appears to be virtually absent in Atlantic Scotland. There are no communal funerary monuments, very few cremation burials, and the instances of inhumation which do occur often seem to be intimately associated with domestic contexts and do not represent a dominant rite (Tucker, 2010)". The lack of evidence of Early Iron Age dates prohibits any definitive conclusions for this period though it is pointed out that the lack of evidence for burial does not necessarily indicate that the same funerary rites were carried out across the region.

Drawing together almost any and all available information, Wallace's (2011) 'Handlist of Iron Age Burial Evidence in Scotland' is the most detailed compilation of Iron Age burial evidence from across Scotland to date. Wallace divided his handlist according to burial type and by geographical region, Table 1, and indicates the variability in burial practice across Scotland between the C.8thBC and C.5thAD.

ATLANTIC SCOTLAND	**EASTERN SCOTLAND**	**WEST & SOUTH-WEST SCOTLAND**
Single inhumations in graves & cists	Single inhumations in graves & cists	Single inhumations in graves?
Multiple inhumations	Multiple inhumations	
Burials below cairns or mounds	Burials below cairns or mounds	Burials below cairns or mounds
Cremation	Cremation	Cremation
Cave burials	Cave burial?	Cave burial?
Bog bodies?		Bog bodies?
	Roman burials	Roman burials
incorporation of human remains in structured deposits & in structures	display of human remains?	display of human remains?
later deposits in earlier burial mounds		later deposits in earlier burial mounds
	Other aspects: re-openable vaults, cart burial, weapon burials	

Table 1: Burial types by region from Wallace, 2011.

Though the possible autonomous nature of society and variability of domestic settlement and architecture at this period has been noted (Darvill, 1987; Hingley, 1992; Haselgrove, 1999), this variability is seemingly less acceptable when discussing funerary practices. There was no single tradition of inhumation burial in Scotland during this period; however, there are areas in which burial did occur. “No two regions of Scotland treated their dead in quite the same way, and even within these regions, variety of practice was the norm; there are local idioms rather than monolithic traditions” (Maldonado, 2011, 69). It is our search for what we recognise as a ‘formal’ or ‘dominant’ burial rite which affects our interpretation of funerary rites of this period. Rather than trying to create a single dominant burial rite for the period, our analysis of the treatment of the dead during the Iron Age needs to be more site-specific and we need to acknowledge the variation in burial rite even in small geographical regions; “It is becoming increasingly apparent that heterogeneity, not homogeneity, was the norm for late Iron Age burial practices” (Carr, 2007, 445). In trying to recognise a dominant rite, this heterogeneity has gone unnoticed. It is becoming more obvious that it is the variation, and “plurality” (Armit, 2013) in burial practices in Scotland which should be of interest rather than the apparent lack of one ‘normative’ practice. An increase in interest in the treatment of human remains in the region of Atlantic Scotland has allowed for new developments in this area in recent times. Tucker (2010) drew together all evidence for human remains of Iron Age date from across the region. This work not only showed a greater volume of human remains from the Iron Age than previously thought existed but also highlighted the variation in burial practices both geographically and temporally. Reflecting the variability of burial forms of this period, research has tended to be regional in character or concerning particular burial types and practices.

Excarnation

Despite the low numbers of burials attributable to the Iron Age across Britain, the discovery of fragmented human bones on sites of otherwise domestic nature is common. Finding such fragments of human bone has led to the suggestion that the main funeral rite employed in this period was excarnation (Carr & Knüsel, 1997;

Carr, 2007). “All ‘archaeologically invisible’ methods of dealing with the dead by definition involve the loss or destruction of the corpse, and natural excarnation, the most likely funerary practice, entails dissolution of the individual body” (Armit & Shapland, 2012, 102). Parts of the skeleton may then have been retrieved and brought back to domestic areas after the remains have become skeletonised, perhaps for use in further rituals associated with the dead (Hingley, 1996). Fragmented human remains found on settlement sites across Britain would appear to support this theory.

Much of the recent research on human remains in Scotland, in particular in the region of Atlantic Scotland, has concentrated on the occurrence of such fragmentary human remains in domestic contexts (Armit & Ginn, 2007; Tucker, 2010; Armit & Shapland, 2012) and has brought to light a more complicated treatment of human remains than previously known. Many of the bones found in domestic contexts appear to be from the cranium leading to the suggestion that these are the remains of the heads of ancestors kept for veneration or of enemies kept as trophies while those showing evidence of modification have been interpreted as evidence of suspension or use as amulets (Armit & Shapland, 2012, 106; Armit, 2012). This research and a programme of radiocarbon dating have shown that the retention or use of human bone fragments continued into the late Iron Age and into the Viking period in Atlantic Scotland (Tucker, 2010; Armit & Shapland, 2012).

It is interesting that on a number of sites across Britain along with these fragmentary human remains are intact burials, some in pits within domestic areas and others grouped in small cemeteries outside the main area of settlement. In a recent re-examination of the human remains from five Iron Age enclosure sites in Hampshire, it was found that both excarnation and inhumation burial were taking place in parallel (Tracey, 2013, 176). The majority of burials discovered occur close to or in settlement sites, which may be the result of excavation bias towards such settlement sites rather than a true indication of burial practise. Such burials are also found in Scotland though in smaller numbers than those examined in Tracey’s recent work.

The large Iron Age enclosure site at Broxmouth was excavated in the 1970’s, the results of which were the subject of an extensive research project at Bradford

University (Armit, 2013). Nine graves of 5 different types (Hill, 1982) were excavated in the small cemetery area which lay outside the outer ditch in the northern part of the site and four others were found within the enclosure. Many of the burials were in a fragmentary state due to poor preservation conditions on the site. The burials from the cemetery area included nine adults and one child from the only double burial. All of these burials were flexed or crouched inhumations apart from one, a male, from within the enclosure area that lay in an extended position orientated east-west with head to the west (Armit et al., 2013, 80). Radiocarbon dates from the human remains concentrated between 320BC-100BC though the adult male extended burial was dated, later at around 280ad (Harman, RCAHMS MS1019/53). New dates from the burials at Broxmouth were attained during the reanalysis of the remains. The statistical analysis of the dates from the site determined that the cemetery was in use for a defined length of time at the end of the first millennium BC; the burials located inside the enclosure spanned a longer period, were more dispersed and earlier in the sequence of dates from the site as a whole (Armit, 2013, 80). The re-examination of the human remains from the site has shown that disarticulated and fragmentary bones found across the site had a wide range of radiocarbon dates; some of which coincided with both the cemetery and the earlier pit burials within the enclosure. However, results of analysis of 13C and 15N isotopes indicated that the fragmentary remains were most likely from individuals not native to the site and treated differently after death; it was suggested that these fragmentary remains derive from a population separate to that of the cemetery (Armit, 2013, 91). The results of the new dating evidence and reanalysis of the human remains from the site at Broxmouth highlight the variability in burial practice during this period. The small cemetery indicates that whatever the prevailing funerary rites may have been, at certain times burial of the body formed the final act of those rites. Though the numbers of burials in these groupings are usually low, similar burial evidence can be seen in areas across Scotland.

South-East Scotland - Cist Burials

A number of sites have been identified in the southern areas of Scotland on which there occur cist burials in such numbers as to suggest that small cemeteries were established in the last centuries of the first millennium BC and first centuries AD.

The site of Broxmouth and the burials found there form part of a group of sites in the south-east of Scotland which form a possible burial tradition for that region. Excavations at the enclosed site of Dryburn Bridge revealed ten pit burials both within and on the outer edges of the enclosure. Bone preservation was poor due to both soil conditions and the stone backfill which was placed over the burials in each pit (Dunwell, 2007). It could be determined that all of the remains were of adults and all were in a crouched or flexed position at the base of the pits. An early set of dates for the remains gave a wide ranging set of results but more recent results were concentrated between 790-400BC (Dunwell, 2007), a similar date to the earlier pit burials from within the enclosure at Broxmouth. "The character of the burials is similar to those at Dryburn Bridge and it is tempting to see them as expressions of a common culture" (Hill, 1982, 180).

Similar to the two small cemeteries at Broxmouth and Dryburn Bridge but not associated with any known enclosure was a small cemetery found at Winton House during construction works in 1988. A total of six burials were located though there may have been more in the area prior to development. There were a variety of graves found, two were cists, three round pits and one coursed stone cist. The remains were in a poor state of preservation and showed signs of having been disturbed in antiquity. It could be determined, however, that there were eight individuals including six adults, two of whom had been buried with a child. Due to the poor state of the remains only one yielded a radiocarbon date which dated one of the adult burials to AD10-340 (Dalland, 1992). The similarities between the graves at Winton House, Broxmouth and Dryburn Bridge and their proximity prompted the suggestion that a common burial rite was in use in this area of Scotland for at least part of the population for a number of centuries – "the similarities between the Broxmouth and Winton House cemeteries indicate that they both derive from the same burial tradition which, based on the available dates, spans from the middle of the first millennium BC to the end of the third century AD."(Dalland, 1992). Two sites investigated near Gullane, on the coast west of North Berwick in the early twentieth century might also form part of this regional tradition; these two cist cemeteries included a large number of cist burials though dating evidence is limited (Richardson & Richardson, 1902; Ewart & Curle, 1908).

One of the grave types identified at Winton House, a cist lined with coursed stones, has been recorded at a number of sites in the Tyne-Forth region around Dunbar; together, these may form part of the burial tradition common to this region; a theory put forward in many articles and excavation reports (Dalland, 1991; Crone, 1992; Maldonado, 2010; Armit, 2013). Short cist burials have also been found on sites which later became large long-cist cemeteries such as at Hallow Hill, and Kirkhill in St.Andrews.

Many cist burials in Scotland have also been found to contain more than one individual. Though in the majority of cases these involved just two individuals, as at North Belton Farm (Crone, 1992) or an adult and child as at Winton House and Broxmouth, there are some which appear to have been reopened at various times to accommodate new interments; such as Lochend, Dunbar which contained the remains of about 20 individuals (Longworth, 1967). These sites are reminiscent of such sites as Rennibister and Sandquoy in Orkney where a number of individuals were interred in the disused earth-houses of older domestic buildings (see below).

Burials under mounds or cairns

Burial under mounds and cairns occur across Scotland in the Iron Age, in the north-eastern region of the country, such burials occur in small groups which may suggest that this burial rite was more commonly adopted in this area at an early date. In many cases, these were assumed ‘Pictish’ or early Christian in date due to the discovery of symbol stones on a number of sites (Ashmore, 1978). Many such sites have been found in very similar circumstances, located by the coast, and exposed by the erosion of sand dunes or cliff edges. It may be that many more such sites await discovery. In some cases, these burials have been incorporated into what are most likely earlier burial mounds, possibly of Neolithic date (see Keiss, Caithness in Laing, 1866 and Boghead, Moray in Burl, 1985). A number of burials have also been found which rather than being incorporated into earlier mounds, have had a cairn or mound constructed for them. Unfortunately, many of these sites were discovered and excavated in the late 19th and early 20th centuries before the possibility of radiocarbon dating which would have allowed the date of such burials to be more accurately established.

At Loch Borralie, Sutherland, two burials were uncovered from a damaged cairn. The cairn had been constructed in at least two phases with the burials taking place at different times. The burials were of an adult male and an adolescent; though the skeletons were disturbed and partly disarticulated, it was possible to see that they were laid in an extended, supine position and a cairn created over the location. It was also possible that there were other burials outside the excavation area. Radiocarbon dates from the skeletons revealed that this site was in use in the first quarter of the first millennium AD. “It is possible, therefore, that Loch Borralie and Gullane stand for a form of cemetery mound dating to the late first millennium BC or early first millennium AD that represents the precursor to later, sub-rectangular cairns containing single graves or cists.” (Macgregor, 2003,12).

Long-cist burials.

Long-cist inhumation burials are found across Scotland, the majority of which cannot be accurately dated due to the lack of associated grave goods, the poor preservation of the remains or a lack of radiocarbon dating evidence.

Small long cist cemeteries have been identified in the Western Isles which date to the early centuries of the first millennium AD. Long cist burials were discovered at Galson, Lewis and Boreray under similar circumstances, suffering severe coastal erosion. At Galson, a number of long cist burials were exposed through coastal erosion at the site and have been recorded since the 1950’s. A total of 14 burials are reported in Neighbour et al. (2000) along with an overview of the body positions, finds and dating evidence from a number of excavations. The burials were mostly in long cists with the body lying in an extended position; the mix of positions on either side or supine may indicate that this is a site used for burial during a time of transition in burial rite. The radiocarbon dating evidence may support this; the three available dates reported indicate that the site was in use in the early centuries of the first millennium AD (Neighbour et al, 2000). At Boreray, two cists were found eroding from sand dunes at this site. One was an oval shape and contained the tightly packed crouched inhumation of an adult male. The second was a long cist and contained the skeleton of a male in a flexed position. Both skeletons lay on the right side. Radiocarbon dates reveal that these burials took place in the early centuries of the first millennium AD (Badcock & Downes, 2000). At Northton, Harris, excavations revealed a large midden with evidence for prehistoric settlement, Bronze Age and Iron Age burials (Murphy et al., 2004). The Bronze Age burials were found in cists and in stone-set graves. The Iron Age burials were divided into two possible phases. The earlier Phase I burials were disturbed and contained the mixed remains of adolescents and adults. One was identified as an adult male in a dug grave, in a flexed position. Radiocarbon dates from the Phase I remains indicate that a burial ground was established here between the 3rd and 6th Century AD. The Phase II burials were also in a disturbed state but included the remains of an adult male and a subadult skull. A date of 690-940AD was gained from these remains indicating that this may be a later burial interred at a site known as a burial ground for a long period (Murphy et al., 2004). At A'Ceardach Ruadh, Baleshare, North Uist the remains of an Iron Age site including midden deposits, walls and burials were exposed through coastal erosion. A long cist, dug grave and a grave pit contained the remains of two adult males and an adult female. Though organic remains (marine shell) from the site were dated to the Iron Age, no radiocarbon dates were available for the human remains but they are assumed Iron Age due to the surrounding midden deposits and eroding structures (Armit, 1993; MacLeod, 2001 & Barber, 2003). The majority of these burials in the Western Isles were discovered because of their exposure through coastal erosion. It may be that other similar sites have been lost or remain to be discovered along the coastal areas of the Western Isles, forming a regional burial tradition.

It was traditionally accepted that burials which are extended and supine belong to the later phases of the Iron Age when this form of burial grew dominant, due to the increased influence of Christianity. Large and late dated cemeteries fall outside the scope of this study but have recently formed the focus of an in-depth study by Maldonado(2011), examining the spread of Christianity and its influence in Scotland through changes in burial patterns. The tradition of extended burial, often in long cists, has been pushed back to the early centuries of the first millennium AD; " it is becoming clear that the most common grave type of the Late Iron Age has its origins in Atlantic Scotland in the centuries before Christianity" (Maldonado, 2011, 87). Such early cemeteries were also established in Orkney as at Westness on Rousay

(Sellevold, 1999), Newark Bay on Orkney Mainland (Barrett & Richards, 2004; Barrett et al. 2006). Rather than a new development, influenced by Christian and external practices, when inhumation burial became more popular across Scotland, it was already established local practices which flourished at first, later to be replaced with what we recognise as Christian cemeteries today.

Human remains from caves and rock shelters

The recovery of human remains from caves is not uncommon; however, the accurate dating of these remains is difficult where radiocarbon dating has not been employed. Many of the remains from old excavations have been scientifically dated in more recent times have proven to be of later dates than previously believed, indicating the use of caves and rock-shelters for the placing of the dead at various times in the past, including the Iron Age. In his section on Northern Britain and Scotland, Whimster (1981, 172), discussed the discovery of human remains of Iron Age date from cave sites and cave deposits.

Human remains have been recovered from cave sites and rock shelters in Argyll and Oban since the nineteenth century. The majority of these cave sites occur in the west; the most well-known in the area of Oban where caves were seemingly used for the burial of human remains until the early Christian era (see St.Columba's Cave in Tolan-Smith, 2001). Reanalysis of the remains from three of these caves has revealed that these sites held whole bodies rather than being used as ossuaries as previously supposed (Saville & Hallen, 1994). The remains of a female and a number of infants were also found on a stair inside High Pasture Cave, Skye. These sites may form a local burial practice for part of the Iron Age in the region. "Similar burials from other caves and rock shelters around Oban may well belong to the same burial tradition, and the presence of children as well as adults of both sexes suggests that these caves may have been used as cemeteries by small communities in the vicinity" (Armit, 1999, 91).

Though located on the east coast of Scotland and so outside the region of the main concentration of cave burials, one site in particular has led to discussion over the years on the subject of sacrifice and execution in the Iron Age. At Sculptors Cave, remains were found dating from both the late Bronze Age and Middle Iron Age.

While those of Bronze Age date appear to be from whole burials laid in the cave, those from the Iron Age proved to be the remains of victims of decapitation. It suggests that thought the site may have been used for burial in the earlier period, by the Iron Age it was used as a site, if not to carry out these executions or sacrifice, then as a suitable place to leave the bodies (Armit et al., 2011). Other human remains have been discovered in cave sites on the Eastern coast; infant remains found at Seacliff, East Lothian in the nineteenth century. These remains were found under a large rock interpreted as an altar and were said at the time to be “unhappy victims of barbarous superstition.” (Sligo, 1857, 355). This site also revealed a number of other human bones from deposits removed from inside the cave, these were all interpreted as the remains of victims of sacrifice at the time but perhaps now can be seen as part of a more widespread funerary tradition.

Cremation

The greater number of radiocarbon dates gained through modern excavation is increasing our knowledge of this burial practice for this time period. It is likely that many cists containing cremations have been incorrectly assumed to be of earlier date (Davies, 2007) though this is now being rectified through the radiocarbon dating of cremated remains from older excavations. The reuse of Bronze Age urns, cists and cairns in later periods has been seen at a number of sites in Scotland which without radiocarbon dating would have been assumed Bronze Age in date (Cook, 1999; Sheridan et al 2005).

Many remains found on antiquarian excavations are now lost, removing the opportunity to use modern dating methods. Cremations found in small cists inserted into the mound at Oxtrow Broch (Petrie, 1890) may have been Iron Age in date. Recent excavations at Nybster, Caithness revealed cists emptied of anything they once held (AOCArchaeology online Dig Diary) and the mound at Knowe of Skea also included a similar empty stone cist (Moore & Wilson, 2010); perhaps these cists once contained cremations.

Burials in Abandoned/Disused Structures – The Orkney Islands and the NorthEast

An increase in inhumation burial was identified across Atlantic Scotland during the Middle Iron Age and the development of variation in burial type and 'formality'. Tucker saw a rise in 'formal' burial in the west with individual, sometimes isolated burials such as at Loch Borrallie, Sutherland becoming more frequent though numbers remained low; these burials eventually came to form the early examples of inhumation cemetery to which Maldonado (2011) attributed the local origins of cemetery burial in the later Iron Age. In contrast, during this period Orkney and Caithness saw an increase in the placement of inhumations on sites of domestic or possibly ritual nature, within or under walls, souterrains or in rubble deposits. Though there was a rise in 'formal' burial types in Orkney and Caithness in the Later Iron Age period, the practice of inhumation on the ruins of older structures continued (Tucker, 2010, 337). This regional variance in burial practice mirrors the differences in settlement patterns between west and east. The nucleated 'village' settlements which grew around complex Atlantic roundhouses or brochs in the east, Gurness or Howe for example, are not seen in the west. Perhaps whatever influenced the people in Orkney to live in close proximity (presuming these structures are contemporary) also held some influence over the way in which they buried their dead.

Evidence from the excavations at Knowe of Skea indicates that the site had been occupied with roundhouse structures in the Bronze Age and but there is also evidence to suggest that the earliest activity on the site was in the Neolithic (Moore & Wilson, 2010). Reuse of sites of Neolithic chambered tombs during the Iron Age has been identified on a number of sites across northern Scotland (Hingley, 1996). These Neolithic structures were large and very visible in the landscape and perhaps presented the ideal location and opportunity for Iron Age communities to place their claim on an area. To appropriate such a site for their own use would create a strong link to the land and perhaps created or bolstered an ancestral connection.

Evidence for the use of the chambers of Neolithic tombs for domestic activity during the Iron Age has been most commonly found in Orkney and the Western Isles (Hingley, 1996). Most of these sites contain very few Neolithic finds, indicating that

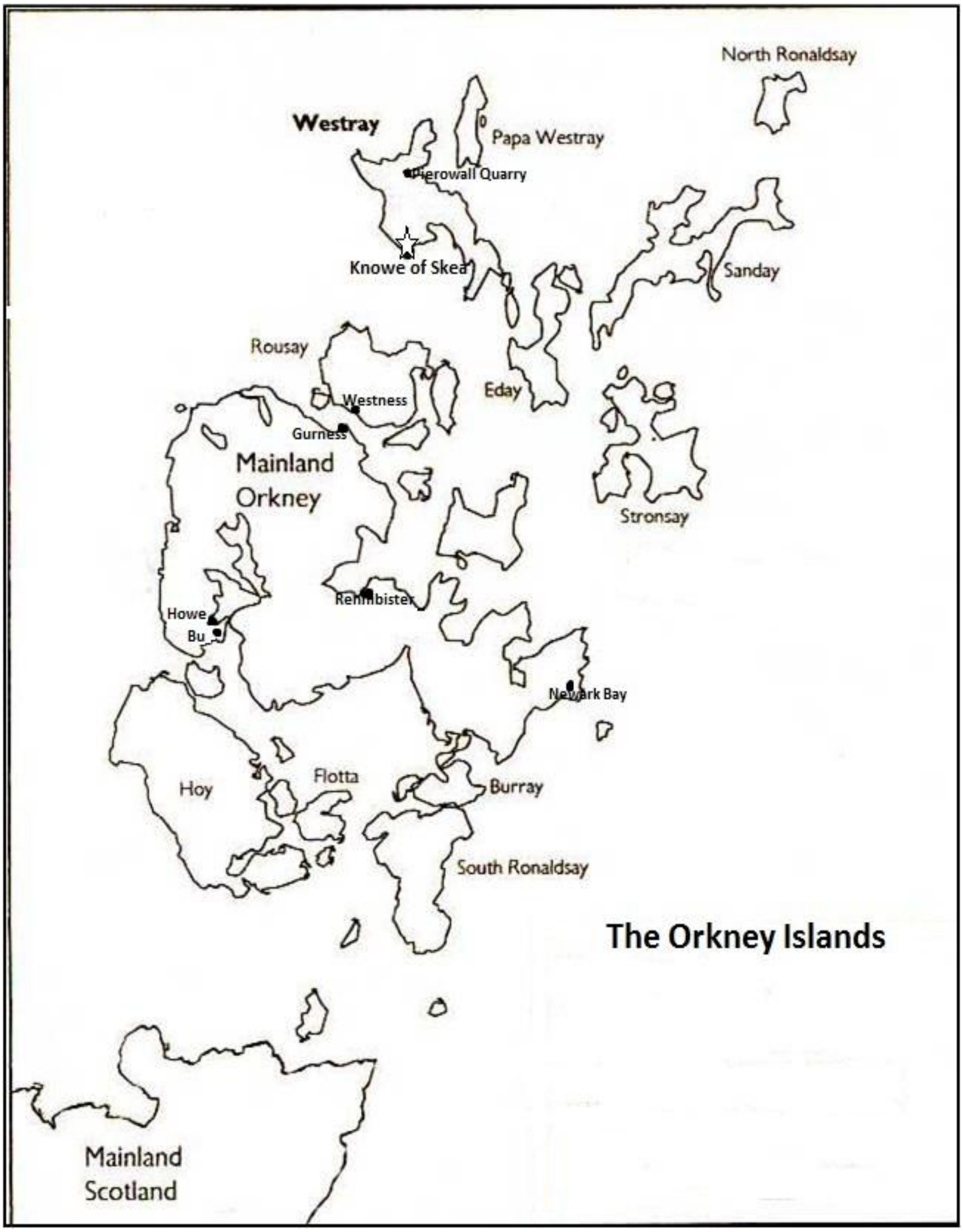


Figure 2: Map of Orkney Islands showing sites mentioned in text.

the contents were cleared out. Whether the clearances were carried out by the Iron Age occupants or at some point earlier in the sites' history cannot be known (Hingley, 1996, 234). The discovery of human remains during excavation of these sites was often attributed to the Neolithic phases of these sites and assumed to be the displaced bones from the interior of the original tombs such as at Pierowall Quarry, Westray (Sharples, 1985) or Howe, Orkney (Ballin Smith, 1994). However, with greater interest in these remains in recent times and new radiocarbon dates, this is proving to be a false assumption; many of these remains are in fact Iron Age in date (Tucker, 2010; Tucker & Armit, 2010).While it seems that the reuse of Neolithic structures for Early Iron Age domestic activity was common in Orkney, it appears that once these later structures had been abandoned some of these locations were then used as burial sites.

Some sites were not completely abandoned, as at Howe, which saw further construction and occupation at the site but others remained in ruin and were used as burial grounds for longer periods, as at Knowe of Skea. Was this an effort to keep a hold on these older sites after new sites have been acquired for settlement? Perhaps they were used as burial sites by the community now installed in new domestic structures to maintain a connection to those older buildings or to the particular location.

The site of the Howe on mainland Orkney is a multi-phased site excavated over a number of years in the 1970-80s. The earliest structure on the site was a Neolithic chamber tomb which was altered over time to create a series of successive roundhouses and broch structures. Human remains representing eight individuals - 5 adults, 1 child and 2 infants - were found during the excavations both scattered through the rubble deposits and as almost complete skeletons. While it is possible that these scattered remains were a result of clearance of the Neolithic chamber tomb, it is also possible that they are from Iron Age burials, a rare find in such numbers. Despite this, only one set of remains was dated at that time (Lorimer in Ballin Smith, 1994, 262-2).

These dated samples came from a drain below the entrance passage to the roundhouse of Phase 5 which was dated to between the 4th-3rd centuries BC. The remains represented two young adult individuals, and dated to an earlier phase of activity on the site (524-375calBC), and so were already old when deposited in the drain at the end of Phase 5 when the roundhouse was in a state of collapse. Other disarticulated remains were found in Phase 5/6 on site which, it is suggested, were already old in these phases (Ballin Smith, 1994, 260-1) suggesting that perhaps there had been a small number of burials attached to the early Phase 3/4 settlement.

The second and first centuries BC saw the collapse of the Phase 5 roundhouse and the construction of another structure on the same alignment in Phase 6, which lasted until the site was completely remodelled for the construction of the large broch structure of Phase 7 and the construction of six houses in the village settlement. Phase 7 was split by the excavators into early and late phases, separated by apparently contemporary fires in the broch and settlement (Ballin Smith, 1994, 64). These fires were radiocarbon dated to the first-second centuries AD and while the tower and eastern settlement continued in use, the structures to the west - in particular the north-western building and yard - were abandoned and used for dumping ash and filled with rubble as the walls collapsed. It was during this time that a child was buried in the north-west yard and as the area fell further into disuse, an adult male and two infants were also buried in the rubble deposits in the same area. The adult male burial was radiocarbon dated during more recent research to 40BC-180AD (Tucker & Armit, 2010, 215) which is contemporary with this period of upheaval and partial abandonment of the 1st-2nd centuries AD. Though they represent a smaller number of individuals than at Knowe of Skea, it is possible that the human remains from the Howe represent a period of time during which burial in the abandoned areas of the site was favoured over whatever was the prevailing burial rite of the time.

A possible Iron Age earth-house was destroyed at Sanquoy in 1928 and three human skulls and large amounts of human bone were recovered (RCAHMS, MS519/1, 1946). The remains have since been lost and no records of their excavation or original location were kept. It is impossible to know whether these remains were interred in the earth-house simultaneously or if the site was used for successive burials but it bears resemblance to the human remains found at Rennibister.

The earth-house at Rennibister, dug in the 1920s, contained the remains of children and adults on the water-logged floors (Bryce, 1927). Though the remains were examined, little was recorded of the original location of the bones other than a number of the skulls were found in an upside-down position. As was the case at Sandquoy, whether the remains were placed in the earth-house all at once or successive burials were placed inside over time cannot be determined. These two earth-house sites are reminiscent of the multiple burials within cists such as at Lochend, Dunbar (Longworth, 1967) and of the remains found within a collapsing earth-house at Bu described below.

At Bu on mainland Orkney, an Iron Age roundhouse was excavated as a rescue operation. Fragmentary human remains and intact burials were discovered in the rubble deposits on site. "It looks as though the collapsing site was used extensively for the disposal of the dead during PhaseIIIb, an interesting finding in view of our slight understanding of burial in the Early Iron Age" (Hedges, 1987, 91). The skeletons of two adults were damaged by machine trench on the site; it was found that these remains had been placed in the earth-house which in total contained the remains of at least two adults, an adolescent, two children and four infants. The remains of one child were found in the rubble in the broch entrance, and another child and one infant were located in the upper fill of the broch tower. Unfortunately, despite the recognition of the importance of these remains to the study of Iron Age burial in Scotland, the human remains from this site were not radiocarbon dated.

Disarticulated human remains were found during the rescue excavation of an Iron Age roundhouse at Pierowall Quarry, Westray which had been constructed on the site of a probable Neolithic tomb (Sharples, 1985). These remains included adult and foetal/perinate bones. None of the remains were radiocarbon dated and it was assumed at the time that the bones were from a clearing out of the contents of the Neolithic tomb. Though this is very possible, given the results of the excavations at Knowe of Skea on the same island and a re-examination of the human remains on other similar sites in Orkney, this assumption may well be mistaken. Only radiocarbon dating of these remains will provide any answers here.

Human remains were found in phases belonging to the post-broch period at Gurness, Orkney; fragmented bones were found in the upper fills of ditches but more substantial amounts of bone were located in some of the outbuildings (Hedges, 1984, 192). Due to the poor nature of the recording from the original excavations it was not possible to ascertain the exact nature of the human remains though they may represent a number of burials. Viking burials were found on the site and it may have been presumed that all of the human remains were of similar date.

The discovery of human remains in the ruins of abandoned or partly ruinous structures is also seen on mainland Scotland, particularly in Caithness and Sutherland. The majority of these sites were unfortunately investigated in the nineteenth century however, and in many cases the records are poor. At Kintradwell, Sutherland, a number of cist burials were excavated in the area of a ruined broch tower in the 1860's (Tait, 1870). Sometime later, during the excavation of the broch human remains were discovered both inside and outside the structure itself (Joass, 1890). "...there need be no hesitation in believing that some of them, at least, were as much later as required to reduce the tower to a ruined heap and cover it with turf," (Joass, 1890, 101). Descriptions by the author suggest that the majority of the bones were found in collections, though only a few were thought to be complete skeletons. A large amount of human remains were reported from Yarhouse, Caithness - a skull and 'other remains of a human skeleton' were near the top of the mound; a set of poorly preserved remains on one side of the mound; another skeleton found in a cavity created between two stones set on edge with a covering stone near the base of the mound; human bones in the upper part of Chamber E and a skeleton in the ashes and refuse on the floor of Chamber G 'nearly level with the base of the broch wall' (Anderson, 1890) At Brounaben, also in Caithness, a long cist grave with a badly preserved human skeleton was located by the door and human remains were found in a chamber at the foot of the stairs while human bones were also found during excavations outside the walls of the broch (Anderson, 1890). Also in Caithness, the Wester Broch, Keiss was covered in windblown sand dunes in which were located four long cists and the bones of a small child were discovered in one of the outbuildings attached to the broch (Anderson, 1901).

Unfortunately the majority of the remains from sites such as these remain undated. A skull fragment from Kintradwell was recently radiocarbon dated to 1820+/-35BP (80-260AD) which places this skull in the early centuries AD though a burial located in the mound was dated to 1120+/-35BP (810-1020AD) (Tucker & Armit, 2010, 215). Other human remains and probable burials from this site most likely span the time between these dates, perhaps representing both fragmented bones deposited during occupation of the site and burials deposited after the site went out of use. Recent reinvestigation of The Whitegate, Caithness uncovered human remains in an intramural cell which have been radiocarbon dated 259-432AD (Sheridan, 2008). A further date from this site provided a much earlier date of 2130+/-30 (210-50BC) (Tucker & Armit, 2010). These sets of dates highlight the complications associated with the study of Iron Age burial traditions. What does appear clear is that in this region of Scotland for a protracted length of time, it was not unusual for burials to be placed in the ruinous remains of abandoned structures.

Location, location, location

The occurrence of probable Iron Age burials on archaeological sites of earlier date is well-known; however such burials have traditionally been termed unusual or deviant burials, or regarded as Pictish or Viking intrusions. Often little attention was actually given to their examination or retention and in the majority of cases such remains were not radiocarbon dated. During this period it seems that in some cases collapsing or disused earlier buildings or earth-houses were used as areas to place the dead. In a discussion of the upstanding brochs and other buildings in the north of Scotland that attracted inhumations after abandonment, Maldonado states - “This did not constitute a coherent funerary rite, as the inhumations were laid in any number of positions and orientations, with or without cists, articulated or otherwise.”(Maldonado, 2010, 84-5). However, when examined together, it seems possible that this was a more widespread practice than previously thought, albeit still mostly within the Orkney Islands and Caithness. Having already been ancient when reoccupied for domestic use, it is possible that these locations held some special importance in the collective memory of the population which encouraged the use of these abandoned structures as burial grounds (Mulville et al., 2001; Maldonado, 2010). This theory was touched on back in the nineteenth century by Jaoss when discussing the human remains from the broch structure at Kintradwell in Sutherland; - “perhaps from its ascertained traces of structures, it came to be regarded with a sanctity which is often associated with the mysterious, and was used as a grave mound after all tradition of its original purpose had perished.” (Joass, 1890, 101). The fact that at the majority of these sites, burials were found in the rubble deposits of collapsed or ruinous buildings rather than in soils or midden deposits may support this theory. The location of many of these burials within rubble deposits on sites otherwise disused and often in isolated locations suggests a degree of planning and preparation. Opening a space in rubble large enough to accommodate the body, then arranging the body before covering it over with the stone would have taken time and effort. None of this suggests a lack of consideration or formality.

The appropriation of ancient structures is known across Atlantic Scotland, as mentioned earlier sites such as Howe, Gurness and Knowe of Skea, all in Orkney show earlier structures and activity supplanted by Iron Age constructions. This is a common feature of late prehistory (Hingley, 1996; Driscoll, 1998). Maldonado suggested that the growth of a cemetery can be seen as the creation of a special place (2010, 61) for which the history of the site before, during and after its use for burial needs to be recognised. Disused structures in the landscape undoubtedly held some communal memory, perhaps associated with ancestors or local folklore and the creation of a special place was no doubt already underway before burials began to take place. “The placement of human remains within domestic sites in Atlantic Scotland highlights the multi-dimensional ways in which these locations were used, and their symbolic importance for communities during the long Iron Age. Similarly, the deposition of human remains along the shore, in caves and subterranean chambers, and within the ruins of earlier settlements and burial monuments, reveals a pattern of ritualised perception of these places. Human remains were utilised to add to the power of these significant points within the landscape.” (Tucker, 2010, 326) Few of the sites used for burial which would have formed ‘grassy mounds’ in the landscape were reused for settlement or domestic activity (Foster, 1989, 200).

Population

The size of the population of Scotland during the Iron Age is impossible to estimate. Tucker (2010, 84) identified human remains from 96 sites across Atlantic Scotland, representing just 300 individuals - the numbers of individuals identified in burials from across the country cannot represent the living population. The demographic information available is limited by the low numbers and the loss of many of the remains from early antiquarian excavations.

Tucker reports that the make-up of the disarticulated human remains from across the region shows a wider demographic profile indicating that bones chosen in this practice were from a variety of ages and sexes; the majority of individuals in 'formal' burials were adult females and those placed on settlement or ritual sites were adult males (Tucker, 2010, 314). Much of the evidence for burials placed on settlements is confined to the east, Orkney and Caithness in particular, and unfortunately many of the excavations in these areas were carried out by antiquarian investigators; most skeletal material was not retained and often only given a mention in site reports. Among those burials available for examination there appears little evidence that individuals were specially chosen for any particular burial method. In more recent excavations in Orkney, greater attention has been paid to burials on all sites. Unlike the individual burials more commonly found in the west, burial in the east and Orkney in particular occurred in larger numbers and appear more inclusive. These sites include the remains of infants, children and adults. As described above, at Howe, Bu, Rennibister, Pierowall Quarry burials of both sexes and all ages have been identified.

It can be expected that infant mortality was high in the past before the advent of hygiene and medical advances (Goodman & Armelagos, 1989; Chamberlain, 1997). Given the lack of burial evidence for the majority of the Iron Age population of Scotland, it is not surprising that there should be a lack of evidence for children and infants also. In fact, children and infants are often poorly represented and this can be a common problem in archaeological assemblages. Maldonado found that radiocarbon dating showed a concentration of infant burial in the later first millennium AD (Maldonado, 2010, 174) but noted that the majority of those infants dated were from a small number of cemetery sites of late Iron Age and Viking date.

Beyond Atlantic Scotland, children were present in the cist burials of south-eastern Scotland though in low numbers; as well as those cists containing children together with adults at Broxmouth (Hill, 1982; Armit, 2013) and Winton House (Dalland, 1991), cists constructed specifically for a child have also been identified (Baker, 2002). The graves of infants and children have also been identified in early cemeteries across Scotland such as Thornybank, Midlothian (Rees, 2002) though preservation is often poor due to soil conditions.

The date from the adult male burial at Howe, Orkney (cal40BC-180AD; Tucker & Armit, 2010) which was associated with two infants and the large number of infants from Knowe of Skea show that infants were accorded much the same status in death as other individuals buries on such sites. A newly excavated Bronze Age burial mound at Cantick, Orkney has revealed later burials including a number of infants placed in the upper layers of the mound. Though the primary burial on the site has been dated to the Bronze Age (Dan Lee, pers comm) the infant remains have yet to be radiocarbon dated and it may be that they belong to an Iron Age phase of burial at the site (Dan Lee, 2010). Infants and children were also present on the later Iron Age/Viking cemeteries in Orkney at Westness, Rousay (Sellevold, 1999) and Newark Bay, Mainland (Barrett & Richards, 2004; Richards et al, 2006).

Infants and children were also identified among the human remains recovered from cave deposits in Oban (Turner, 1895; Saville & Hallen, 1994). “Similar burials from other caves and rock shelters around Oban may well belong to the same burial tradition, and the presence of children as well as adults of both sexes suggests that these caves may have been used as cemeteries by small communities in the vicinity” (Armit, 1997, 91). This statement could also be made regarding the sites in Orkney and Caithness on which burials were placed over a protracted length of time such as at Knowe of Skea. Perhaps it was not the act of burial, or which individuals were buried, but the location that was significant and which saw the growth of some of these sites into cemeteries used by small communities or even single families over generations.

Summary

Perhaps what should be most obvious from the above is the degree of variance that is evident in Iron Age burial practice and treatment of human remains, across Scotland. That there may be some regional difference between east and west in Atlantic Scotland is also apparent. While single burials occur in some numbers across the Western Isles, burials in greater numbers on rubble mounds, or in collapsing structures, seems to have been more common in the Northeast and in Orkney. The Knowe of Skea represents the largest such group of burials from Orkney and the Northeast discovered so far; the site and the excavation of the burials from the site are described in detail in the following chapter.

3. Archaeological background – Knowe of Skea

Site History

The site of the Knowe of Skea is located on the far southern tip of the headland of Berst Ness on the west side of the island of Westray in the Orkney Islands. A number of Bronze Age burial cairns are located on the headland (RCAHMS, 1946, #1050; Lamb, 1970; Bell & Lynn, 1983/1990; Moore & Wilson, 2000) but the mound of Knowe of Skea occupies a roughly triangular area of rough grassland cut off from the headland and accessed only by a rocky causeway (Plate 1&2). The mound is exposed to the sea on three sides and slopes gently down to the causeway in the north.

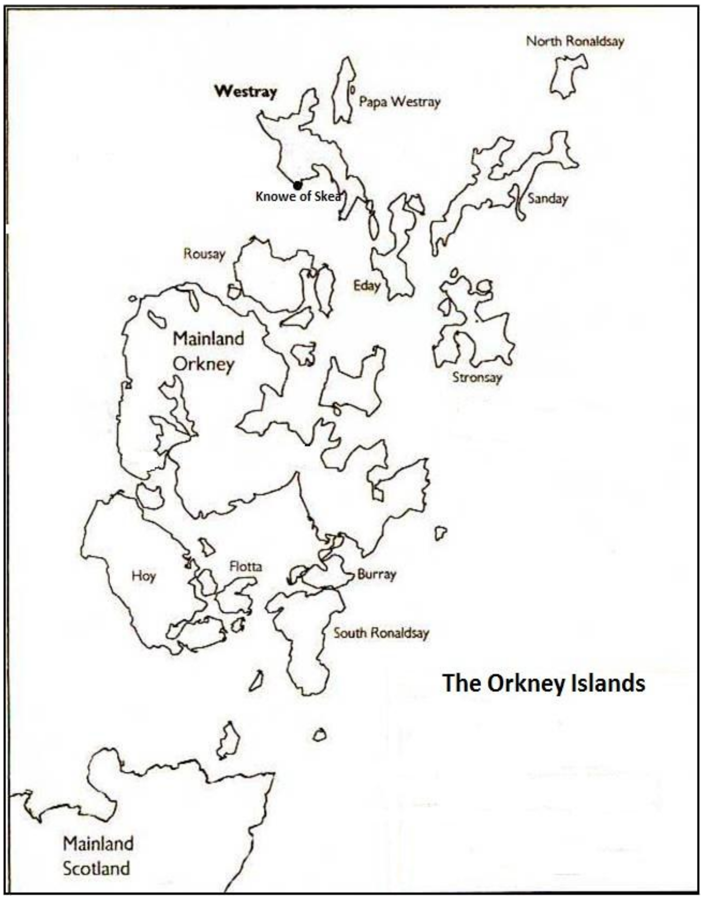


Figure 3: Map of the Orkney Islands. Knowe of Skea is located on the west coast of the island of Westray.

The site was visited in 1928 and recorded by the RCAHMS in 1946 as “A large, grass-grown cairn”, 85 feet in diameter, with some signs of disturbance and large stones protruding through the turf in the vicinity (RCAHMS, 1946, #1049). The site was visited by Ordnance Survey and archaeologists over the years and the mound was repeatedly recorded and described. Dr.R.Lamb visited the site for Ordnance Survey in 1970 and recorded the eroding mound as an occupation site of uncertain character. Burnt bone, midden deposits and Iron Age pottery fragments were found during two inspections in 1983 and 1990 (Lynn & Bell, 1984; 1990) and the site was interpreted as a probable broch site. The site was again visited and recorded during the Westray Coastal Zone Assessment Survey in 1998. The mound was found to be severely affected by coastal erosion; bone, shell and pottery fragments were identified in exposed deposits while protruding stones in the turf indicated buried structures. (Moore & Wilson, 1999). Following the coastal survey, a number of sites on Westray, including Knowe of Skea, were put forward as candidates for further investigation due to the threat of coastal erosion. For the Knowe of Skea, it was proposed that a programme of ‘limited open area excavation be carried out to determine the nature, extent and importance of the eroding remains.’(Moore & Wilson, 2000, 4). The assessment excavations which took place in 2000 led to a more concentrated programme of excavations over a number of seasons until 2009.

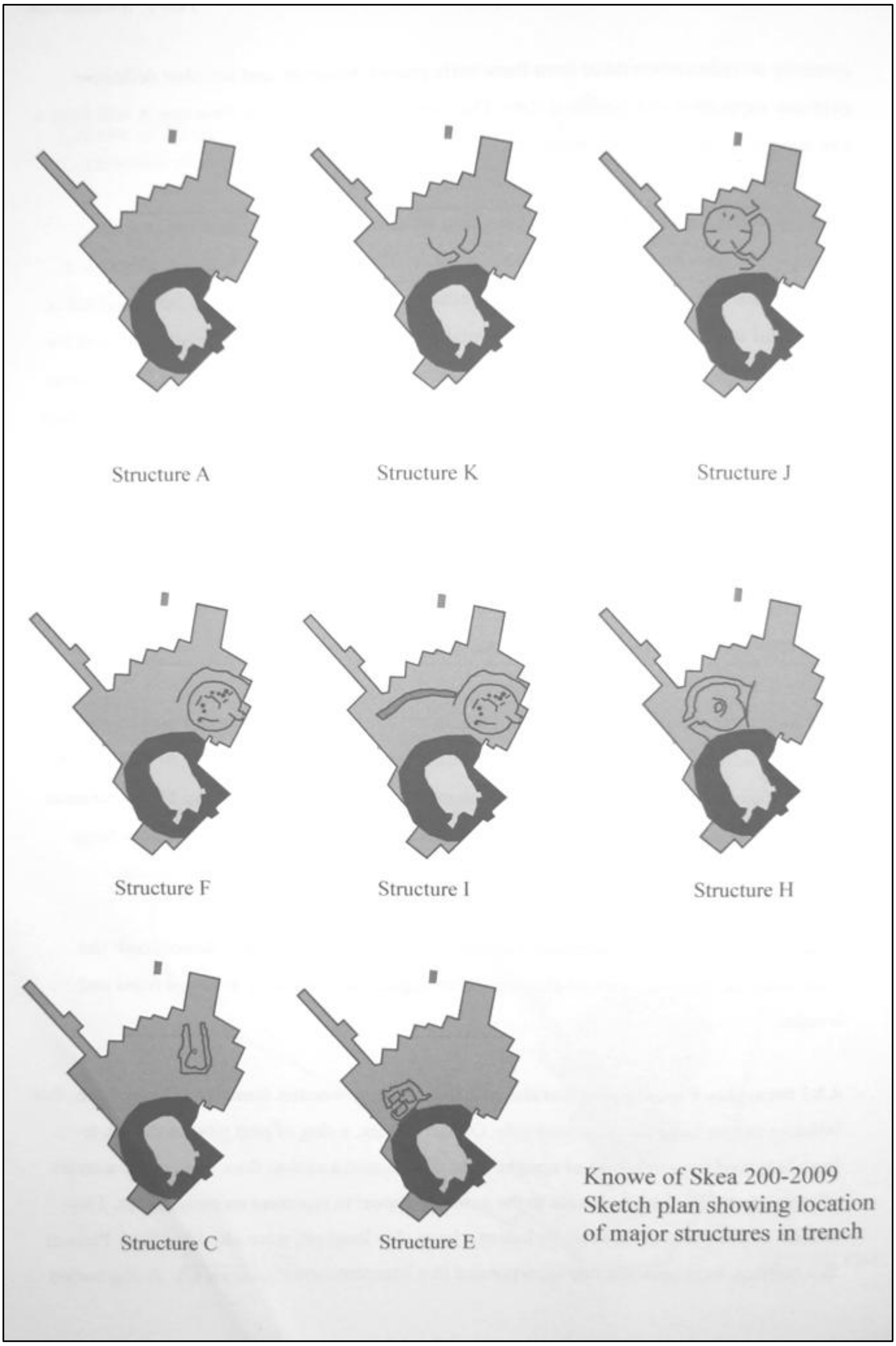
Results of the excavations

The exact nature of the site was never fully understood and prompted the need for further investigation and the sequence of structures and activity at Knowe of Skea became clearer as the years of excavation went on. The excavations revealed a number of structures at this location which dated from the Neolithic through to the late Iron Age.

The information for this section is taken from data structure reports and the site archive provided to the author by EASE Archaeology for this purpose. More detailed descriptions and analysis are available in the site reports compiled by H. Moore and G. Wilson. The excavators divided the sequence of activity at the Knowe of Skea into a number of phases (Table 2) to facilitate the discussion of each time period or structure in isolation when necessary.

1.A view from the air looking northwards, showing the roughly triangular shaped Knowe of Skea accessible via rocky causeway from the peninsula Berst Ness, Westray. (Photo: ©EASE).

2.View of the mound at Knowe of Skea jutting into the sea, looking across towards the island of Rousay and Orkney Mainland. (Photo:D.Gooney)



3. Sketch plan of structures uncovered during excavation, Moore & Wilson (2011). ©EASE

4.Looking down the rubble mound on the east side of site. Taken during excavation of the eastern side of Structure F in 2009. (Photo:D.Gooney)

5.Burials outside the intramural passage in the northwest of Structure A excavated in 2002.(Photo: ©EASE)

6.Removal of rubble deposits in the interior of Structure H during 2004 revealed a number of burials including (4036) and (4038). The interior face of the walls of Structure H formed the limits of both burials shown. (Photo: ©EASE)

7(4019), above left and (6030), above right. Excavators notes suggest that the position of the skeleton of (4019) indicate that this individual had been covered over in rubble where he fell. The position of the upper body is actually the result of natural movement of the remains during decomposition and disturbance by later burials in the immediate vicinity. The two small upright stones placed in front of the abdominal area of (6030) may have been an attempt to maintain the position of the body after burial. (Photos: ©EASE)

8.(4038) – this was the only burial which could be positively recognized as purposefully laid in a face down position. (Photo: ©EASE)

9.(3054) during excavation. This badly disturbed group of bones included partly-articulated elements and was found during analysis to represent a single individual. (Photo: ©EASE)

10.(4017); a large concentration of commingled infant remains excavated in 2004. (Photo: ©EASE)

11.Removal of the south east wall of Structure E revealed the partial remains of an adult (3111), shown here when first identified during excavation (Photo: ©EASE)

12.(3111) and the partial cow skeleton exposed following removal of the wall of Structure E. (Photo: ©EASE)

13.Uncovering (6071) during excavation. Two disarticulated crania can be seen lying on top of the burial (6072). Note the arrangement of the sloping stones surrounding the human remains and the large upright slab which may have served as a marker for this location. (Photo: ©EASE)

Phase	Activity/ Structure
1-3	earliest activity; possible building rubble
4-5	construction and all activity within Structure A
6-9	poorly preserved buildings truncated by later activity
10	Structure J
11-13	Structure F; dog burial in entrance dated to 800-500calBC most likely marks final abandonment
14	Structure I
15	Structure H
16	Burial activity across the rubble mound
17	Structure C
18	Structure E
19-22	later phases of activity; fish processing and kelp pit

Table 2: Phases of activity at Knowe of Skea. Greater detail can be found in Appendix.

The human remains

Human remains were discovered across the site and in almost every season of excavation. A system for recording and identifying human remains was implemented by the excavation team whereby human remains were ascribed either a context number or a small finds number. Context numbers (Table 3) were ascribed in cases where an articulated or partially articulated skeleton was present or where a scatter of bone could be reasonably adjudged to represent a single individual, or at least a single act of burial. Small find numbers were given to disarticulated bones, small scatters of bone and spreads containing mixed bones. The number of small find numbers (Table 4) ascribed to human remains grew very large and only those of particular interest, such as very large concentrations or those associated with articulated burials, were recorded in any detail on site.

2000 - Following a topographical survey and a geophysical survey across the site, a single rectilinear trench was excavated extending from the summit of the mound to its base. This covered an area of some $100m^2$ and uncovered a large central chamber surrounded by a cairn (Moore & Wilson, 2000). Spreads of human bone and a complete inhumation (106) were also recovered from the cairn.

2001 - Excavations in 2001 concentrated on the central chamber and the area immediately to the north of this central structure, Structure A. A number of walls and structures were uncovered and human remains were again found in the rubble deposits. During the excavation of one of these structures, further human bone and an articulated inhumation (2021) burial were uncovered beneath the walls. Human long bones had, in one instance, been incorporated into the matrix of the wall core (Structure D), presumably deriving from a burial disturbed during the construction work.

2002 - Excavations in 2002 investigated the sequence of wall construction on the exterior of the large central Structure A and completed the excavation of the interior of that structure. Human remains were found in two main areas in 2002.

Trench BM was located outside of the entrance to Structure A, in the south-west side of that building. The removal of rubble deposits to the north side of a pathway found leading up to this entrance revealed a number of concentrations of human bone, and one intact burial, (2100).

Trench HM was located outside the intramural stair and passage identified in the north-east of the central Structure A. The removal of rubble deposits in this area revealed two disturbed burials, (2114) and (2115) and two concentrations of remains, (2118) and (2121).

2003 - Excavations in 2003 concentrated on one large trench across the northern exterior of the large central Structure A; this incorporated Trench HM from 2002. Two structures, C and E were discovered to the north of Structure A. Excavation also continued in Trench BM to the north side of the entrance to Structure A with the aim of removing any remaining human remains. Human remains found during 2003 included both complete inhumations and concentrations of mixed bones.

Structure E was located slightly north-west of the central Structure A and was completely excavated in 2003. This building consisted of two rectilinear chambers in an angular figure-of-eight shape. The walls of this structure were built into the surrounding rubble of the mound. Human remains from disturbed burials, (3111) and (3118), were found incorporated into and beneath the walls of Structure E.

2004 - Excavations in 2004 continued in the same areas as in 2003 and concentrated on Structure C and Structure H. Structure C was located to the east of the site. The upper levels of this structure had been investigated in 2003. As with Structure E, a number of deposits of human remains were found in the rubble surrounding this building and incorporated into the wall core. Little articulation was observed in these remains and it seems likely that they represent burials disturbed during the construction and remodelling of Structure C over time.

Structure H was located below Structure E which was completely removed during the 2003 season of excavation. Structure H was a large circular structure which had become completely filled with rubble. These rubble deposits contained a very high number of both articulated burials and concentrations of infant bones. The high concentration of burials within the 'enclosure' formed by the walls of Structure H argue that the latter use of this building was as a cemetery and that this activity continued over an extended period of time.(Moore & Wilson, 2004).

A level deposit of compacted but voided rubble, 4002/ 4012 was discovered underneath the location of the removed Structure E. This deposit extended down the slope of the mound and was found to fill the interior of Structure H and contained a large number of both articulated burials and collections of human remains. In total, 29 separate incidences of human remains were recorded, with 5 accorded context numbers and 24 recorded as small finds (abbreviated as SF).

A second rubble deposit was identified in the area of the interior of Structure H. This second lower level in the rubble deposits, 4016, was made up of larger flatter stones and was more voided in places than 4012. This rubble layer also contained a large number of both articulated burials and concentrations of human bones. Excavators identified five separate human remains contexts and 33 which were accorded small find numbers (S.F.). The majority of those accorded small find numbers consisted of large collections of mixed late foetal, perinate and neonate bones. Those for which greater detail was recorded are described below.

2006 - The greatest number of both articulated burials and groups of associated bones were excavated during the 2006 season. In this year, work continued on removing rubble deposits from the interior of Structure H and completing the excavation of Structure C. The removal of Structure C revealed an earlier building, Structure F which was also partially excavated in 2006.

Excavations in Structure H involved the removal of the last rubble deposits in the south-east quadrant of the interior and the exposure of the entrance in the west side of the building. The rubble deposits in the south-east quadrant were found to correlate with rubble deposits excavated in 2003 below Structure E and in 2004 filling the interior of Structure H. The majority of the burials in 2006 came from rubble deposits 6015, 6016 and 6055 and these were interpreted as rubble into which the walls of Structure H had been revetted. This small area of the site was located at what would have been the junction of Structures C/F and H; the walls of these structures in this area were often dismantled and disturbed through the insertion of these later burials. The large number of intact burials from the south-east area of Structure H is most likely the result of this location, away from the later Structures E and C.

The rubble deposit 6055 extended across the area south of Structure C and partly covered the southern extent of Structure F. A number of burials were recovered from this area in earlier seasons of excavation including (2114), (2115) and (2118). Removal of 6055 revealed a large number of infant burials and a smaller number of partly articulated individuals of older ages.

Also investigated in 2006 was the entrance to Structure H in the western side of that building. Human remains were found in the rubble deposits filling the entrance passage and in the surrounding area. The human remains found within the entrance passage to Structure H were at first identified as groups of bones and only later identified as possible discreet burials. This initial confusion was mainly due to the unstable nature of the rubble deposits in this area and to later disruptions caused by the construction of Structure E.

2007 & 2008 - Fewer burials or collections of human remains were identified in 2007 and 2008 as the main area of investigation during that season concentrated on structures which predated the use of the site as a cemetery. An extension of the excavation trench westwards investigated the area around the entrance to Structure H. One articulated adult burial (7015), and the disarticulated remains of a child were recovered from this area.

2009 - Human remains were recovered from an extension to the east of the site in 2009 where the main focus was to reveal the whole of Structure F. Burials were found in the rubble deposits across this area. As this area was at a distance from Structure E and lay just outside of the area of Structure C, the majority of the burials here were beyond the areas of later construction and therefore were almost complete.

Location of burials across the site.

The burials were catalogued, stored and analysed in order by context numbers and by year of excavation. While this method of organising the remains was the only practical method as the excavations went on, this did not reflect any groupings or connections that may have existed in the cemetery. By examining the site notes, photographs and plans provided by EASE Archaeology the location of each burial, body position and orientation are all assessed in greater detail. The author's own involvement in the later seasons of excavation was also an invaluable experience which greatly aided in this assessment.

Though burials occurred across the site the cemetery is divided into areas both for convenience and because at a number of locations there was a particularly concentrated number of burials.

***a)** Human remains from the area around the entrance to Structure A*

The two collections of remains, (2098) and (2099) appeared to represent single individual burials which had been disturbed and the bones placed in this area. (2122) was made up of more fragmentary remains. (2117) was a concentration of infant bones located to the north of the concentration (2099). These concentrations appear to be at a similar level in the rubble deposits to the north of the entrance to Structure A. Further excavation into these rubble deposits below (2122) revealed a rough cist containing the complete burial (2100). This burial was laid on the right side and tightly crouched; the legs were drawn up to the chest, though the left knee has slumped forwards and the arms were positioned below the legs. The burial is orientated roughly southeast-northwest with the head to the south-east. Following the excavation and removal of (2100), further bones (2124), were noted underneath.

Located to the north of the entrance of Structure A, (3015) was uncovered in Trench BM and lay immediately to the south of burial (2100). This was the burial of an adolescent; the legs were tightly flexed to the right but the upper body lay supine. The arms were bent at the elbow with the lower arms lying across the abdominal area. The burial was orientated roughly north-south which may have been dictated by the proximity of the outer wall of Structure A. The skull and upper vertebrae of this skeleton were absent. Site photographs show that this burial is situated extremely close to and almost underlying an outer facing of the wall of Structure A. Another section of walling possibly associated with the pathway which led up to the entrance of this structure, lies over the area where the skull of this individual would have been. It is possible that this burial was disturbed by construction of this pathway or by adaptations to the outer surface of the wall of Structure A.

b) *Burials found near/in the entrance to Structure H*

Human remains were found in the rubble deposits filling the entrance passage and in the surrounding area. The human remains found within the entrance passage to Structure H were at first identified as groups of bones and only later identified as possible discrete burials. This initial confusion was mainly due to the unstable nature of the rubble deposits in this area and to later disruptions in this area by the construction of Structure E. An almost complete adult skeleton, (6030), was located in this area (Plate 7). The burial was orientated roughly southeast-northwest with the head to the southeast and lay on the right side. Site notes record that the burial lay in a crouched position with the legs drawn up to the body though the left leg was drawn slightly higher than the right. The right arm was bent at the elbow so that the right hand lay below the area of the chin and the left arm lay parallel to the upper body, also bent at the elbow with the lower arm lying across the abdominal area. Associated with this burial were animal remains which during analysis were determined represented a number of dogs. A later infant burial, S.F.292, was located close by the legs of this adult. The excavator's notes record that the positions of the bones of this infant suggested that this burial had been placed vertically, or feet first, into a small space in the rubble deposits. The cranium of a child recorded as S.F.251 was found amongst the rubble filling the entrance passage to Structure H and further excavation revealed that this cranium belonged to the almost complete but seemingly disturbed burial of an infant which was orientated roughly east west with the head to the east. The skull was found to be in a position lying over the rest of the remains which were fragmented and only partly articulated. The excavator's notes state that as the rubble in this area was made up of large stones with spaces in between, the movement of these stones over time and with later activity in the area must have caused the disturbance to the infant skeleton.

Also in this area were (6096) and associated groups of bones S.F. 284 and S.F.627. These remains were disturbed by a later wall which the site records state was built almost directly over a number of burials. The legs and pelvis of the adult (6096) were partly articulated, and this individual originally lay on the right side with the legs in a crouched position.

Two burials were located to the west of the site, outside of the entrance to Structure H. The articulated skeleton of an adult (7015) lay in rubble deposits orientated roughly east-west with the head to the east. This individual lay on the left side with the legs flexed at the knee and both hands drawn up by the head. The second burial in this area was of a child, (7037). Site notes indicate that this burial was probably disturbed by a later wall; the remains were fragmented and incomplete with only upper body bones present.

c) *Burials disturbed by Structure E*

Structure E was located slightly north-west of the central Structure A and was completely excavated in 2003. This building consisted of two rectilinear chambers in an angular figure-of-eight shape. The walls of this structure were built into the surrounding rubble of the mound. Human remains were found incorporated into and beneath the walls of Structure E.

Human remains found within the walls of this structure consisted of small collections of loose bones. Two collections of human remains were found within the wall core, 3016, of the north wall, [3053]. S.F.94 included skull fragments and mixed bones of neonate infants and S.F.95 contained adult foot bones. Five human bone small finds were found in the wall core, Context 3101, of the north wall of Structure E, Context [3053]. S.F.87 was an adult skull fragment; S.F.88 was an infant skull fragment; S.F.92 was a small collection of adult skull fragments; S.F.93 consisted of infant skull fragments and S.F.97 was an infant skull fragment. Human bones were also found in Context 3113, which was the wall core of a pier in the north side of the interior of Structure E; this pier was conjoined to the north wall; S.F.'s 99/100 and S.F.103 were small collections of bones of infants. There is no indication that these bones were in articulation when discovered and it is probable that they represent burials disturbed during construction of Structure E and then incorporated into wall core.

Removal of the wall in the south-west corner of Structure E revealed the partial burial of an adult and an articulated, partial cattle burial in close proximity. Site photographs (Plates 11 & 12) indicate that the burials appeared to be protected by the presence of the wall of Structure E as any remains that may have gone beyond the limit of the wall edge were not present. It is most likely that these burials were disturbed by the construction of Structure E and that any bones which extended into the interior of the building were removed. The adult burial (3111) consisted of bones of the upper body only; the cranium was absent. From site notes and examination of the site photographs it was noted that the upper body of this burial lay prone, with the scapulae uppermost. Without the lower limbs, it is not possible to say what position the legs lay in originally; however, the upper body suggests a position similar to that of (4019) excavated in 2004 (see below). The proximity of the cattle burial is unusual for this site; all other animal burials found in association with human burials on the site were of sheep or dog.

Two further deposits of human remains were found in the north-east corner of Structure E. A cist [3020] was set into the wall of Structure E in this area, constructed of stone slabs and measuring 80cm x 40cm orientated north-south.

Though an adult femur was found close by, the cist itself contained only a small number of human bone fragments. The burials (3118) and (3117) were found below the base slab of this cist.

The bones of (3117) were scattered around the partially articulated burial (3118). Site notes record the presence of a mixture of human and animal bones in the scatter (3117) which was collected to the north and south of burial (3118). The partially articulated burial (3118) was an adult; the site photographs and excavator's notes indicate that the skeleton was tightly crouched, and lay on the right side. Some bones were noted absent during excavation, notably the cranium and scapulae. It is possible that the burial of the child (3117) was disturbed by burial of the adult (3118) and both were later disturbed by the construction of Structure E. Two isolated crania were located in the rubble deposits in this area, S.F.31 and S.F.32. One of these was a child cranium and the other an adult; it could be that these were in fact the crania of burials (3117) and (3118).

Also located to the north-east of Structure E was a bone scatter, (3036) which included the mixed bones of humans and animals. Within this scatter an associated group of bones, (3054), was identified which consisted of articulated thoracic vertebrae and ribs and arm bones (Plate 9). A second group of human bones within (3036) was accorded a small find number, S.F. 53. During excavation it was unclear whether these groups of bones were from a single individual and so they were stored together in order that this might be investigated during analysis.

d) *Burials in rubble deposits near the intramural stairway of Structure A*

The excavation of a trench labelled 'HM' and removal of rubble deposits in this area revealed two disturbed burials, (2114) and (2115) and two concentrations of remains, (2118) and (2121), (Plate 5).

Site notes record (2114) as the partial remains of an articulated adult with the lower limbs, pelvis and upper limbs in approximate articulation; the skull and upper vertebrae were absent. Examination of the site photographs allow for little further interpretation though site reports state that the body appeared to have been buried in a tightly crouched position on a NE-SW alignment.

Though the site photographs reveal little, site notes record that the burial (2115) appeared to have been buried in a tightly crouched position, lying on its left side and aligned approximately NE-SW. The site notes and site reports record that the cranium was found on top of the crouched burial and turned facing downwards. While the excavators suggest that this may have been the result of decapitation, they also suggest that the location of the skull may be a result of later disturbance of the burial with the skull moved to 'tidy-up' the remains. "The unusual separation of the skull and the jaw from the body may have resulted from decapitation prior to burial but may alternatively indicate that the burial was subsequently disturbed with the skull being 'tidied up' into a pile." (Moore & Wilson, 2003). The collection of remains (2121) was located in a lower position in the rubble deposit to the east of burial (2115). Site notes record that these remains were much disturbed, and were mixed with crushed fish bone and other evidence of otter activity within the rubble. These remains were not planned or photographed during the excavation due to their very disturbed nature.

The collection of bones (2118) was located in the north of Trench HM. Site notes state that similar to (2115), the cranium was found in a higher position than the rest of the remains and lay over the torso and the rest of the skeleton. The cranium and loose bones were excavated in 2002 and the remainder collected in 2003. Site photographs record the location of the cranium in 2002 only. Unfortunately whether these remains were in articulation on site could not be determined from the site records and so no information on body position or orientation is available.

A concentration of infant bones, (3107), was found in Trench HM, outside the intramural passage in the north-east of Structure A. These remains included the skull fragments and teeth of infants. This concentration was located in the immediate vicinity of the concentration (2121) excavated in 2002 which also included infant remains. A large structure, Structure C was discovered in this eastern part of the site; it is assumed the construction of this structure caused much of the disturbance to burials in this area.

One burial, (4015) was found in wall, Context [4013], to the east side of Structure C. The excavator's notes describe the burial - "groups of bones are in regular association ie. radius, ulna, humerus, but the overall positioning is jumbled."(BNKS04 Context Records). The relationship between the wall of Structure C and this burial was never clearly determined. The site reports suggest that this burial was situated in rubble underlying Structure C and so disturbed during the construction of the wall (Moore & Wilson, 2004). Given the incomplete nature of the skeleton and the disturbed state in the ground, this seems the most probable interpretation.

Removal of rubble deposit Context 6055 revealed a large number of infant burials and a smaller number of partly articulated individuals of older ages. The rubble deposit 6055 extended across the area to the south of Structure C and partly covered the southern extent of Structure F. A number of burials were recovered from this area in earlier seasons of excavation including (2114), (2115) and (2118).

One infant burial, S.F.417 was located to the east edge of the site orientated roughly east-west with the head to the western side. Though the remains were disturbed, examination of the site photographs showed that some parts were in articulation and that this infant was laid on the left side with the legs in a crouched position. A number of collections of infant remains, S.F.429, S.F.440 and S.F.422 were also found in this area. The site notes indicate that some bones in this collection were partly articulated. A number of small collections of infant bones were excavated and kept separate from any other remains when the excavators noted that they may represent a single infant burial. Infant burials in this area seemed to occur more often as single inhumations and there were fewer of the very large concentrations of infant remains found during excavation of the interior of Structure H in 2004. This may be a result of the increased experience of the excavators or an actual difference in burial practice between the two areas of the site.

The disturbed burial of an adult, (6065), was found in rubble at the south-east end of Structure C. This burial was orientated roughly northwest-southeast with the head to the southeast. Skeletal analysis determined that this was a young adult female. The upper body was badly disturbed and the excavator's notes state that this disturbance was most likely caused by other burials in the vicinity; the skull, cervical and most thoracic vertebrae were absent. The skeleton was articulated from the pelvis to the ankles and it could be determined that this individual lay on the left side with the legs tightly flexed.

A spread of human bone was found in the rubble deposits close by (6065). This spread of bone was numbered S.F.443 and consisted of mixed adult and adolescent bone and some mixed bones of infants. Below this spread of bone lay a large flat stone which once lifted revealed a second collection of bones S.F.625 which also consisted of mixed adolescent and adult bones. Site notes record that the bones below this flat stone showed some articulation, particularly the arms which indicated that the adult individual lay on the left side. It is most likely that these burials were disturbed by the shifting of rubble to accommodate other burials in the immediate area.

The burial of an adolescent, (9003) was located in these rubble deposits orientated roughly east-west with head to the east. The skeleton lay on the right side with the legs tightly crouched though the left leg, which was uppermost, was drawn much closer to the body than the right. The upper body and skull of this burial were disturbed, possibly by movement in surrounding rubble deposits and also due to the decomposition of the remains in a voided space between stones.

The burial of an infant, (9007) was lying in an east-west orientation with the head lying to the east. This burial was one of the more unique found as it included the bones of a sheep which had been placed over the infant at the time of burial. Many animal bones, particularly sheep or dog, were found with burials across the site. However, this was one of the few where the skeleton of the animal and that of the infant were correctly identified and recorded as individual skeletons and separated during excavation.

The burial of an adult, (9010) was found in the rubble deposits close to the edge of excavations. The feet of this skeleton were most likely recovered in an earlier season as no foot bones were collected with (9010). The burial was orientated roughly east-west, the head would have laid to the east. The upper body was in a disarticulated state, most likely disturbed by movements in the rubble deposits over time and by later burials in the vicinity, however aside from the feet and though fragmented, all elements of the skeleton were present. It could be determined that the burial originally lay on the left side with both legs tightly flexed at right angles to the upper body.

The burial of an adolescent, (9013), was found to the north end of the area excavated in 2009. The burial extended beyond the edge of the excavation and so a small area was extended to uncover the whole skeleton. This burial was orientated roughly north-south with the head to the south. The upper body was in a disturbed state but apart from the skull, all of the elements were present which suggests that the decomposition of the burial in space cleared in the rubble may have been the cause of this state of the remains. The teeth of this individual were present but only a few small fragments of cranium were collected. The reason for this is unclear, the burial lies close to the exterior of the large central Structure A which saw numerous phases of construction which may have caused the skull of (9013) to be removed. Or it may be that the skull of (9013) lay beyond the limit of the extended excavated area. It could be determined that the burial lay on the right side with the legs in a crouched position; the right leg was drawn closer to the body than the left.

The burial of an infant, (9016), was found within the rubble deposits in a space created by two large stone blocks. The skeleton was in a disarticulated state, but it could be seen that this burial was laid on the right side and orientated roughly east-west with the head to the east. This burial was most likely disturbed by other burials in the vicinity; the skull fragments of two other infants were located close by (9016). A small collection of bones, (9021) contained the pelvic bones and legs of an infant and may have been associated with the disarticulated skull fragments of a second infant found with (9016).

An almost complete skeleton of an infant, (9023), was found to the far east of the excavation. This burial was in a very disturbed state, most likely due to the decomposition of the remains within a space in the rubble deposits. It could be determined however, that the burial was orientated roughly north-south with the head to the north. The skeleton lay on the left side and may have been in a flexed or crouched position.

A collection of infant remains, S.F.910, was found in this eastern area of the site during the 2007 season of excavation. Site notes suggest that these may be associated with other infant remains excavated from this eastern area of the site; without any further information however it was not possible to determine if this was the case.

A large number of infant burials were identified in this area during 2009 which were accorded small find numbers. Many of these were complete enough to suggest that they were individual infant burials. Occasionally it was noticed that these small infant burials lay in a particular position; skulls lay on top of the upper body bones which lay over those of the pelvis and legs. It was suggested during the excavations that these infants, perhaps in a wrapping or bag, had been placed vertically, feet first into a space created in the rubble then simply covered over by stones. This may have been a burial rite favoured for such small infants, or a method favoured for the minimal disturbance caused to other burials known to lie in the area.

e) *Burials in the area between Structures C/F and Structure H*

This small area of the site was located at what would have been the junction of Structures C/F and H; the walls of these structures in this area were often dismantled and disturbed through the insertion of these later burials. The large number of intact burials from the south-east area of Structure H is most likely a result of this particular location, away from the later Structures E and C.

Early in the excavations in 2001, a set of human remains (2121) was located which had been disturbed by the construction of later walls. These remains were carefully planned and photographed during excavation and allowed for a clearer interpretation of the burial. It would appear that this burial was indeed disturbed by the later construction. The upper body was the least disturbed, remained in articulation and lay on the left side with the head to the east, so that the burial originally faced southwards with the arms bent at the elbows and lower arms lying across the body. However, the legs and pelvis were in a disturbed state. The pelvis bones and the femora were described in the site notes as ‘piled’ and it was these bones which show the most signs of disturbance. Both femora have been moved from their position to lie parallel to and over the upper body. The upper body lies at a lower level in the rubble so that it is possible that when these bones were moved, the rest of the skeleton was not even visible. The lower legs of (2021) then remained *insitu* and roughly in articulation against the external wall of the large central Structure A. By examining the site photographs and plan, the original position of the body could be interpreted; originally the body lay on the left side, with the legs bent at the hip and knee to form a rough right angle. This was a similar position to burials (4019), (4038) and (4045) excavated in 2004.

The burial (4019) was located in the south-east area of Structure H, to the south of the location of burial (4045). (4019) was orientated roughly north-south with the head to the south (Plate 7). The body was laid on the left side with the legs flexed but not placed together; the left leg was placed closer to the body than the right. The upper body appeared to lie in a prone position; the right elbow lay away to the right of the body though the bones remained in close association. It is possible that rather than buried in this prone position, the body in fact 'rolled' forward slightly during decomposition in a void in the surrounding rubble deposits. The position of this burial very closely resembled that of (4045) which lay almost immediately to the north. Three human bone small finds were recorded with this burial, S.F.196, 197 and 198.

The burial (4045) was of an adult, orientated roughly northeast-southwest with the head to the northeast. Site notes record that a copper pin was found close by the skull of this burial, and may have been associated with it. The skeleton was laid on the left side with the left leg drawn up to the chest but the right leg lay in a less contracted position. The right elbow lay in front of the body with the elbow bent so as the right hand was situated beneath the mandible. The left arm lay under the body, bent at the elbow to 90 degrees so that the left hand was situated close to the left knee. Though the skeleton appears in strict articulation, the lower vertebrae are not in sequence; this was the result of the decomposition of the body in a voided space in the rubble.

Burial (6032) of an adult was found in a slight hollow within these rubble deposits. Site notes describe this burial as 'twisted' as the lower vertebrae and pelvis appeared to lie supine while the upper body lay on the left and the legs were flexed to the right side. This may have been the result of the movement of the body during decomposition or due to disturbance after burial which site notes suggest was also indicated by the displacement of the arm found slightly higher in the rubble deposit than the rest of the skeleton. Given the number of burials inserted into the rubble deposits in this one area, it is surprising that not more of these burials were in a similar state of disruption.

Located in the rubble deposits below burial (6032) was the burial of an adolescent, (6043). This skeleton lay in a tightly crouched position orientated roughly south-north with the head to the south. Though this skeleton was almost complete a number of bones were fragmented due to the rubble and stones in which it was located. Site notes record that the skull of this individual was not *in situ*, being in a position slightly to the west of the skeleton. The cervical vertebrae were found lying on a slope below the upper ribs. This slope most likely caused the skull to roll from its original position. Without an accurate description of the location and position of both cranium and mandible, it is impossible to determine whether this movement occurred through the action of humans or was a natural occurrence during decomposition. The movement and manipulation of bones is not unusual for this site. In an apparent effort to 'tidy-up' disturbed remains during successive burials, the crania were moved in (2115), (2118) and (6072).

The burial of a child, (6061) was also located in this area. The excavator's notes state that these remains were not articulated and that this was due to the uneven nature of the stones and rubble deposits in which the burial was situated; the majority of the bones were in roughly the correct location. Site photographs show that the skeleton lay on the left side with the skull sheltered below a large flat stone which may have been deliberate. The vertebrae had fallen into a void in the rubble below the level of the rest of the skeleton, the ribs lay across a large stone and the skull was very fragmented.

A large collection of human remains, (6071) - labelled the 'mass burial' by excavators, was found in an area of the rubble deposits located at the junction of Structures C/F and H (Plate 13). This area of the rubble was particularly voided and included some large stones which from the site photographs appear to have been set at angles to create possible settings for burials or perhaps even grave markers. The excavator identified two partly articulated adult skeletons and the mixed remains of a number of children. The disarticulated collection of bones (6071) contained mostly the mixed up bones of children. It is likely that the two more articulated adult burials disturbed the burial location of a number of children. However, given that this location appears to have been marked it is also possible that this spot was chosen for the relocation of the bones of children disturbed elsewhere on site.

While excavating the upper most bones within (6071), it became clear that there were articulated burials located within the larger collection. (6072) was a tightly crouched adult orientated roughly north-south with the head towards the north. This individual was laid on his back, with the arms folded across the abdominal area. The site photographs appear to show that the legs were lightly drawn up and slightly to the right of the upper body, the skeleton was disturbed in this area however, and the exact original position of the legs could not be confidently determined. The skull and cervical vertebrae of this individual were also disarticulated. The cranium lay on top of the rest of the skeleton, along with another cranium of a child. This burial lay within the larger collection of human remains (6071) which also included (6076).

The partly articulated burial of an adult, (6076), was located close to the north-east of (6072) within the larger collection of remains (6071). (6076) was identified by the articulated legs, pelvis and vertebrae which lay in a crouched position orientated roughly northeast-southwest with the head laid to the southerly side. The skeleton originally lay on the left side with the legs drawn towards the chest area; it appeared during excavation that the right leg was drawn tighter to the body than the left which lay at a less acute angle below the right. This position is similar to many of the other burials on site. Though the arms of this individual were not *in situ*, adult arm bones were found in the large collection of bones (6071) which were possibly those of the adult (6076); this was further investigated during analysis. Though some articulation was noted in the other remains, (6076) in particular, (6072) was by far the most complete which may indicate that this was the last burial placed in this location. Any later disturbances may have occurred during later construction and an attempt to organize or tidy the burial area. Examination of the site photos show a number of upright stones arranged around this area, some of which were visible on the surface and may have marked the location of this ‘grave’.

The almost complete burial of a perinate infant, (6029), was found in a small space within the rubble deposits. The skull was found lying on top of the rest of the skeleton. The excavators suggested that the burial may have been tightly wrapped as the skeleton showed few signs of any disturbance.

f) Burials in rubble filling the interior of Structure H

A level deposit of compacted but voided rubble, Context 4002/ 4012 was discovered underneath the location of the removed Structure E. This deposit extended down the slope of the mound and was found to fill the interior of Structure H. This rubble deposit contained a large number of both articulated burials and collections of human remains (Plate 6).

Skeletal analysis showed that S.F.117 was a concentration of mixed bone, including bones of perinate infants, infant skull fragments and fragmented upper body remains. Site notes record that some of the bones were crushed against a large slab and there was no grave cut in evidence. This collection perhaps represents the disturbed burial of an infant or early child somewhere in the vicinity.

The site notes and report record SF121 as a concentration of child/young adult remains, not articulated and possibly representing more than one individual. These remains were found below a flat slab, but not apparently lying in a cut. Site notes also record that S.F.121 was located close by S.F.163, a large concentration of mixed perinate infant bones from the rubble deposit, Context 4016, described below.

The discovery of an infant burial, (4011) & SF131, is described in site notes; the skull was identified first, with other, possibly associated bones found beneath a flat stone. A cattle ulna and a hammerstone were found in close association though it is not stated whether these were considered as grave goods.

A concentration of both child/young adult and infant bones was recorded as (4014). Site notes record that some of the child/young adult bones were articulated, although the skeleton is not complete. There was no grave cut in evidence. Site notes also record that (4014) and S.F.144 were in close proximity. As the site notes and photographs show some of the child bones in approximate articulation, it seems likely that (4014) and S.F.144 represent the disturbed burials of a child and a number of infants.

A second rubble deposit was identified in the area of the interior of Structure H. This second lower level in the rubble deposits, Context 4016, was made up of larger flatter stones and was more voided in places than Context 4012. This rubble layer also contained a large number of both articulated burials and concentrations of human bones. Excavators identified five separate human remains contexts and 33 which were accorded small find numbers (S.F.). The majority of those accorded small find numbers consisted of large collections of mixed late foetal, perinate and neonate bones. Those for which greater detail was recorded are described below.

A large collection of infant remains, (4017), was found within rubble layer Context 4016. Site notes record that some parts of this collection were partly articulated and this can also been seen in the site photographs (Plate 10). SF.135 was close by (4017) and site notes suggest that the two were associated.

The rubble deposit Context 4016 contained large concentrations of infant bones. One of these, S.F.188 was particularly large. This concentration was uncovered below a large flat slab of stone. The removal of the large slab revealed an irregular setting of stones within which the bones had been placed. The concentration was made up of the mixed bones of a number of infants. The excavator’s notes record that some of the bones appeared to be in articulation suggesting that this location was used for the successive burials of complete infants.

The articulated skeleton of an adolescent, (4038), was uncovered in the rubble deposit Context 4016 in the interior of Structure H, to the north of the entrance. This burial was orientated roughly east-west with the head to the east. This burial lay on the right side; the legs were flexed but were not in alignment, the right leg was more tightly flexed than the left. The upper body was in a prone position so that the left scapula was uppermost. The vertebrae and pelvis all appear in articulation. The left arm lay slightly in front of the torso, bent at the elbow so that the hand lay below the chin while the right arm lay under the torso with the right elbow showing on the left side also bent so that the hands were together below the chin. The skull lay face downwards with both cranium and mandible in tight alignment. The site photographs show that this burial lay within a rough stone setting with large stone to the front and a small upright to the back (Plate 8). This suggests that the position of this burial was deliberate. The position of this burial is very similar to that of (4045) and (4019) though both of these showed some signs of movement after burial due to voids in the surrounding rubble deposits.

A spread of human bones, (4039), together with S.F. 203 and S.F. 204 which site notes record in close proximity, contained a mix of bones of children and infants. This bone spread most likely represents the disturbed burials of children within the rubble deposits.

Another burial, (4036) was located to the north side of the interior of Structure H, again in rubble deposits. This burial was in a disturbed state and disarticulated. Site records show that the lower lumbar vertebrae, the sacrum, pelvis and femora were still articulated. These lay in a supine position with the legs drawn very tightly upwards and slightly to the left. The position of the rest of the skeleton could not be determined. There were also the mixed remains of at least two infants collected with this burial. These infant remains were numbered separately as S.F.206. It seems likely that this burial was disturbed either by the later insertion of the infant burials, or by later construction activity in this area.

g) *Burials in more isolated locations*

The burial (106) was located on the sloping surface of the north side of the mound. The skeleton was in a good state of preservation. A large level slab, resting on several smaller stones had been set above, but not touching, the skull, which survived intact. A second large slab covered the legs. The burial was entirely removed but no trace of a cut or further stone setting was found (Moore & Wilson, 2000). Examining the site photographs shows that this burial was laid on the right side in a roughly northeast-southwest orientation with the head to the southwest. The legs were tightly bent at hip and knee and though the photographs are not clear, site notes record that the arms were crossed over. A number of small infant bones were also recovered from around (106) and were assumed to be associated with the concentration of infant bones, (107), which was located close by.

One articulated infant burial, (6094) was located in rubble deposits outside and to the north of Structure H. The excavator's notes state that many of the bones were broken but that it could be seen that this burial was orientated east-west with the head to the east and lay on the right side.

The articulated partial skeleton of an adult male, (7039), was found in a section of walling between Structures C/F and H to the northern side of the site. Only the left arm, the ribs and vertebrae were present.

One further set of articulated remains, S.F.1064, was found in a soil deposit laid below the wall of Structure H. These remains were of a perinate infant and were the only remains to predate the use of the site as a cemetery; this infant was placed in a build-up of soils onto which Structure H was constructed.

Burial rite, body position and orientation

Unless disturbed by later burials or construction, the majority of the burials at Knowe of Skea survived in very good condition. These were single inhumation burials within the rubble deposits created by the collapse of earlier structures. Grave cuts were difficult to recognise and only one or two cases showed the arrangement of the stones into a rough cist, for example burial (2100). Burials were placed in the rubble of the earlier structures; stones were pulled aside to create a space and the body was placed down, usually in a crouched or flexed position, then stones or slabs replaced over the top. In site photos of burial (4045) excavated in 2004, it is possible to see that this individual was placed in rubble consisting of large slabs under which more burials were discovered in 2006. There were some incidents where there had obviously been some effort to arrange the stones in a burial location which was returned to a number of times. The location of burial (6072) was marked by a large upright which was visible through a number of seasons of excavation before the burial itself was uncovered. The stones and slabs in this area had been arranged to create a type of pit into which (6072) had been placed.

Burials which showed little or no disturbance remained almost completely intact (eg. 2100, 4045 and 6030). Excavators noted on a number of occasions that a cranium had been placed on top of the rest of a burial and used the apt term 'tidied-up' to describe this situation. For example, burial (6072) had two crania associated with it, (6071A) and (6071C) both of which lay on top of the articulated skeleton. Attempts were made in antiquity to maintain the connection of remains once disturbed, presumably during the burial of another individual in close proximity. In light of the degree of recent research into the treatment of human remains in the Iron Age, skulls or crania in particular, it is interesting to note that a number of the burials at Knowe of Skea were missing this skeletal element and attempt to account for these absences. In the majority of cases these are already disturbed and incomplete skeletons eg. (2099), (2098) and (6096). In the case of isolated crania found amongst the rubble such as S.F.31 and S.F.32, it is most likely that these came from disturbed burials in the area, in this case burials (3117) and (3118). Those skeletons missing crania appear to be those disturbed by later construction of Structures C or E, by which time it is possible that any sense of responsibility and familial connection to the burials may have passed, or the building of this new Structure more significant.

Body position

The site records, plans and photos were examined to establish whether a predominant mode of burial was adopted at Knowe of Skea. Many of the remains collected from the site were in disarticulated concentrations and so body position was only assessed for those burials which were complete or almost complete and showed some part of the skeleton in articulation.

The majority of burials showing articulation were either crouched or at least flexed. Those which had been placed in a crouched position were tightly-crouched. Others showed tight flexing of just the legs and not the whole body, while yet others showed only slight flexion of the legs, eg.(4038)/(7015). The vast majority of burials on the site were laid on one side with the legs in a crouched or flexed position. There was some variation in the position of the arms. The position of the body on one side was not reserved for adults; when it was possible to determine the position of children and infant burials, it was found that many of these were also laid in a similar position.

The location of the burials within rubble deposits, often with large stones or slabs laid over them in the ground indicates that the bodies were originally laid into a voided space. Decomposition in a voided space allows for the movement of skeletal elements through natural forces caused by the loss of muscle and ligament attachments and by gases and liquids created during decomposition (Duday, 2009, 32). A number of burials were described in a prone or semi-prone position in the excavation notes and as the prone or face-down position of burials often has negative connotations; individuals in this position are often suggested as witches, suicides or somehow outside of normal society (Tsaliki, 2008) it is important to point out that this was the position in which these burials were found, not necessarily the position in which they were originally laid down. Burial (4019), an adult male was found in a semi-prone position, however, examination of the site photos showed that the vertebrae were disturbed and the left upper and lower arm bones had become separated. It seems likely this position was probably the result of natural decomposition processes causing the skeleton to slump forwards from its original position on the left side and later disturbance caused by successive burials in close proximity. In one case is seems that some effort was made to perhaps maintain the original position of the body; upright stones were found around the torso of (6030), seemingly keeping the body on the right side and preventing any slumping forwards. In only one case among the burials at Knowe of Skea could it be determined that an individual had purposefully been laid face-down at the time of burial. (4038), an adolescent was laid face-down with the legs in a crouched position. The skeleton was in good condition and the skeletal elements remained in position; there was no loss of articulation of any of the skeletal elements indicating that this was the original position in which the individual was laid for burial. Analysis showed that this individual suffered an injury to the face during childhood causing many of the front teeth to break and others to grow in crooked. Perhaps if this injury also affected the soft tissue of the face, such disfigurement may have caused some stigma among the community.

For those children and infants for whom body position could be determined, it was seen that the placement of the body on one side was also practised for the young. This was seen for (6061), (9016) and (9023). Unfortunately, the majority of child remains recovered from the site were rarely in their original position and showed signs of disturbance. The area occupied by the “mass burial” (6071) included the remains of a number of children of around the same age which were disturbed and disarticulated, most likely by the "tidying-up" of bones in antiquity during successive burials in the same location.

The body position of the majority of the smaller infant burials could not be determined due to the loss of many of these small bones in the rubble deposits into which they were placed. In a few cases however, the excavators note what they labelled "baby-in-a-bag burials" whereby the bones of the skull and upper body lay over those of the pelvis and legs. Such positioning indicates that the body was placed feet/legs first in the space created in the rubble, perhaps in a small shroud, or even, a bag. Unlike the older children and adults, there were numerous occurrences of large concentrations of infant remains. On one or two occasions the site notes record that articulation was visible between some bones in these concentrations though this was impossible to recognise during later analysis. It seems likely that particular locations, such as that of (4030) were repeatedly returned to over many years for the burial of infants. Those concentrations of infant remains for which no articulation was noted and which analysis showed contained the mixed and incomplete remains of a number of infants may have been created by clearing of the areas of later construction of Structures C and E. Infant burials may have been gathered and deposited en masse at a new location outside the construction area.

Orientation

The orientation of the majority of the burials was recorded in the excavation notes and in some cases was determined through examination of the site photographs. It would seem that orientation in some cases may have been influenced by the location, by the state of the rubble deposits, by the presence of older burials or by the structural remains of older buildings.

There was a slight majority of east-west and southeast-northwest orientated burials, followed closely by south-north orientations. Though there may not have been a clearly dominant orientation there was a definite propensity for the position of the head to the eastern or southern aspect. Of 23 burials for whom confident orientations were determined, 10 had the head to the east, 5 to the south, 3 to the southeast and 2 to the southwest. Of the remaining burials, it is most likely that the presence of other burials in the immediate vicinity affected their position and orientation.

Comparisons

The absence of burial goods in many cist burials discovered across Scotland has long hampered the dating of such burials, in particular those excavated prior to the widespread adoption of radiocarbon dating. It is possible that many such discoveries have been presumed Bronze Age in the past, however a number of such inhumations have been found to in fact date to the Iron Age (Davies, 2007, 278).

In a major study of Iron Age burial practices in Britain, Whimster (1981) found that in those regions where inhumation burial was adopted, the crouched or flexed position lying on one side was the most common form of burial. Among the Yorkshire inhumations, mainly Danes Graves, Barton Fleming and Wetwang Slack, there was a predominance of burials lying on the left side and the north was favoured for the position of the head within the graves (Whimster, 1981, 102). In the cist burial traditions of Cornwall and the Scilly Isles a crouched position again dominated with a similar predominance of northerly orientation (Whimster, 1981, 73) while in the Durotrigian graves of Dorset, there was a dominance of burials placed on the right side with an easterly orientation of the head (Whimster, 1981, 48).

Crouched or flexed inhumation also occurs across Scotland in the majority of burials shown to be of Iron Age date. The similar burial types uncovered at Broxmouth, Dryburn Bridge and Winton House were all either crouched or flexed in position and placed on one side (Dunwell, 2007; Hill, 1982; Armit, 2013; Dalland, 1991). Though the remains from Winton House were poorly preserved, those from Dryburn Bridge and Broxmouth showed a favouring of the left side with a predominance of north-south orientation. Inhumations in the Western Isles also showed a dominance of burial on one side in a crouched or flexed position. At Galson, the burials were almost supine in a number of cases though flexion of the legs was observed (Neighbour, 2000). Unfortunately, burials in the Orkney Islands, many of which were located in the rubble deposits of earlier buildings which caused problems of disarticulation during decomposition, were excavated in antiquarian investigation and often disregarded as intrusive. The adult male burial at Howe was in a crouched position on the left side, but showed signs of disturbance, probably from the burial of infants and a child close by (Ballin Smith, 1994). The human remains from Bu were in a disturbed state, mainly due to the rescue nature of the excavation and the location of many of the remains within the earth-house (Hedges, 1987).

The majority of these burials date from in and around the same period as those from Knowe of Skea. It is interesting that despite the low numbers of inhumations from across Britain at this time, those which have been identified as Iron Age hold many of the same characteristics, body position and single inhumation in particular. Whimster saw this as an indication of cultural connections between isolated communities such as those of Cornwall with those of central and eastern England. Perhaps this can also be extended into the isolated communities of northern Scotland.

Grave Goods / Special Deposits

Very few grave goods were found with the burials at Knowe of Skea. This is not unusual for Iron Age burials in the region. A copper alloy nail headed pin was found close by the head of the adult male (4045) and may have been associated with it. By far the greatest candidates for possible grave goods are the deposits of animal bone, or possible food offerings, which are also attributed to Phase 16 - the cemetery. A number of animal burials were identified from the earliest seasons of excavation and the recovery of animal bones in association with human remains was common. Animal bones were also recovered during the analysis of the human remains; these animal bones had been collected together with the human remains during excavation. Animal bones were separated from these human remains and sent for analysis with the rest of the faunal collection from the site.

Of the deposits of animal bones recovered from Phase 16, sheep were the most common species represented in the associated bone groups and single skeletal elements. Overall, sheep bones recovered from Phase 16 contexts showed markedly less fragmentation than those from other phases (Fraser, 2012). Sheep burials were found both in isolation and together with human remains. The majority of these collections represented predominantly ‘meat bearing’ bones of the skeleton.

Burial (1095) was located close to the intramural passage in the north side of Structure A. The skeleton was articulated and lay on one side. Later analysis showed that (1095) actually included 2 sheep. There were no heads with these skeletons and Sheep 2 was missing foot bones. A bone from this collection was radiocarbon dated 1585+/-BP(SUERC-8395); this was the latest dated bone sample from the site. Two concentrations of animal bones, S.F.1482 and S.F.1507 were recovered in close proximity from rubble 9002 in the east of the site. Analysis showed that this concentration included the skeletons of four sheep in total. Though there were no signs of butchery on the bones there were very few foot bones identified. Sheep bones recovered with human burials (2114) and (2115) each represented two animals. A concentration of sheep bones from rubble 6055 also contained two animals. Sheep bones were also recovered from burials (4045) and (6096) but in smaller quantities than in other deposits.

Two of the collections of sheep bones found in association with human burials showed evidence of butchery. The sheep bones found over the burial of infant (9007) contained the bones of two juvenile animals. Butchery marks on the bones indicated that the carcasses had been disarticulated and stripped of meat before burial with the infant. Bones from the burial of adolescent (4036) represented three neonatal, two juvenile and one subadult sheep, all of which showed evidence of butchery.

Some differentiation was noticed between the ‘meat bearing’ deposits and those which may indicate skinning of the animals. Context 3066 and S.F.63 contained the skull, mandible, foot bones and vertebrae of a sheep and the mixed remains of one perinate infant and one slightly older neonate infant. No long bones were found with the animal bones; there was some evidence of skinning and the vertebrae showed signs of dismemberment. Unlike the other deposits of ‘meat bearing’ bones described, it may be that S.F.63 represents the inclusion of a sheep skin with the human burial.

One of the more spectacular deposits on the site was the articulated, partial cattle skeleton Context 3112, located below the wall of Structure E and in close proximity to the partial skeleton of adult (3111). No signs of butchery were identified and it is most likely that both the animal and human burials were damaged by the construction of Structure E. Cattle bones were also found in the wall cores of this structure which the excavators note probably originated from the cattle burial below.

A number of dogs were also identified in Phase 16. These were found in association with the adult (6030) located in rubble which filled the entrance of the earlier Structure H. Three dogs were represented in total, one older, medium sized dog and two juvenile dogs. The skulls of the animals were missing but some articulation was seen during excavation. It is possible that these animals were included with the human burial, however, it must be noted that a dog skeleton was located in the entrance of Structure F which was interpreted as a closing deposit marking the final abandonment of the building. The location of (6030) in the entrance to Structure H may have disturbed a similar closing deposit in that location. This can be resolved only by attaining a radiocarbon date from each dog which could be compared with that of the human.

Discovery of animal burials and special deposits of animal bones is not unusual in the Iron Age. Such discoveries are more common than those of human remains of the same period. Such animal remains have been the focus of a number of studies; investigation into the use of pits on settlement sites, some of which also contain human burials being of major interest. The formality of the funerary rituals associated with the human remains in such deposits and the ritual aspect to the deposition of the animal remains have been much discussed (Cunliffe, 1992; Hill, 1995).

In a recent examination of animal burials in Britain Morris, (2011), noted that animal bones were discovered in burials in almost all periods. Articulated bones from funerary contexts in Iron Age Yorkshire were most commonly of pig though single bones of sheep were also common. In contrast, associated groups of bones from settlement sites were most often of cattle. In the Iron Age pit burial tradition across southern England, those pits with human remains present contained a higher proportion of cattle and pig bones than other pits. A change in this pattern was noted however in deposits of mid to late Romano-British date; the most common associated groups of bones from funerary context during this later period were domestic fowl, perhaps representing dietary fashions as society adapted to Roman influences.

Animal burials from a number of phases of occupation were found at the site of Howe on Orkney mainland. Burial of cattle, sheep, pig, foal, dog and cat were identified from Phases 5/6 to Phase 9 (Ballin-Smith, 1994). Those burials from Phase 9 were seen as medieval and later intrusions after the site had been abandoned. An unbutchered sheep skeleton was discovered from Phase 5/6 and the south-west building had the deliberate burial of a sheep in the floor during early Phase 7. Disarticulated human remains were recovered from Phase 5/6 and the burials of an adult male, a child and two infants were all recovered from an abandoned area of the settlement during late Phase 7 dated to the first and second centuries AD. These human burials were not seen as formal burials at the time of excavation however new developments from the Knowe of Skea may allow them to be seen in a new light. Perhaps some of the animal burials from Phases 5/6/7 are connected to the Iron Age funerary aspects of the site.

Excavations at the Iron Age wheelhouse site of Sollas in the Western Isles uncovered 60 pits beneath the floors which contained special deposits of animal remains. Some of the descriptions are markedly similar to those of some of the animal bone deposits at Knowe of Skea. The pits at Sollas held four types of animal bone deposit – complete skeletons showing signs of defleshing and dismemberment, skeletons missing heads and/or feet, articulated foot bones and cremated bones (Campbell, 2000). Cattle bones dominated the cremated deposits but the inhumed deposits were predominantly of sheep. The make-up of the inhumed deposits suggests that butchered and meat bearing parts of the animals were deposited separately from the heads and/or feet which indicate that the animals were skinned. Finlay, 1991, suggests that the carcasses may have been roasted prior to burial. The absence of human remains in these pits at Sollas removes the possibility that these were food offerings used as grave goods as at Knowe of Skea. The similarities however may indicate a similar pattern in the exploitation of sheep both for cooking and for deposition in ritual deposits.

Perhaps the most remarkable deposit of human and animal remains of Iron Age date is that of a child and mixed animal remains from Hornish Point in the Western Isles (Barber et al, 1989). Here, the dismembered remains of a child were placed into four separate pits along with parts of a number of animals. This quite clearly represents an event quite different from the funerary deposits at the Knowe of Skea and resembles more the special deposits in the pits at Sollas.

Summary

The number of individuals buried at Knowe of Skea is somewhat unusual for this period, especially in the region of Atlantic Scotland. However, the flexed or crouched position of the burials, lying on one side, is a burial position seen across Britain in areas where inhumation burial was practised. Few objects of note were found in close association with the burials that might be interpreted as grave goods. Animals represented on the site were of the main domestic species; however there were indications that both food offerings and possibly animal skins were deposited with the human burials. The burial of almost complete animals without an associated human burial may represent a more widespread ritual aspect of animal deposition common in Iron Age Britain.

That this site remained in use as a funerary complex for such a protracted period unlike other sites in Orkney in this period is most likely due to the geography of its location. The islet of Knowe of Skea is somewhat cut-off and the mound created on it would have been small and impractical for the construction of any large buildings such as those which dominated the sites of Howe or Bu on Orkney Mainland. Examination of the burials has shown how this group of people treated their dead; information gained from examining the skeletal remains told more about how they lived their lives.

4. Data Recovery and Analytical Methods

The excavations carried out at the Knowe of Skea were conducted between 2000 and 2009 and human remains in varying amounts were collected in each year. The cemetery phase of the site's history was primarily made up of the rubble created from the collapse of structures of Iron Age date. To expose these earlier structures, the rubble deposits were removed from around walls and from building interiors. During the excavations, burials were found within these rubble deposits. The burials had been placed into rubble across the site and over time loose disarticulated bone had become mixed amongst the stones and light soils. "Due to the loose and voided nature of much of the rubble, many of the burials had slumped over time, were frequently found in loose articulation or as concentrations of bone" (Moore & Wilson, 2011, 75). Once located, exposing the full extent of any human remains involved removing any and all rubble from the area above and around the skeleton; this often exposed more burials or large amounts disarticulated bone. The involvement of the author in the later seasons of the excavation, from 2006 to 2009, was invaluable to this research and provided an in-depth understanding of the archaeology of the site and the excavation procedures.

Contexts, Small Finds and General Finds

A system was implemented to deal with the manner in which remains were discovered and excavated. This system resulted in three forms of human remains categories. Complete skeletons or large collections of bones that showed signs of articulation or some association between the bones, indicating that they might belong to a single individual, were assigned context numbers; these context numbers are shown within parentheses in this work, for example, (2100). This is to differentiate between context numbers representing human remains and those representing soil deposits or structural features which are shown without parenthesis, for example, 4012. A total of 127 contexts were assigned to the cemetery phase of the site; 41 of these represented articulated skeletons or groups of associated bones. During excavation, these sets of remains were entirely exposed then planned, photographed and recorded *in situ* before being removed from the ground. Bones from each skeleton were lifted and placed in plastic bags labelled with site code, context number and skeletal element.

Collections of disarticulated bones found in varying amounts, or unusual finds of bones such as isolated crania, were assigned a small find number (S.F.). Small find numbers were usually allocated to concentrations of infant remains that occurred in a disarticulated state but within a single rubble context; these concentrations varied in volume from just two or three bones to hundreds of bones. There were 235 small finds (S.F.) which consisted of concentrations of human bones identified on site. Once cleaned, these small finds were usually photographed *in situ*. Notes were made in the site records for any small finds of interest such as very large concentrations or those which may have included some articulated remains.

Lastly, isolated and disarticulated bones collected during the course of the excavations, which did not appear to be part of any burial or concentration, were collected along with the 'general finds' from various deposits on site. The general finds collection contained a mix of human bones, animal remains and marine shells. This part of the assemblage originated mainly from the rubble deposits and consisted largely of small bones of the hands and feet, bone fragments, loose teeth and the small bones of infants. While some of these were bones disturbed from their original location by later construction or by successive burials, many must have simply fallen through voids in the rubble deposits after decomposition. Soil samples from the site were routinely sieved for environmental data both during the seasons of excavation and during post-excavation. Any human remains found in these samples were also separated and stored according to the context from which they were retrieved. Over five thousand human bones were extracted from the general finds and identified, processed and catalogued during post-excavation work by the EASE Archaeology team.

Processing

Human remains assigned context numbers and those with small find numbers (S.F.) were delivered to the author for processing and analysis. Before examination the skeletal material was washed, air-dried and then repacked. All of the remains were

14.An example of a commingled collection of infant bones before cleaning, in this case S.F.194 (above.
15. A collection of infant bones, S.F.183, after cleaning (below left).
16.A selection of the most complete bones from a large group of commingle infant bones (below right).

washed in cool tap water using soft brushes to remove soil or root material adhering to the bones. The remains were placed on acid-free tissue paper on drying racks to air-dry at room temperature. It was found that though the small infant bones dried quickly, those of adults took on average 48 hours to become completely dry. To maintain a reliable system all remains were allowed to lie on drying racks for at least 48 hours before repacking. All dry bones were packed in clearly labelled, clean re-sealable plastic bags and placed in larger boxes according to context number. Large concentrations of infant bones, many of which were fragile, were packed together in labelled plastic containers then stored within larger plastic boxes (Plate 14 & 15).

The collection was processed and later examined according to the year of excavation in which they were recovered; this was merely for convenience as this was the order in which the collection had been stored at the end of each season and later delivered to the author. Site records, plans and photos were later used to establish the location of each burial on site and in relation to other burials.

Observations

A number of observations in this early stage were made note of to be investigated further as the project progressed. During processing it was noted that many of the more complete skeletons were missing skeletal elements. Also, the parts of the skeleton which showed the greatest degree of damage were the crania and long bones. Missing elements were usually those small bones of the hands and feet; on some excavations this might be seen as a result of excavators' inexperience or error, however in this case it was known to be due to bones lost after falling through the voided spaces in the rubble in which the burials were placed.

Though the condition of the majority of the material was excellent, there was a large degree of mixing of bones and fragmentation caused by the shifting of the rubble deposits and by disturbance from subsequent burials and later construction. The loose nature of the deposits on site also led to the postmortem loss of many teeth from the maxilla and mandible of individuals, without soil to hold them in place many had simply fallen out of their sockets and became lost in the rubble. Comingling was most obvious in those collections of bones given small finds numbers and consisting mainly of infant remains and smaller bones of older individuals such as those of the hands and feet.

Many of the larger bones such as crania and long bones were fragmented due to the sheer weight of stones often placed directly on top of the burials. Later examination of the site notes indicated that undamaged crania had been provided protection by being placed within a gap in stones covered by a capstone. The degree of fragmentation would create problems for taking measurements and the use of those measurements for any comparative metrical analysis possible would be curtailed. The good condition of the majority of the small infant bones from the large concentrations also indicated that these concentrations had been afforded similar protection in the rubble. During cleaning, the true volume of infant material recovered from the excavations became more apparent. It was noted that most of these concentrations of infant remains consisted of the bones of more than a single infant. A number of the infant bone collections were very large with some containing over 200 individual bones from a number of infants, all of very similar age (Plate 16). Though this indicated that the number of infants buried at Knowe of Skea was very high, it was also noted that as very few of the concentrations could be recognised as the burial of single individual infants, certain aspects of the results of analysis would be limited.

Also noted during processing was the presence of animal bone among the human bones. Articulated and partial animal burials had been identified during the excavations (Moore & Wilson, 2011, 75) and though small fragments of animal bone might be expected in the burials through movements in the rubble deposits, in some cases the volume suggested the likelihood that animal remains had been interred with the human burials, for example, as in (4036). To ascertain if this might be the case animal bone was removed at this point and sent to the animal remains specialist for analysis.

Site records

Any section of the site archive relating to the human remains was made available to the author by EASE Archaeology in the later stages of the project. These consisted mainly of context records, excavators' notes, and site photography. Data structure reports for each year of excavation and the site interim report prepared by EASE Archaeology were also provided and proved very useful. During excavation, a number of methods were used to record the human remains found on the site. An individual context record was created for each set of remains assigned a context number. These remains were then drawn to scale and carefully photographed in detail. Those human remains assigned small find numbers (S.F.) were usually photographed and descriptive notes made in the record for the context from which they originated. Because these small finds varied in size and in their make-up, the records for the small finds vary from detailed descriptions of large concentrations of bone to just a mention of the number assigned. Additional records were found in the site 'Daybook' in which excavators made note of their own impressions and any extra information such as location or unusual positioning.

The lack of a standard recording method made examining these records somewhat confusing at times. The quality of the information provided tended to vary between years of excavation and sometimes between excavators. The most valuable part of the records was undoubtedly the photography which was of the highest standard for each year.

Creating the database

The collection was examined in order of the year of excavation. This was for convenience as this was the order in which the collection had been processed and stored. Also, this would allow for recognisable cut off points during analysis and when organising the database. A large database was created which catalogued each bone present in the collection and allowed for the creation of an inventory of bones for each of the burials as well as the larger concentrations of mixed remains. Approximately 15,000 bones were recorded.

The groups of human bones assigned context numbers usually consisted of near complete skeletons or collections of bones for which some articulation or association was recognised on site. These were laid out in anatomical position in the lab, which allowed for an assessment of completeness and condition. Each bone was given a number and included in the database and relevant measurements and observation taken. The age, sex and any pathology were recorded for each individual using approved methods (discussed below).

For those remains assigned small find (S.F.) numbers each bone was given an individual number and included in the database. Most of the small finds consisted of large volumes of bones of infants of similar age; although each bone was assessed individually, it could rarely be attributed to a particular infant. Examining the remains in the small finds bone by bone rather than by individual reduced the degree to which these remains could be used to interpret health status, or to compare individuals. Many fragmented bones within the small finds could be matched and were reconnected during analysis so allowing for measurements and thus reducing the overall numbers of bones. This was particularly noted for proximal and distal fragments of infant long bones.

Context	Contents	Context	Contents	Context	Contents
106	Adolescent	3010	mix	6071	infant mix
107	Infant	3022	adolescent bone	6014	mix
2011/2012	adult	3007	adult bone	6014	infant mandible
2021	adult	3011	infant mix	6032	adult
1014	Infant	3021	adult fragments	7015	adult
2114	adult	4015	adult	7039	adult
2115	adult	4036	adolescent	7037	child
2107/2115	infant	4038	adolescent	9010	adult
2098	adult	4019	adult	9003	adolescent
2100	adult	4045	adult	9023	infant
2121	infant mix	4017	infant mix	9016	infant
2121	adult bones	4012	infant/adult mix	9013	adolescent
2121	infant	4014	mix	9007	infant
2122	mix	6072	adult burial	7015	infant mix
2122	adult mix	6071A	adult cranium	7067	mix
2099	adult conc	6071C	child cranium		
2118	child	6071G	adult mandible		
2117	infant	6071F	child mandible		
2117	Adol/Ad mix	6071E	child mix		
2124/2117	infant	6071 I	child mix		
3111	adult	6071H	child limb bones		
3118	adult	6071	mixed bones		
3117	child	6076	adult		
3054	adolescent	6061	child		
3036	adolescent	6030	adult		
3017	infant mix	6043	adolescent		
3015	adolescent	6065	adult		
3055	Infant/child mix	6045	mix		

Table 3: Context assigned to human remains during excavations.

Context	**S.F**	**Contents**	**Context**	**S.F**	**Contents**
3018	40	infant mix	3080	76	infant fragments
3025	45	infant	3113	103	infant fragments
3023	42	infant mix	3101	93	adult fragment
3036	53	adolescent/infant mix	3004	50	mix
3036	51	infant	3066	63	infant mix
3036	52	infant	4016	179	infant/child mix
3019	41	infant mix	3083	144	mix
3024	43	infant	4016	194	infant
3026	46	infant mix	4002	125	infant mix
3067	65	infant/adolescent mix	4030	188	infant mix
3004	47	infant mix	4012	153	adolescent bone
3009	32	adult	4016	182	infant mix
3006	31	child skull fragments	4002	130	infant
3069	?72	infant/adult mix	4012	154	infant mix
3068	84	adult bone	4016	187	infant mix
3068	85	adult bone	4016	193	infant mix
3101	87	adult fragments	4002	133	infant mix
3101	88	infant fragments	4012	152	mix
3102	89	tooth	4016	195	infant mix
3106	94	infant mix	4011	131	infant
3106	95	adult bones	4002	128	infant mix
3113	99	infant mix	4012	149	infant mix
3113	100	infant mix	4019	196	adolescent bone
3101	92	adult fragments	4019	197	child bone
3091	82	adult bone	4019	198	mix
3101	97	infant fragments	4039	203	child mix
3068	77	adult fragments	4004	228	child/infant mix
3068	80	infant fragments	4039	204	child mix
4016	126/167	infant mix	4002	122	infant skull
4016	183	infant mix	4002	129	infant mix
4016	206	infant mix	4016	126/167	infant mix
4016	200	infant mix	4002	124	infant mix
4016	181	infant mix	4012	135	mix
4003	117	infant mix	4016	174	infant mix
4016	237	infant mix	4016	163	infant mix
4016	184	infant mix	4016	171	mix

Context	S.F	Contents	Context	S.F	Contents
4016	192	infant mix	4016	166	infant mix
4016	205	infant mix	4016	161	infant/adult mix
4016	190	infant mix	4016	155	infant mix
4016	190/191	infant bones	4016	172	infant mix
4016	191	infant mix	4016	173	infant mix
4016	189	infant mix	4012	156	infant mix
4016	207	infant mix	4016	167	infant mix
4002	116	infant/ child mix	4016	176	infant mix
4057	234	infant mix	4016	162	infant mix
4002	136	mix	4016	178	infant mix
4005	121	infant mix	4016	156	infant bone
4002	115	infant bone	4016	160	mix bone
4001	119	infant bone	4016	177	infant mix
4002	134	mix bone	4016	165	infant mix
4002	123	infant mix	4016	157	infant mix
4002	126	infant mix	6055	625	Adolescent/Adult mix
4002	139	infant mix	6055	443	Adolescent/Adult mix
4012	148	infant mix	6014	447	infant mix
4002	118	infant mix	6055	401	child skull
4016	127	infant mix	6055	424	infant mix
6055	440	infant	6055	439	infant mix
6055	429	infant mix	6055	389	mix
6014	362	infant mix	6015	340	infant mix
6014	283	infant mix	6014	284	fragments
6055	417	infant	6015	319	infant mix
6029	297	?foetal	6015	294	mix
6055	425	infant mix	6055	434	infant skull fragments
6055	407	child mix	6023	263	child frontal
6014	262	dentition of (6030)	6055	433	infant occipital
6030	292	infant mix	6045	1296	skull fragments
6014	292	infant mix	6055	436	child maxilla
6014	251	child	6023	265	child maxilla
6055	422	infant mix	6096	284	adult
6055	423	infant mix	6096	284	child
6055	448	mix	6014	284	child
6094	639	infant	6014	284	infant mix

Context	S.F	Contents	Context	S.F	Contents
6015	272	infant	6014	627	mix
6014	500	infant mix	6015	282	neonate?
6015	289	infant/adult mix	6055	408	adult skull fragment &vertebrae
6055	396	infant mix	6055	438	adult mix
6015	250	adult foot	6014	449	child mix
6014	450	mix	6055	444	infant mix
6014	363	mix	6014	485	infant mix
6055	442	child mix	6014	501	infant mix
6034	316	mix	6074	494	adult skull fragment
6013	427	infant mix	6014	486	child mix
6055	428	infant mix	6014	274	mix
6014	335	infant mix	6014	361	infant mix
6014	271	infant mix	7041	864	adult mix
6014	253	infant mix	7093	1083	infant skull fragments
6013	285	cremation? Nothing recognised as human.	7000	640	child skull fragment
6012	246	mix	7085	1051	child skull fragments
6013	266	adult mandible frag	7004	658	infant mix
6014	248	mix with loose teeth	7051	911	infant skull fragments
U/S	359	skull fragments	7051	908	infant mix
6014	252	mix	7051	916	infant mix
6000	240	infant mix	7051	913	infant mix
6012	249	infant mix	7051	909	adult shoulder/spine
6012	242	mix	7024	919	foetal
7015	880	infant skull fragment	7017	1036	adult mix
7015	868	infant skull fragment	7006	676	adult mix
7015	866	infant femur	7017	1037	adult femur
7024	779	infant mix	u/s	900	skull fragments
7094	1064	infant	7064	1042	infant/ child mix
7024	736	infant mix	7024	722	infant mix
7024	728	infant mix	7024	696	infant skull fragments
7024	703	infant skull frags	7051	917	infant skull fragments
7024	701	infant	7051	918	mix
7041	876	infant skull fragment	7051	902	infant mix
7041	884	child radius	7024	766	infant spine parts

Context	**S.F**	**Contents**	**Context**	**S.F**	**Contents**
7041	851	adult atlas	7041	872	adult axis
7041	870	child rib	7041	869	child fragments
7041	883	infant mix	7041	863	infant fragments
7041	858	mix	7041	874	infant femur
7041	871	infant mix	7051	907	infant mix
7085	1050	child mandible			
7058	910	infant/child mix			
8104	1187	skull fragments			
8104	1188	infant skull fragments			
8104	1196	infant mix			
9005	1490	infant			
9001	1400	infant mix			
9044	1666	infant mix			
9002	1472	adult mandible			
8104	1390	mix			
9005	1486	mix			
U/S	1538	infant mix			
9005	1500	adult spine/pelvis			
9005	1498	infant mix			
9005	1509	infant mix			
9005	1502	infant mix			
9005	1512	mix			
9005	1508	infant			
9005	1503	mix			

Table 4: Small Finds (S.F.) identified as human in site records.

Analytical Methods: Assessing Sex

Assessing sex of adult skeletal remains

Assessing the sex of adults in a skeletal population follows the generalisation that males will be larger and more robust than females. Variations between and within populations, across time and geographical area can exist however and though the standards used as guidelines in assessing sex are extremely useful, an awareness of the potential for variation is needed. The most commonly used methods employed for sexing skeletal remains are based on visual assessments of the most sexually dimorphic skeletal elements, the pelvis and skull. The standards and guidelines for assessing these traits are provided in Buikstra and Ubelaker (1994).

Pelvis

Five areas of the pelvis were assessed :- the presence or absence of the ventral arc, the angle of the sub-pubic concavity and the presence of an ischio-pubic ramus ridge, the width of the greater sciatic notch and the presence of a preauricular sulcus. The most commonly used method of estimating the sex of an individual from the pelvis has been termed the ‘Phenice method’. Prior to the publication of this method in 1969, the estimation of sex from the pelvis had relied on features of the bone which, according to Phenice, were often ambiguous. A new method was needed to reduce the subjectivity of the analysis and enable less experienced researchers achieve accurate results (Phenice, 1969, 297). The Phenice method became widely used for sexing individuals as a result of the apparent ease with which it could be applied and its reputed accuracy. In 1989, Lovell carried out tests to establish the reliability of the technique by applying it to a skeletal sample with known ages and sex.

As the mean age of the samples used for this test was higher than those of Phenice’s original sample, Lovell determined that the accuracy of the technique seems to decrease when used on older individuals but that this was not unreasonable considering that the bony changes associated with advanced age “may mask the expression of one or more of Phenice’s diagnostic features” (Lovell, 1989, 119). As the original study did not include sub-adults, Sutherland and Suchey, 1991, expanded the Phenice study to include younger adults and adolescents when establishing sex by the presence or absence of the ventral arc. Their study showed that a high number of younger females had a ventral line on the pubis which preceded the arc and that the arc proper was fully observable in the twenties (Sutherland & Suchey, 1991, 504). Though some individual variation was obvious, this made it possible to sex a higher number of individuals in total. The above techniques rely heavily on the survival of the pubic bone for accurate estimation of sex. As this is one of the skeletal elements most likely to be damaged in skeletons recovered from archaeological contexts, the Phenice method often cannot be employed when sexing archaeological skeletal material. Another feature of the pelvis which is sexually diagnostic and more likely to survive in reasonable condition is the greater sciatic notch. The most basic principle behind the use of the greater sciatic notch in estimating sex is the visual observation of the difference in shape between male and female. Ideally, the male pelvis will have a narrower, U-shaped notch while in the female it will be wider and shallower (Walker, 2005, 385). The individual notches are compared with diagrams and assigned a score ranging from the most female at 1, to the most male at 5 (Buikstra & Ubelaker, 1994, 18). This method can be subjective however, and much depends on the experience of the investigator and the availability of reliable diagrams and scoring systems (Walker, 2005, 386). Walker conducted a study involving a number of skeletal assemblages from North America and Europe. His results showed that the sciatic notch decreases in size with increased age, being wider in younger individuals and smaller in those with a higher age at death (Walker, 2005, 388). The sexing of individuals from just the sciatic notch can be unreliable for younger males therefore, as wider notches indicate a more female morphology. These methods were developed based largely on American populations and are continually tested and adapted for use on other populations. Maclaughlin and Bruce (1990) and Rogers and Saunders (1993) tested the methods to assess their usefulness when examining skeletal collections in Europe. It was advised that multiple factors be used when assessing sex to achieve greatest accuracy.

Skull

After the pelvis, the most sexually diagnostic element of the skeleton is the skull. The estimation of sex of the skull involves assessing the overall size and rugocity of the individual skull. The most sexually diagnostic features of the skull are :- the presence or absence of a nuchal crest on the occipital bone, the size of the mastoid process, the sharpness of the supra-orbital margin, the prominence of the supra-orbital ridge and the expression of the mental eminence on the mandible. These features are usually visually assessed, compared with diagnostic diagrams and assigned scores which range from 1, being the most female, to 5, the most male (Buikstra & Ubelaker, 1994, 20). Most individuals rarely fall neatly into one or other category, some show both male and female characteristics and as the skull can show massive levels of individual variation the assessment of sex can be misjudged when based on the skull alone. The accuracy of methods using cranial traits are also continually tested (Rogers, 2005; Williams & Rogers, 2006).

The methods for sexing skeletal material were tested in 1985 by Meindl & Lovejoy et al to determine their accuracy. The test involved assigning sex to the skull and pelvis independently of each other, bringing the two elements together and comparing results to make a final overall assessment of sex, then determining the accuracy of the results by comparing them with the records for each individual. Sexual dimorphism of the skull was found to be less definitive than that of the pelvis; six of the males were wrongly sexed by skull alone. The test also showed that the sexing of skulls became more problematic in older individuals, with the sex dependent morphology of the skull being affected by age. Greater age created an increasing male morphology in sixteen of the female skulls which were assigned slightly female status during the testing of skulls alone, though none of the females were sexed wrongly on the basis of pelvis alone (Meindl & Lovejoy, 1985, 81).

The results of this study led the researchers to conclude that both the skull and pelvis were necessary for the most accurate estimation of sex of individuals. They determined that there would almost always be an underestimation of males but very few mistakes with females (Meindl & Lovejoy, 1985, 81). This is probably due to the more female aspect of the sciatic notch of the pelvis in younger males described by Walker (2005, 388) resulting in younger males being attributed lower, female scores when compared with the diagnostic diagrams.

Metrical analysis

In sexing the post-cranial skeleton, many of the long bones are found to show some level of sexual dimorphism based on the generalisation that males are larger and more robust than females. Measurements on these long bones or on the more dimorphic parts have been shown to give accurate results. Bass (2005) provides an overview of where and how to take the relevant measurements and provides the average male and female standards for comparison. Skeletal material in good condition is generally required. Inconsistencies may occur should a skeletal population include larger females or small males and the degree of sexual dimorphism within a population should be assessed.

Statistical methods of establishing the sex of skeletal remains are not utilised to a great degree when large numbers of individuals are concerned due to the time they require and the difficulty of locating the correct anatomical locations for measurements (Walker, 2005, 385). The use of statistical methods does not guarantee a more accurate result; " numerous attempts to resolve metrically the sex of those very few cases in which the pelvic morphology is indeterminate have never proved more successful than ordinary observational methods" (Meindl & Lovejoy, 1985, 84).

Sexing juvenile remains

It should be remembered when using the methods described above, that they are not usually suited to the estimation of sex of infants, children or adolescents as those sexually dimorphic characteristics relied upon for accurate assessment are not developed until puberty (Lewis, 2007, 47) and not fully expressed until adulthood. A number of methods attempting to sex immature skeletons have been developed with varying degrees of accuracy (Weaver, 1980; Mittler et al, 1992; Schutkowski, 1993; Molleson et al, 1998). The only reliable method of assessing sex in immature skeletons remains has to be DNA analysis which as of yet is costly and often unsuccessful due to the poor condition of much of the skeletal material recovered from archaeological contexts. Each of the methods relies heavily on the condition of the skeletal material. Often skeletal material recovered from archaeological excavation will be fragmented and/or incomplete due to any number of factors. Also, it is necessary to be able to attribute each element to an individual in order to compare results of assessment on each element. Should the remains be recovered in large concentrations, such as at Knowe of Skea, assessing the sex of individual infants or children becomes increasingly unlikely.

Analytical Methods: Estimating Age at Death

The age stages used in skeletal analysis are based on biological growth stages and dental development rather than age in years (Lewis, 2007, 38). Ageing child and adolescent remains is therefore more accurate than for adults as known stages of skeletal fusion and dental development take place in childhood.

Age ranges shown in Table 5 were used in the assessment of age at death in the Knowe of Skea population and were compiled from age ranges commonly used in skeletal analysis of infants and children (Scheuer & Black, 2004; Schaefer et al, 2009) and adult age ranges suggested in Buikstra & Ubelaker, 1994. For adults, ageing techniques are concerned mainly with skeletal degeneration, which takes place at unknown rates and can vary from person to person; adult age ranges therefore tend to be quite broad and adults for whom a more accurate age cannot be determined are classed simply 'adult'.

Age Range	**Definition**
Foetal	Conception to birth
Perinate	Around the time of birth (38 to 40 weeks)
Neonate	From birth to the end of the first month
Infant	To the end of second year
Early Child	From 2 years to about 6 years
Late Child	From about 6 years to puberty
Adolescent	Around 12 years to cessation of growth (around 17/18yrs)
Young adult	From cessation of growth to complete fusion (c.23-30/35years)
Middle adult	30/35 years to 45/50 years
Older adult	50/55 years+

Table 5: Age categories used in analysis.

Estimating age of foetal/ perinate/ neonate remains in the collection

The results of these ageing methods for each bone would normally be compared in order to estimate an age for a single individual; however this was very rarely possible in this collection. The vast majority of the small infant remains recovered from the Knowe of Skea were from large concentrations of bone which usually contained the mixed remains of more than one infant. Few of these remains could be separated to represent a single individual. It was necessary therefore to examine, measure and age each bone in the collection separately and then use the information gained to create a general interpretation of the health and mortality profile of this section of the population.

Dental development usually provides the most accurate method of estimating age at death. Teeth begin to mineralise at an early stage of foetal development and grow at a known progression. In the case of foetal and neonate skeletons, the developing teeth are held within large crypts in the mandible and maxilla and are often lost in archaeological contexts. This was particularly the case in the Knowe of Skea collection and there were very few foetal or neonate examples of teeth remaining in the bones.

Long bone measurements

The methods used to age the remains were those outlined in Schaefer, Black and Scheur's (2009) *Juvenile Osteology lab and field manual*; particularly measurements from Fazekas and Kosa, 1978, cited by Schaefer *et al*. All bones were measured when possible and aged by comparing the results with the data provided in these studies.

For long bone measurements age was also calculated using the linear regression equations of Scheuer *et al* (1980), though this was only possible for complete long bones. The results of calculations based on the equations of Scheuer *et al* were used when comparing the Knowe of Skea infants with studies discussing the possibility of infanticide which favoured this ageing technique (see Infant health and mortality).

The methods developed for ageing such young remains are invariably based on modern populations. This carries with it a few problems and questions which need to kept in mind when working with prehistoric infant remains. The main concern usually is whether measurements from modern infants can be used to age prehistoric infant remains that may come from populations with poor nutrition and health in general. Poor health and nutrition can affect growth and therefore size and measurements. The health of the population from which the infants come should be taken into account and all relevant information to make informed decisions as to the aging of infant remains. Also, some of the methods are based on results from examination of infants for which the accuracy of the age at death has been questioned (Lewis, 2007). Despite these concerns, the majority of new techniques seem to consistently refer back to these earlier works, particularly Fazekas & Kosa (1978) when compiling new data; this work remains the standard reference material when examining the remains of young infants.

Skull

Development of the tympanic ring and pars petrosa of the temporal bone are useful when distinguishing between foetal and neonatal remains and measurements were taken wherever possible. However the tympanic ring is an extremely delicate bone prone to fragmentation or loss in archaeological collections. The pars petrosa of the temporal bone is one of the more robust bones in the human skeleton and is often used to calculate numbers of individuals. Measurements of this bone and an examination of the fusion rate between the parts of the temporal bone are also used when ageing young infants (Schaefer *et al*, 2009).

The occipital bone is also used when ageing young infants. As well as comparing measurements with standards (Schaefer, 2009), the rate at which the parts of the occipital (the pars lateralis, pars basilaris and squama) fuse to each other is known and can be used to age immature skeletons into childhood (Redfield, 1970; Molleson & Cox, 1993).

It must again be mentioned that though each of these methods was employed, the disarticulated nature of the infant remains in the assemblage prohibited any definitive age assessment for individual infants. While it was possible to assess the age of individual bones, these could rarely be attributed to a single infant.

Estimating age of children and adolescents

Ageing individuals from skeletal remains can rarely be accurately calculated to age in years. More common is the estimation of biological or developmental stage which might span a number of chronological years. The age categories used in the current study reflect these developmental stages – infant, early child, late child and adolescent.

Dental development

Estimating age through dental development is seen as the most reliable ageing method; dental development, particularly of the deciduous teeth, is rarely affected by external influences (Konigsberg & Holman, 1999). Dental development progresses in known stages, from the first mineralisation of the teeth early in foetal life to the completion of the permanent teeth in early adulthood (Smith, 1991; AlQatani, 2010). The eruption of the teeth also follows a pattern and is used in age estimation. The first deciduous teeth begin to erupt in the first year and a continuous process of eruption continues throughout childhood with the deciduous teeth eventually replaced by the permanent dentition. The third molar is the last to develop and erupt in late adolescence or early adulthood. There is however a degree of variation in the timing of the eruption of the third molar and often its presence and stage of development can only be assessed by x-ray. Van Beek's (1983) *Dental Morphology* was used in identification of loose teeth, and age estimated using dental charts in Buikstra & Ubelaker (1994), which illustrates the different stages of development and eruption. The age ranges used in these charts can be quite wide; this allows for any dental sample to be assigned to a developmental stage rather than an exact chronological age in years (Hillson, 1991).

In the Knowe of Skea collection, the post mortem loss of many of the teeth from their sockets meant that age at death estimates based on dental development often relied on incomplete dentition, reducing the accuracy of the estimate.

Bone measurements

At the Knowe of Skea, the remains of older infants and children were also most often discovered in a disarticulated state or in concentrations that contained the commingled remains of a number of individuals. Long bone measurement is a direct reflection of the growth during life. Illness or malnutrition directly affect height and weight and so will affect the growth of the child. Discrepancy between the age estimated through dental development and that estimated through long bone measurement may indicate periods of stress (Lewis, 2007). In only a small number of cases could the bones be recognised as those of a single individual and it was again necessary to age skeletal elements in isolation. Apart from a small number of individuals, this removed the possibility of comparing age estimations reached through measurements of the bones and those reached by examining dental development.

Measurements were taken on all bones wherever possible; fragmented bones were measured only when the fragments joined tightly and reconstituted the complete bone or section of the bone required. All measurements were taken as described in Schaefer, Black & Scheuer (2009); this volume also compiles the results from various studies into child growth and development and provides numerous tables of data which were used for comparison with the Knowe of Skea. Of particular use were those sets of data from Maresh (1970) in the ageing of child remains from the length of the long bone diaphyses. Long bone diaphyses were measured on an osteometric board to the nearest millimetre. Other sources were used for estimating age from the rest of the skeleton; in particular - Molleson & Cox (1993) for ageing infant ilia; Black & Scheuer (1996) for the clavicle and Rissech & Black (2007) for scapulae. These sets of data are based on studies of skeletal collections of varying dates and from various geographical locations. The degree of accuracy with which the data can be used to age prehistoric material might be questioned; however the degree of commingling and fragmentation and a lack of dental information created a necessity to employ a number of methods.

Epiphyseal fusion and maturation

Secondary ossification centres (epiphyses) appear and develop throughout infancy and childhood. The age at which the epiphyses in different parts of the skeleton appear is known, however in archaeological contexts developing epiphyses often are lost due to their small size or are difficult to identify with accuracy when seen in isolation. The epiphyses fuse in a known pattern and at a similar rate, beginning at the elbow and finishing with the medial clavicle usually in early adulthood (Stevenson, 1924), though there can be variation between individuals. Schaefer, Black & Scheuer (2009) provide detailed information on the appearance and fusion timings of the epiphyses of the skeleton and these were used as a standard in the current study. Fusion of the epiphyses was recorded as ‘open’, ‘partial’ or ‘complete’ for each bone present. The sequence of fusion in an individual skeleton could then be assessed to estimate the age.

The age at which epiphyseal fusion begins and completes differs between the sexes. Females usually reach skeletal maturation about two years earlier than males (Scheuer & Black, 2004; Lewis, 2007) and so wide age ranges are applied when estimating age at fusion of different skeletal elements. Assessing sex of younger individuals in skeletal collections is difficult and the wide age ranges employed allow for individuals to be placed in developmental age groups rather than exact age in years.

The onset of puberty marks a transition time between childhood and adulthood (Shapland & Lewis, 2013). A number of biological markers can be used to assess the maturation stage of an individual; Shapland & Lewis (2013) have outlined a method for assessing the pubertal stage of adolescent skeletons. This method involves the examination 6 different skeletal elements to determine pubertal stage (mandibular canine calcification, hook of the hamate development, fusion of the hand phalanges, fusion of the distal radius, presence and fusion of the iliac crest and morphology of the cervical vertebral body). There are 5 pubertal stages proposed: pre-pubertal, acceleration, around peak height velocity, deceleration and post-pubertal. Determining to which pubertal stage an individual can be assigned may help to ascertain biological development; menarche in girls and full adult voice in boys usually occur in the deceleration phase about a year after peak height velocity (Shapland & Lewis, 2013). Rather than age in years, such stages in development as these were probably more significant in the past (Scheuer & Black, 2004, 7). This method was applied to the adolescent skeletons in the collection from Knowe of Skea.

Estimating age of adult skeletal remains

Ageing adult skeletal remains is based on an examination of age-related osteological changes within the skeleton. These changes can vary from person to person and can be affected by sex and health of the individuals. Accurate observation of these changes can also be hampered by taphonomic damage to the skeleton after burial and so it is considered best to employ a number of methods and not rely solely on one single skeletal element. Rather than exact age in years, estimated age of adult skeletal remains are usually confined to broader stages; young adult, middle adult and older adult.

Pubic Symphysis

Age related changes in the surface of the pubic symphysis have been used to determine age at death. The Todd method was the first to be widely used and ascribes ten phases according to age groups (Todd, 1921). The Suchey-Brooks method is now more widely used and Buikstra & Ubelaker (1994) supply illustrations and descriptions of each phase. This method describes six phases of alteration to the pubic symphysis surface according to advancing age (Brooks & Suchey, 1990). The age ranges employed in this method are however very wide and should be refined through the use of more than one ageing method.

This section of the pelvis is also very often fragmented in archaeological collections, as was the case for many of the skeletons from Knowe of Skea.

Auricular surface

In this study, age related changes of the auricular surface of the ilium were examined and recorded according to the illustrations and descriptions of Lovejoy et al (1985). The age ranges employed in this method are narrower than those in the examination of the pubic symphysis and this section of the pelvis survives in better condition than the pubic symphysis in archaeological skeletons. There have been numerous tests and modifications of methods that use the auricular surface in ageing techniques in recent years and testing these techniques on known-age-at-death populations is growing (Murray & Murray, 1991; Buckberry & Chamberlain, 2002; Falys et al, 2006; Moraitis et al, 2014). The refining of these ageing techniques is an ongoing process.

Cranial suture closure

A system for scoring the rate of closure of the sutures of the skull was developed by Meindl & Lovejoy, (1985). A total of 17 suture sites from around the skull are assessed and scored 0 (open) to 3 (complete) from which a composite score is calculated. A table of the age range suitable for each composite score are provided and allow for the estimate of age. This system requires complete or almost complete skulls on which the correct sections of sutures are visible and from which composite scores can be calculated. This is not always possible in archaeological skeletal collections and proved a problem when examining many of the adult remains from Knowe of Skea.

Rib-end morphology

A system for the ageing of adult skeletal remains through examination of age related changes to the sterna end of the fourth rib was developed by Iscan & Loth (1986a&b). The sternal end of the rib changes as age progresses from a billowed surface with rounded edges to a ragged surface with rough edges. These changes and the stages assigned by Iscan & Loth to age ranges were used for adults in the assemblage. In archaeological skeletal material, ribs are most often recovered in a fragmented state and identification of the fourth rib end during analysis is not always possible. The system was used in the current study but it is recorded that the rib used may not have been the fourth rib.

Dental attrition

Tooth wear can be assumed to grow worse with advancing age however this is affected by any number of factors such as diet, malocclusion and dental disease. The Scott system was used to score attrition on the molars. By this system, the molars were divided by their four quadrants, the rate of attrition for each quadrant scored separately, then the total for that tooth calculated by adding the results (Scott, 1979, 213). This allowed for an examination of the rate and pattern of dental attrition within the population.

Examination of the wear on the occlusal surfaces of the teeth can provide information on the diet of individuals from a skeletal population. Foods in the past contained more abrasives than in modern times due to the use of stone quern stones for grinding flour and other such food preparation techniques. As a result, the wear evident on adult teeth from archaeological skeletal assemblages is often quite excessive. The rate of attrition on the teeth can be indicative of age, though this could be distorted depending on the coarseness of an individual's diet and needs to be compared within a skeletal population whom, it could be assumed, shared a similar diet. Dental attrition was not completely relied on as an ageing method in the current study due to the rate of ante-mortem tooth loss recorded. The rate and pattern of attrition of the individuals in the collection were however compared to that of prehistoric British populations provided in chart form in Brothwell, (1981).

Analytical methods: Calculating stature

The most commonly used method for estimating stature is based on regression equations taken from the long bones, with those of the leg, the femur and tibia providing the most accurate results. As the calculation of stature requires measurements of fully mature bones, stature is calculated for adults only.

The standard used was that of Trotter & Gleser (1952/ 1958). Formulae are provided for the calculation of stature based on measurements taken of each of the long bones. The most reliable calculations are those made using the length of the femur, however as many archaeological skeletal collections are often in fragmentary state, it is necessary to use whatever bones are present and in the best condition. Though the accuracy of these formulae has been questioned due to discrepancies in measuring technique, specifically for the tibia (Jantz et al, 1995), these remain the most commonly used standard in osteological studies.

Unfortunately, many of these bones from Knowe of Skea were either fragmented or missing from some of the articulated skeletons and this made accurate calculations difficult for some individuals. Stature calculations were made on complete bones where possible and using fragmented bones only when a tight connection could be made between fragments.

Analytical methods: Examining pathology

Any forms of illness or trauma identified on the bones were recorded. Though a full diagnosis is not usually possible, broader categories such as metabolic disease and infectious disease are normally used to assess the health of the population under examination. By assessing a number of different pathological markers on the bones a picture of the health and nutritional history of an individual, and the population from which they came, can be produced.

Steckel, (2003), stresses the importance of selecting 'general health indicators that are understood and recorded by virtually all physical anthropologists' when attempting to establish the health of a population from skeletal remains, (2003, 214). Each of these conditions and skeletal markers needs to be studied in relation to, and together with, all of the others to reveal the most accurate picture of community health possible, (Goodman & Martin, 2002, 12). A brief description of each of the most commonly used skeletal markers is given below.

Skeletal markers in infants and children

Infants and children, being the most vulnerable section of a population and more susceptible to changes in their environment, will become affected by poor nutrition and ill-health sooner than adults in the same community. Analysis of subadult skeletons therefore can provide information about the environment in which a child was living at the time of their death; 'their health and survival have become an accepted measure of population fitness' (Lewis, 2002, 211). The main indicators of health in subadult skeletons are general growth/stature, dental enamel hypoplasia and evidence of stress (porotic hyperostosis).

Growth/Stature

The rate of growth in children is dependent on their nutrition and environment, as well as on genetic design. Attaining the stature of an individual is based on calculations made with the length of the long bones, the femur in particular. By comparing the stature calculated with the age assigned to an individual through the analysis of the dental development, an overall mean stature for a certain age group in a population can be ascertained, (Mays, 1998, 68). Comparing the stature of an individual with the mean for their age group can help to determine their rate of growth and can infer their state of health. Poor nutrition or illness can slow or even stop growth for a time, or lengthen the growing period meaning an individual or age group will attain their adult height at an older age than other, well nourished populations. Similarly, by comparing the mean statures of a population with those of another, perhaps modern sample can help determine the general rate of growth for that population. Should the population in question be smaller for their age than another contemporary population then it could be inferred that their environment or diet was impeding growth in some way, (Humphrey, 2000, 23).

Evidence for arrested growth can be seen in the radiographic analysis of the long bones as linear horizontal markers at the site of the epiphyses at the time of stress (Harris, 1931). Such linear markers are termed Harris lines and by measuring the length of the shaft of the long bone between the first set of Harris lines at the proximal and distal ends, the age at which the period of stress occurred can be determined. The obvious limitation is the need for radiographic examination of the bones which does not always take place in the examination of archaeological skeletal material.

Dental Enamel Defects

Evidence of disturbances in growth and development can also be seen on the teeth. Dental enamel is a substance which is unaffected by nutrition or environment once it is deposited. During its deposition however, as the teeth are maturing in the early years of growth, disturbances in the nutrition and health of an individual can alter the formation and deposition of enamel creating linear markers or pits on the maturing teeth (Lewis & Roberts, 1997). Such horizontal markers are linear hyploplasias, can be seen with the naked eye on the erupted teeth and can occur more than once in an individual indicating numerous periods of stress during development either *in utero* for deciduous teeth, or during childhood for the permanent teeth.

By examining on which teeth and at what point in development they were formed, these defects were used to estimate at what age the disruption may have occurred. There are formulae which can be employed using measurements taken on the teeth to calculate the timing of the disruption more accurately, however this was not attempted in the current study. The fragmented state of many dental samples and the commingled nature of so many of the immature bones in the collection meant that in most cases accurate and repeatable measurements were not possible. Often, both left and right sides were not present for comparison and isolated dental samples and post-cranial elements could not be attributed to a single individual.

Metabolic disease – Vitamin deficiency

Vitamin deficiencies can lead to a variety of illnesses, only some of which will become severe enough to affect the skeleton. Vitamin D deficiency leads to rickets in children which results in softening of the bone and often leaves the weight bearing long bones misshapen. Vitamin C deficiency leads to scurvy and will affect the skeleton in its more advanced stages. Subperiosteal haemorrhage associated with scurvy can cause a reaction on bone surfaces resulting in new bone formation (Lewis, 2007, 132). Infantile and childhood scurvy have been identified in a number of cases in Britain (Brickley & Ives, 2006; Mays, 2008) and a recent case identified in Serbia has been linked with seasonal nutritional deficiencies associated with urban living and cereal dominated agricultural systems (Brown & Ortner, 2011). The areas of the infant skeleton most likely to be affected and the reactions in the bone are described by Ortner (1997/ 2001) and Brickley & Ives (2006). These studies involved examination and recording of all cranial bones, scapulae and long bones for abnormal porosity; and the recording of proliferative bone growth on any other bones (Brickley & Ives, 2006, 164) and a similar process was followed in the current study.

Evidence of anaemia usually occurs in early childhood and can be retained or reoccur into adulthood, and takes two forms – cribra orbitalia and porotic hyperostosis. Cribra orbitalia occurs in the upper interior of the orbits as excess of bone growth. Porotic hyperostosis occurs on the skull in the form of pitting in the surface of the outer table of bone which can become thinner and the inner trabecular become thicker. These conditions can occur in a number of stages which indicates that the initial period of stress may have been ongoing or may have passed prior to death. These lesions were recorded as ‘active’ or ‘healing’ according to descriptions in Mensforth et al (1978). Both were traditionally thought to be a reaction to iron deficiency or anaemia which can be due to injury and loss of blood or a diet lacking in iron (Cohen & Armelagos, 1984; Stuart-Macadam, 1985&1987; Palkovich, 1987) or as a defensive response to infection (Stuart-Macadam, 1992). A more complicated process relating to iron and vitamin B deficiencies are now thought to be involved (Walker et al, 2009). Such stress as may have caused the condition may also weaken an individual’s immune system and so their ability to fight infection resulting in early death, (Goodman & Armelagos, 1989, 239).

Adult skeletal markers

Skeletal markers which first occur in adulthood and progress over time such as degenerative joint disease and dental attrition can be used to interpret the diet and possibly the occupational wear and tear on an individual skeleton.

Degenerative Joint Disease

Joint diseases primarily occur in adults and progress with advancing age, osteoarthritis and vertebral osteophytosis being the most commonly identified conditions in archaeological samples, (Mays, 1998, 127). The causes may be genetic, occupational or trauma related and the effects on an individual result in bony growths on the spine and joints which can be painful and reduce the individual’s capacity to work and so possibly inhibit their ability to procure food leading indirectly to poor nutrition and increased susceptibility to infection.

Spinal degeneration, arthritis and eburnation of the joints have been grouped together under this disease category. Each of these conditions can be affected by the age of an individual, by activity or by injury.

Waldron’s ‘operational definition’ (2009) was used in the examination of osteoarthritis in each of the articulated skeletons in the collection. The presence of eburnation is pathognomonic of osteoarthritis and indicates bone rubbing against bone. In the absence of eburnation two of the following changes must be recorded in order to diagnose osteoarthritis; marginal osteophytes or new bone growth on or around the joint surface, pitting on the joint surface and changes to the contour of the joint surface (Waldron, 2009, 34). Osteoarthritis identified in this way was recorded as ‘positive’; those joints which showed no sign of osteoarthritis were recorded as ‘negative’. All joints across the skeleton were examined for evidence of osteoarthritis. In the skull, the temporo-mandibular joint was examined. Three joints in the shoulder (sterno-clavicular/ acromio-clavicular/ gleno-humeral) and the elbow, wrist and hand joints were examined in the arm. The hip, knee, ankle and foot were examined in the leg; and three aspects of the spine were examined (costo-transverse connections, the vertebral body rim and the presence of Schmorl’s nodes). Vertebrae were also examined for evidence of intervertebral disc disease which is recognised through the presence of pitting on the surface of the vertebral body and marginal osteophytes (Waldron, 2009). Probable itervertebral disc disease was identified in a number of individuals; however there were also cases where osteophytic spurring may have been the result of spinal trauma.

The degree of fragmentation of many of the bones in the collection became an issue when examining the joints for signs of infection or osteoarthritis.

Disease / Infection

Diseases which leave skeletal markers for examination in archaeological samples can be divided into three categories: dental disease, metabolic disease and infectious disease. Other conditions like congenital diseases or neoplastic diseases/tumours occur on an individual level and while the state of health of the individual concerned can be interpreted, the use of these conditions in the interpretation of population health is limited. It should also be noted that the majority of deaths in the past were most likely due to the many virulent, contagious diseases which acted too quickly for bony responses to occur in the skeleton. ‘The response of bone tissue to disease is relatively slow, so that in general only the more long-lasting conditions even have the potential to affect it.’, (Mays, 1998, 122). It is known from historical records of the medieval period for example that diseases such as cholera, plague and smallpox were rife in the cities of Europe and killed thousands each year but these leave no physiological evidence on the remains from the time.

Dental Disease

Dental diseases are for the most part directly related to diet. The effect of dental disease on the health and nutrition of an individual is based on the limiting of dietary options due to pain and the difficulty of chewing and the resulting lack of nutrient uptake, (Goodman & Martin, 2002, 45). The main forms identified in archaeological samples are caries, calculus, periodontal disease and abscesses; these can occur in both permanent and deciduous teeth.

Caries and calculus tend to be mutually exclusive and are related to the acid/alkali balance created by the intake of certain foods and the build up of plaque. 'The pH of the plaque varies according to the relative amount of protein as opposed to carbohydrate in the diet.' (Hillson, 1979, 150). Carbohydrate rich foods such as cereals contain sugars which are metabolized quickly creating acids which can dissolve the surface enamel of teeth and lead to the disease dental caries. Conversely, protein rich foods, such as meat, create alkaline conditions which can favour the build up of mineral deposits, calculus, on the teeth.

Periodontal disease occurs as a response of the body to the presence of large amounts of bacteria close to the gums. In fighting the bacteria and infection at this site, the area can becoming so affected as to cause loosening of the teeth and ante-mortem tooth loss, with the bone remodelling and becoming smooth and flat where the tooth once was. As mentioned earlier, dental attrition can be caused by the chewing of coarse foods such as breads made from stone-ground flour. Badly worn teeth or those with caries can lead to infection and the formation of abscesses in the surrounding alveolar bone. Severe dental abscesses prior to the discovery and widespread use of antibiotics could lead to blood poisoning, or septicaemia, which can be fatal (Soames & Southam, 2005).

A dental recording system described by Hillson (2001) and recording forms provided by Buikstra & Ubelaker (1994) were used, and allow for the recording of caries, abscesses, ante-mortem tooth loss and calculus. The location of caries on the tooth was recorded (occusal, interproximal, buccal or lingual smooth surfaces, cervical or root caries and gross caries which affected a larger part of the tooth) as was the severity of the carious lesion (small, moderate, large or massive). The location of abscesses and the amount of calculus present were also recorded. Periodontal disease was diagnosed only when teeth remained *in situ* and when taphonomic damage could be ruled out.

Metabolic Disease

Metabolic disease and poor nutrition leave individuals weakened and more susceptible to infection and infectious diseases. This disease category concerns any pathology identified in the assemblage which could be attributed to some form of dietary or immune deficiency which resulted in stress placed on the individual which then expresses itself on the skeleton. Poor diet can lead to malnutrition and deficiency diseases due to the absence of important vitamins and /or minerals. In some cases however, a particular diet can lack just one of the nutrients necessary to maintain a healthy balance. As with infants and children, the skeletal markers that may indicate nutritional stress in adults are cribra orbitalia and porotic hyperostosis which occur on the skull and can be indicative of iron and vitamin deficiency (Walker et al, 2009). Such skeletal markers take longer to develop on adult skeleton as mature bone is slower to react than the still developing bone of young individuals. The presence of such markers on adults therefore can indicate a long-lasting or chronic condition which may have begun in childhood. Iron is necessary for the manufacture of haemoglobin which in turn is necessary for the transport of oxygen throughout the body. Prolonged lack of iron, for whatever reasons, leads to anaemia, fatigue and weakens the immune system.

The lack of vitamins C and D also leave distinctive markers on the skeleton. Vitamin C is not created naturally in the body and needs to be absorbed from food during digestion. The most common disease associated with Vitamin C deficiency is scurvy, the symptoms of which include haemorrhaging of the mucus membranes and the gingivae causing antemortem loss of the anterior teeth in particular. Though it cannot be made by the body Vitamin C can be stored for long periods; evidence of scurvy on skeletal remains therefore indicates a prolonged period of deficiency, (Stuart-Macadam, 1989, 202). Scurvy was known as a disease related to periods of inadequate amounts of fresh foods in the Netherlands from the sixteenth century and recognised as a seasonal occurrence and a particular affliction of sailors (Maat, 2004). As Vitamin C is used in the body's defence against infection it could be inferred that the individual affected was more susceptible to infection while suffering from scurvy, though recovery is almost immediate on the resumption of a normal diet. Scurvy was identified in an assemblage from a nineteenth century famine cemetery in Ireland where the presence of lesions on individuals of varying ages was a result of extreme deprivation (Geber & Murphy, 2012). Diagnosing scurvy on adult remains can be problematic as the associated skeletal lesions may also be indicative of other conditions or infections (Brickley & Ives, 2008).

Unlike Vitamin C, Vitamin D is not available to any great extent in the diet and can be created during the exposure of the skin to sunlight (Stuart-Macadam, 1989, 207). Vitamin D is needed in the body to aid in the absorption of calcium from the diet. Vitamin D is crucial during the developmental years of childhood as a lack of this vitamin causes softening of the bone so they can grow misshapen, a condition called rickets. Lack of Vitamin D can also affect adults with softening of the bones, called osteomalacia. Rickets commonly occurred in children of the post-industrial revolution urban centres of Britain where pollution and overcrowded living conditions resulted in low exposure to sunlight (Lewis, 2002; Mays et al, 2006; Brickley et al, 2007).

Infectious Disease

The many and varied infectious diseases which affected past populations were for the most part, virulent fast-acting diseases which killed quickly and as a result leave little evidence on skeletal remains. Skeletal evidence of infection therefore indicates chronic slow-acting disease, or that the individual may have survived the initial attack of infection or disease and lived long enough with the illness for reaction to occur in the bones; such diseases include tuberculosis, leprosy and treponomal disease, or syphilis, which cause distinctive skeletal changes and non-specific indicators of infection such as periostitis and osteomyelitis.

Signs of infection can be found on skeletal remains with no evidence to indicate their origin; these are classed 'non-specific infection'. Periostisis, which affects the surface of bone, and the more serious osteomyelitis, can be caused by the spread of infection by insects, bacteria, fungi or parasites. Bacteria are transported to the bone from an original point of infection in the soft tissue via the blood and are most common in the femur and tibia (Aufderheide & Rodgriguez-Martin, 1998; Ortner, 2003). Periostitis occurs on the surface of bones in reaction to an infection or disease, its presence is recorded but little in the way of a diagnosis can be reached without other indicators on the skeleton to point towards a particular disease or infection (Waldron, 2009). Periostitis identified in the Knowe of Skea collection was recorded as 'active' or 'healed' when possible, which bone was affected and the location on that bone.

Sinusitis can be caused by allergies, pollution, viruses or infection (Lewis et al, 1995) but can be difficult to identify in archaeological samples due to the location of the sinuses inside the skull (Waldron, 2009, 114).

Trauma

Evidence of trauma can be seen on the skeletal remains of all individuals, and can take the form of fractures, new or healed, and cuts or blows from violence and warfare. The state of the bone affected at the time of death can indicate the severity of the trauma and its affect on the individual. Open fractures, those which break the skin, often lead to serious infection of the surrounding area and bone due to exposure to bacteria (Merbs, 1989, 163) which can spread to the blood system and cause septicaemia and death. Evidence of infection can take the form of periostitis, a layer of new bone growth on the surface of the affected bone and may be indicative of either open fracture or poor general health of the individual and reduced ability to fight such infections.

The rate of healing of fractures and wounds depends greatly on the age, nutrition and general health of an individual (Waldron, 2009, 148). A child's bones will heal quicker than those of an adult as they are constantly developing and growing. Fully healed trauma with little or no evidence of infection suggests that the individual was relatively healthy and had sufficient nutrition to facilitate a full recovery. Should a fracture go untreated the broken bones can become misaligned and distortion of the limb can occur. The rate of healing can indicate how close to the time of death the trauma occurred, minimal healing will suggest that the trauma took place shortly before death and possibly resulted in infection which killed the individual affected. It may also be that other soft tissue traumas associated with the original event were sufficient to kill the person and this would not be evident on the skeletal remains (Lovell, 1997; Brickley, 2006).

Any fractures or injuries identified in the collection were recorded; the bone affected, locations on the bone and the state of healing were all noted.

Congenital disorders and Non-metric traits

The more pronounced congenital disorders visible on the skeleton are rare in most archaeological assemblages. Congenital disorders such as spina bifida, osteogenesis imperfecta and anencephaly can be identified using modern reference material (Ortner, 2003) however, the fact that in the past most of these conditions were "incompatible with life" (Roberts & Manchester, 1995, 31) would have resulted in the death of infants soon after birth. Those congenital disorders identified in skeletal populations therefore tend to be of the sort that might have had little effect on an individual during life.

The majority of skeletal features which are thought to have possible genetic or hereditary influences on their occurrence are described as non-metric or discrete traits. These are normally minor and asymptomatic skeletal anomalies that are identifiable by eye rather than measurement. The most commonly observed non-metric skeletal traits can take four forms: ossicles, small bones which occur between the cranial sutures; abnormal proliferations of bone such as bridges or spurs; ossification failure which results in bony defects like septal apertures of the humerus; and variations in the number or location of foramina (Buikstra & Ubelaker, 1994, 85). These skeletal variants are asymptomatic and may often only be visible on x-ray in the living, or on skeletal remains. The fragmentary nature of much of the assemblage created a problem when identifying some of these skeletal variants, particularly those of the skull and did not allow for satisfactory comparison between individuals or with other populations. Therefore only the most obvious traits were recorded. These included the presence of metopic sutures; the presence of wormian bones; proliferations of bone, in particular accessory transverse foramina of the cervical vertebrae; ossification failure in the form of septal apertures and sternal foramina; numerical error of segmentation and cranio-caudal border shifting of the spine; squatting facets and vastus notches.

Applying the methods in the current study

The main problem encountered when applying the above techniques during the analysis of the remains from Knowe of Skea was the degree of commingling among the younger individuals and the degree of fragmentation of the bones of older individuals. Those adult bones most frequently fragmented were the skull, long bones, pelvis and ribs, all of which are needed in one or other of the methods described. This reduced the accuracy of some of the estimations.

Commingled infant remains were usually those of late foetal or perinate infants so close in size and age as to make the identification of individuals impossible. In other circumstances, the result of age estimations for different skeletal elements might be compared to reach an estimation of age for the whole skeleton but for this collection ageing was confined to individual bones only. All of the methods described were used where possible and the results of each assessment compared to achieve the most accurate estimations possible.

5. Results of Skeletal Analysis

The results of the skeletal analysis are given here with general assessments of sex, age, stature and pathology. Greater information on individuals or on specific groups of bones and Small Finds (S.F.) can be found in Appendix: Skeletal Examination Notes.

Condition of the Remains

The excellent preservation of the remains from Knowe of Skea is extremely fortunate. The nature of the rubble deposits into which the burials were placed, with well-drained, light and aerated soils, is the main cause of this good preservation. These rubble deposits however also caused much of the fragmentation and commingling of the remains outlined below.

Erosion / Weathering

It was noted by the author during excavation that those remains located higher in the rubble deposits, and so closer to the surface turf, were darker in colour and in some cases showed slight surface etching from hair roots of the grasses growing on the surface. This did not however affect the bones in any way that would have limited the analysis. A small quantity of remains that had been exposed to the elements, either through erosion or in the section edges of earlier excavations, were bleached white in places; these bones are listed in Table 6.

The majority of the damage to the bones in this collection is erosion or abrasion caused by the rock and stone in the rubble deposits in which these burials took place. One set of bones however showed weathering on the bone surfaces suggestive of exposure. These bones were in (2114) which contained the commingled lower limb bones of two adults and assorted upper body remains. The extent of weathering on these bones was assessed using the stages described in Behrensmeyer, (1978). (Table7)

Context	Bone No.	Bone	Age	Description
(7000) – general finds	3697	1st metatarsal, right	Adult	slightly bleached colour to surface
(9001) – general finds	5162	Lumbar vertebra fragment	Adult	bleached white
(9001) – general finds	5165	Ulna, right	Perinate	bleached white
(9001) – general finds	5167	Rib, left	Perinate	bleached white
(9002) – general finds	4348	Femur, right	Perinate	slightly bleached surface
(9005) – general finds	4430	Talus, left	Adult	bleached white
(9005) – general finds	4431	1st Metatarsal, left	Adult	bleached white
(9005) – general finds	4546	1st distal hand phalanx	Adult	bleached white
(4030) S.F.188	4773	Tibia, right	?Foetal	white bleaching to the proximal end
(9010)	13518	Pelvis, right – fragment greater sciatic notch	Adult	bleached white
(9010)	13519	calcaneus	Adult	bleached white
U/S S.F.1538	14588	Radius, right	Perinate	white and green staining to surface from exposure through excavation

Table 6: Bones showing evidence of bleaching through exposure

Context	Bone No.#	Details	Age	Description	Stage
(2114)	516	Scapula, right, fragment	Adult	anterior side shows most advanced weathering with splintering of surface	4
(2114)	520	Clavicle, right	Adult	greyed colour, slight change in surface	1
(2114)	529	Pelvis, right, fragments	Adult	splintering of bone surface in parts	3 / 4
(2114)	651	Radius, right	Adult	surface shows slightly more advanced weathering around midshaft	1 / 2
(2114)	652	Ulna, fragment	Adult	splintering of the bone surface beginning to the proximal end of the fragment	3
(2114)	656	Fibula, right	Adult	surface is greyed in colour, slightly more advance weathering towards the midshaft	1 / 2
(2114)	657	Fibula, left, damaged proximal end	Adult	weathering more advanced towards the proximal end	1 / 2
(2114)	663	Tibia, right, diaphysis	Adult	surface of fragments shows slight cracking and greyed in colour	2

Table 7: weathered bones in (2114)

The majority of the bones in this collection were in excellent condition. However there were a number for which greater erosion was visible on the bones surfaces. The majority of these bones are from those collections of bones described as concentrations, partially articulated or disarticulated in the site notes. The main cause of this erosion therefore, can confidently be assumed to be the shifting of these bones through the rubble deposits and from the disturbing of remains from their original positions.

Animal gnawing

Evidence of gnawing by rodents was noted on a number of bones in Contexts (106), (2011/2012/2021), and S.F.625/443 as well as on a number of bones in the general finds part of the collection (Table 8; Plate 17). Animal bones, including rodent remains, were often found in the collection and were separated during processing. As the burials were situated in voided rubble deposits, evidence of damage or disturbance by rodents is not unexpected.

Context	Bone No.	Bone	Age	Description
(100) - general finds	274	Femur - distal end fragment	Perinate	rodent gnaw marks on diaphysis portion of fragment
(3012) - general finds	845	Humerus, right	Perinate	rodent gnaw marks on diaphysis
(4000) - general finds	916	Femur, right – diaphysis fragment	Child	rodent gnaw marks on posterior surface
(4016) - general finds	1183	Femur, left – 2 fragments	Perinate	rodent gnaw marks
(106)	14	Fibula fragments	Adolescent	rodent gnaw marks on interosseous crest
(2021)	440	Humerus, right – distal fragment	Adult	rodent gnaw marks on fragment edges
S.F. 625	9116	Femur, right	Adult	rodent gnaw marks on linea aspera
S.F. 625	9117	Tibia, left	Adult	rogent gnaw marks on posterior midshaft surface
S.F. 625	9144	Femur, Right	Adolescent	slight rodent gnaw marks on distal third posterior surface

Table 8: **Bones showing rodent gnaw marks**

Commingling

Though the condition of the majority of the human bone assemblage was excellent, there was a large degree of commingling of bones as well as fragmentation caused by the shifting of the rubble deposits in which they were found.

Commingling was most obvious in those groups of bones given Small Finds numbers; these consisted mainly of infant remains and the smaller bones of older individuals, such as those of the hands and feet. The remains of infants and children in particular showed the highest degree of mixing, the large amount of child bones from Context (6071C,F,E,I&H) illustrate this. The loose nature of the deposits also led to the postmortem loss of many teeth from the maxillae and mandibles of individuals; without soil to hold them in place many simply fell out of their sockets and became lost in the rubble; over one thousand such loose teeth were catalogued.

The major constituent of the human skeletal assemblage from Knowe of Skea was bones from small infants, including foetuses, perinates and neonates. Two forms of infant burial had been identified during excavations; single infant burials and concentrations of bones with the remains of more than one infant mixed together. During analysis it was found that single infant burials occurred in varying degrees of completeness, but by far the majority of bones occurred in larger concentrations of mixed remains. The large concentrations of remains, which contained mainly infant bones, also contained many fragmented bones. Where possible, any fragmented bones were joined in order to aid in more accurate estimating of numbers of skeletal elements and eventually for more accurate estimates of minimum numbers of individuals.

A breakdown of the infant remains by skeletal area (Figure 4) shows that the greatest percentage of bones recorded was from the spine, then the skull and thorax. As these anatomical areas occur in a number of elements that fuse together with age, the high volume of these parts is expected. The similarity in the number of upper and lower limbs, pelvis and shoulder elements indicates that, despite mixing and disturbances, the burial of complete infants was taking place at Knowe of Skea.

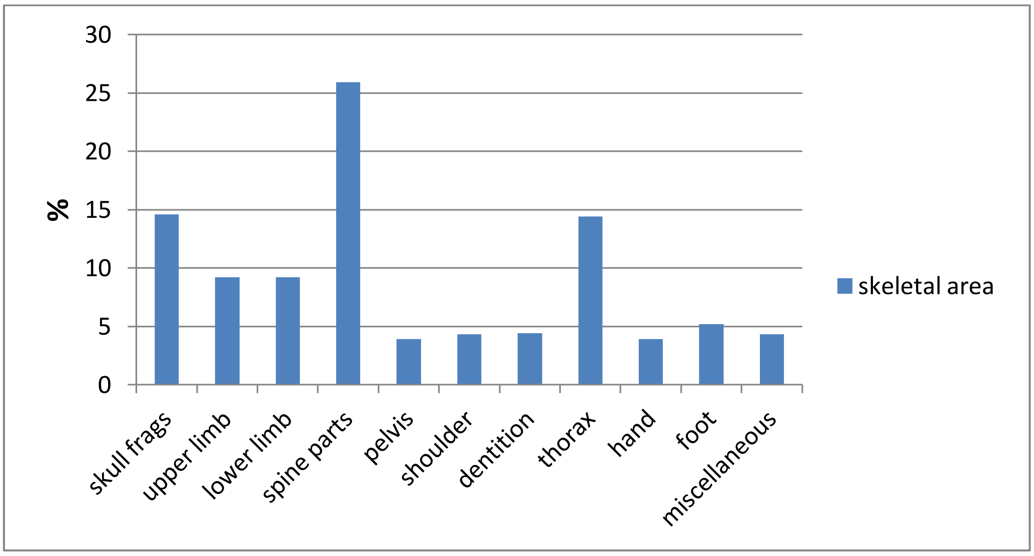


Figure 4: Proportion of each skeletal area represented in infant remains.

Fragmentation

The greatest amount of fragmentation was noted among the disarticulated bones collected in the general finds during excavations. This part of the collection contained in the main fragments of bone which had sustained the most disturbances and could not be attributed to any individual skeleton or concentration of bones. Among the articulated remains, the greatest amount of damage was seen at the ends of long bones, in the vertebrae and the skull.

Due to the rubble deposits into which the bodies were interred, the weight of stones lying directly on the recently deceased caused the fracturing of many long bones and skulls either during the burial or soon after. Had the circumstances of the burials not been known, these fractures may have caused a misleading number of perimortem injuries to be recorded for this population.

A depressed area with radial fractures on the left temporal bone of (2118), a child, may be perimortem but whether this occurred before, during, or after burial could not be determined.

Skeleton (4019), a middle adult male, included a left radius showing a perimortem crushing fracture to the mid shaft, and a corresponding chip on the left ulna. There was also a possible injury to the back of the skull. The right side of the occipital showed very slight indentation but the pressure applied caused the left side lambdoid suture to spilt with resulting radiating fractures working out from the location suggesting it occurred while the bone was ‘green’ or not skeletonised. Though these are perimortem injuries it is most likely that they occurred during burial or soon after in the rubble deposits; in the case of the skull in particular, it was the area of the occipital that was most exposed by body position.

Disturbance by later Construction Phases

Adults remains (2098), (2099), (3111), (3118), (6096) and (7039) had all been disturbed or damaged by subsequent burials or later construction activity on the site (Moore & Wilson, 2011). During analysis long bone fragments and foot bones from two contexts, (2122) and (2124) were found to match and fit together indicating that these were from one individual. Examining the site records showed that these were located in close proximity and represented a burial which had most likely been disturbed by the burial of adult male (2100).

The partial skeleton of a middle age adult male, (6076), included an ulna with perimortem crush fractures which most likely were caused by the rubble deposits into which the burial was originally placed. There were a number of old cuts/strikes caused by sharp implements to the long bones of (6096) which most likely occurred after burial when the remains were at least partly skeletonised - but not during archaeological excavation as the cutmarks were not fresh. As excavation notes indicate that a wall was built over this burial, it is probable that these marks occurred during construction of the later building.

Number of Individuals

Forty-one individuals, based on the number of articulated, partly articulated or concentrations of associated remains were identified during the excavations on the Knowe of Skea. When disarticulated or isolated bones are taken into account and calculations based on counting bones that occur only once per individual, the minimum numbers of individuals (MNI) present increases substantially (Table 9). The differences in these counts can be explained by the nature of the rubble deposits on the site; bones were likely to have been disturbed by the moving of large stones during subsequent burials or the construction of later buildings on the site (Moore & Wilson, 2011). The most accurate estimation of the number of individuals originally buried at Knowe of Skea therefore should be based on the occurrence of skeletal elements in the collection as a whole.

	Foetal	Perinate	Neonate	Infant	Child	Adol	Adult	Total
Articulated/Partly articulated				4	6	9	22	41
L. Petrous part	18	84	21	21		23		167
R. Petrous part	14	108	15	21		23		181
Left Femur	29	91	14	12	16	8	19	189
Left Humerus	27	108	20	8	19	9	23	214
Right Femur	12	113	5	5	14	8	19	176
Right Humerus	29	115	8	10	13	10	20	205
Atlas (/L.neural arch)	4	33	9	4	9	7	26	92
Axis (L. neural arch)	29	21	6	4	12	7	23	102
Pelvis/Left Ischium	18	56	3	6	13	9	16	121
Dental samples (/Left Mandible)	6	57	27	7	16	9	22	144

Table 9: MNI by bone

The highest overall number of individuals was calculated for the left humerus: 214. As long bones can be more susceptible to fragmentation and so the possibility of miscalculation is higher, the more reliable dense bone of the petrous part of the skull is usually counted in these situations. However, in the case of the Knowe of Skea collection, the number of individuals recorded by counting the petrous parts is 181. This calculation in likely to be an underestimate as many of the adolescent and adult burials in the collection were found to have poorly preserved skulls, or only fragments of skull remaining.

Assessing Sex

The Knowe of Skea collection contained few individuals for whom sex was difficult to assess and, especially when both skull and pelvis were available, male and female attributes were quite marked and few uncertainties occurred. The designation of 'possible male' or 'possible female' in this collection was made due to either fragmentation of the more dimorphic elements of the skeleton, or because of the incompleteness of the remains.

The majority of males had a more robust appearance to the bones than females and had more marked sites of muscle attachment, particularly in the upper limbs. One exception of this evident sexual dimorphism was found in the mandible, which in both sexes at Knowe of Skea has a robust, angular appearance and could not be relied on for accurate assessment of sex when employing the usual methods of visually assessing the mental eminence (Plate 18). Sex was difficult to assess for just one individual in the collection: (3118), a middle adult. This was a very fragmented skeleton and the cranium was missing. The shape of the pelvis and mandible fragments present suggested that this was a male, however all of the available measurements suggested this was a female.

Because the sexing of subadult remains is problematic, the assessment of sex of the Knowe of Skea individuals was confined to adults and a small number of adolescents. Figure 5 illustrates the age ranges of the males and females identified from the 22 articulated or partly articulated adults and the adolescents in the collection (see Table 5 for details of age ranges).

AGE	MALE	FEMALE	UNDETERMINED
Young Adult		2098; 6032; SF625; 6065	
Middle Adult	2011/2012/ 2021; 2114; 3111; 4019; 6030; 6072; 6076; 7015	2115; 4015; 9010	3118
Older Adult	2100; 4045		
Adult	2099; 6096; 7039		
TOTAL	13	7	1

Table 10: Male/Female by Age

Males

Thirteen individuals were assessed as male or probably male. Males were recorded in the middle adult (eight individuals), older adult (two individuals) and adult (three individuals) categories.

Females

Seven individuals assessed were female or probably female. The seven females identified in the collection were of young adult (four individuals) and middle adult (three individuals) age. There were no older females.

Adolescents

The assessment of sex is not usually attempted for adolescents or children as they have not gained full maturity and the necessary sexually diagnostic indicators require full skeletal development. Age at death for adolescents is estimated by examining dental development and the rate of fusion of skeletal elements like the pelvis and the epiphyses of the long bones. Epiphyseal fusion can occur later in males than females and so where both male and female age, as estimated by the degree of fusion, are compared to that estimated by dental development the results that correlate closest can indicate the sex of that individual (Hunt & Gleiser, 1955). It should also be noted however that illness and malnutrition may also affect the rate of skeletal development.

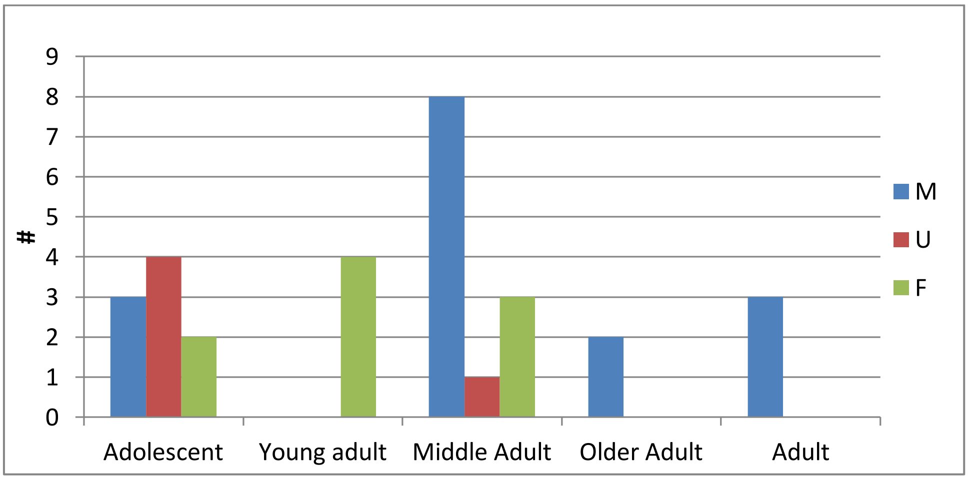


Figure 5: Number of males/females in each age range.

Among the adolescents in this collection, a tentative assessment of sex is suggested for three of the individuals, (106), (9013) and (4038). In these individuals dental development indicated an age which correlated closest with the male age estimated by the rate of epiphyseal fusion. These three individuals also portrayed a narrow greater sciatic notch of the pelvis which is a classic male attribute when visually assessing sex, and so it is suggested here that these individuals were possibly adolescent males.

Two further adolescents in the collection, (4036), and (6043), displayed female characteristics such as wide greater sciatic notches, and unlike that for the possible male adolescents described above, dental development age matched age assessed through epiphyseal fusion for females. It is possible that these two adolescents were female. Due to the fragmentary or disturbed nature and the younger age of many of the remaining adolescents, no further assessments of sex could be made.

Age at death

The age stages used in the analysis are based on biological growth stages and dental development rather than age in years (Lewis, 2007, 38). Ageing child and adolescent remains is therefore more accurate than for adults as known stages of skeletal fusion and dental development take place in childhood. For adults, ageing techniques are concerned mainly with skeletal degeneration, which takes place at unknown rates and can vary from person to person. Adults for whom an accurate age cannot be determined are classed simply as 'adult'. Table 5 shows the age ranges used in the analysis of this collection.

Age range of articulated or partly articulated remains.

Table 11 shows that in the articulated burials there were four infants, three individuals in both early and late childhood, nine adolescents, four young adults, twelve middle adult, and two older adults. There were also three individuals for whom only a broad 'adult' age could be determined.

As can be seen in Figure 6, just over 8% of left humeri and left femurs in the collection are of children, however, only 6 children are represented in the articulated or partly articulated individuals. In the case of S.F.284, this location was disturbed by the erection of a later wall and all the subadult bones in this area could be identified as belonging to one individual (Moore & Wilson, 2009). However, in the case of (6071), the site notes indicate that these remains seem to have been moved and organized to facilitate a number of burials in this one location; though shown here as just one entry (6071) actually included the bones of a number of children.

Age Range	No. Individuals	Context
Infant	4	2117; 9016; 9023; SF251
Early child	3	2118; 3117; SF284
Late child	3+	6061; 7037; 6071
Adolescent	9	106; 3015; 3036/3054; 4036; 4038; 6043; SF443; 9003; 9013
Young adult	4	2098; 6032; SF625; 6065
Middle adult	13	2011/2012/ 2021; 2114; 2115; 3111; 3118; 4015; 4019; 6030; 6072; 6076; 7015; 9010
Older adult	2	2100; 4045
Adult	3	2099; 6096; 7039
TOTAL	41	

Table 11: Number discrete burials/ Age range

Bone counts by age range.

Figure 6 shows a breakdown of age ranges from the left humerus for which the highest number of individuals was recorded (214), and the left femur for which a total of 189 was recorded. The vast majority, around 50% of the total in both cases, were perinates or neonates. Altogether, foetal, perinate and neonate bones formed over 70% of the total, while 5% were infants, 8% children, 4% adolescents and 10% were adults.

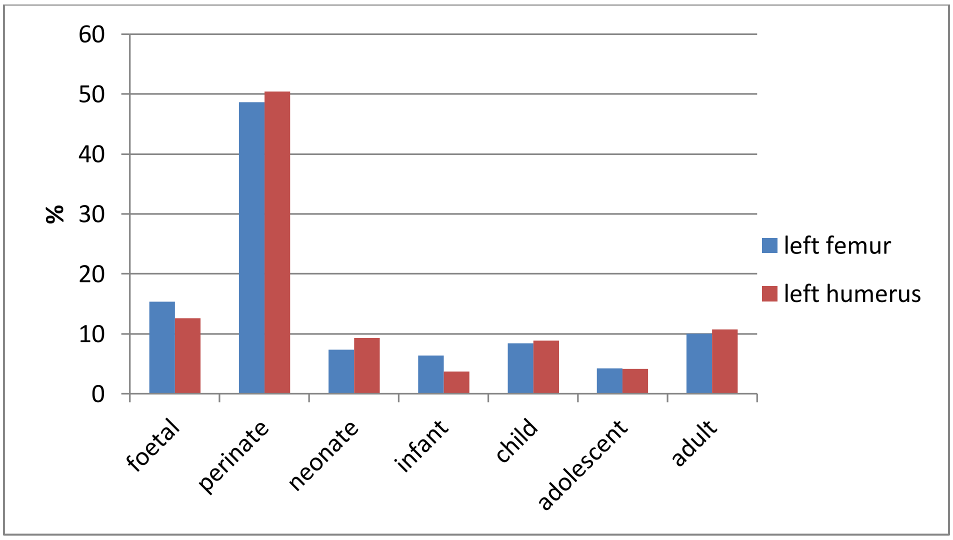


Figure 6: % of collection by Age range. Left Femur total=189; Left Humerus total=214.

Adolescents: Skeletal age and Pubertal Stage

The system outlined by Shapland & Lewis (2013) was used to determine the developmental stage at which the adolescents in the group had died. A total of nine adolescents were identified in the assemblage as almost complete, articulated burials and in disarticulated groups of bones. The skeletal age at death of these adolescents centred around 14 to 16 years but the stage of development at which these individuals died is also of some significance, both biologically and socially (Shapland & Lewis, 2013).

Applying this system to the adolescents in the assemblage from Knowe of Skea was difficult in some instances due to the degree of fragmentation and disarticulation of the remains. The rubble deposits into which the burials were placed also permitted the loss of small bones and teeth during decomposition which also caused some difficulty for this system also. As can be seen in Table 12, only two of the adolescents (4036) and (6043) were assessed as having reached peak height velocity or were in the deceleration phase. Each of the remaining adolescents was at an earlier stage of development which would suggest that these individuals were either entering or going through the pubertal growth spurt. It is interesting to note that the two individuals assessed in the more advanced pubertal stages were also the two adolescents assessed as possibly female (see above) and to hypothesise that females reached puberty at an earlier age than males in this group.

adolescent	age at death	skeletal mineralisation	hamate ossification	phalangeal fusion	iliac crest fusion	distal radius fusion	cervical vertebra stage	pubertal stage
106	15-17	H	H-H.5	unfused	unfused	unfused	2	prepubertal/acceleration
3015	13-16	-	H.5-I	capping epiphyses	ossified	infused	2-3	acceleration/PHV
3036/ 3054	14-16	H	H.5-I	unfused	ossified	unfused	2-3	acceleration/PHV
4036	14-17	H	-	all fusing	fusing	fusing	3-4	PHV/deceleration
4038	c.15	H	H.5-I	capping epiphyses	ossified	unfused	2	acceleration
6043	16-19	H	H.5-I	all fusing	ossified	fusing	3-4	PHV/deceleration
S.F.443	14-16	H	-	unfused	unfused	-	2	prepubertal/acceleration
9003	10-15	H	-	-	ossified	unfused	2-3	acceleration/PHV
9013	14-16	-	-	unfused	unfused	-	1	prepubertal/acceleration

Table 12: Pubertal stage assessment for adolescents according to the system outlined by Shapland & Lewis, 2013.

Age ranges in the Small Finds and general finds

Those parts of the collection attributed small find (S.F.) numbers included concentrations of bones, many of which contained the bones of infants and children. Many small finds contained large quantities of bone and it was not possible to identify individuals. Details of each of the Small Finds are included in Appendix: Skeletal Examination Notes.

The general finds collection contained those bones that had been collected during the excavation as isolated finds. The age ranges represented were predominantly in the infant age groups with older age groups represented by smaller bones, such as those of the hands and feet. It was through examining these parts of the collection that more accurate numbers of infants and children were estimated, primarily through the mandible and maxilla fragments found. The number of infants among the general finds was estimated at ten. The number of children counted and aged through dental development was sixteen; the majority of these children were in the 'early childhood' age category.

Foetus/Perinates/Neonates

Figure 6 above illustrates the percentage of each age range in the whole collection by counts of the left humerus and left femur. Clearly, the greatest proportion of the collection consisted of perinate remains. Closer examination of these remains reveals more information about the age at death of the young infants at Knowe of Skea.

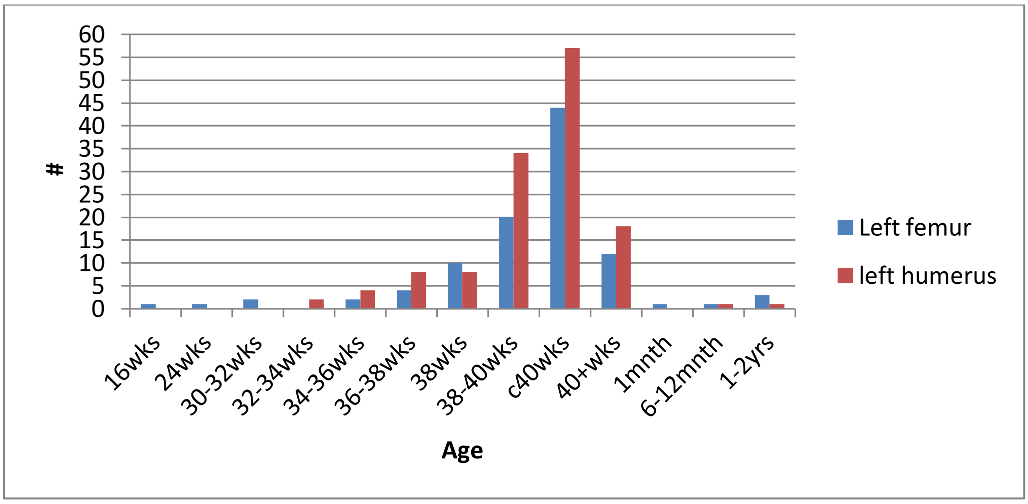


Figure 7: Foetus/perinate/neonate/infant numbers.

The age of young infants was calculated from measurements taken on the bones and those of the left humerus and left femur are represented here in two-week ranges. Figure 7 shows that though the majority of young infants were of perinate age, that is around 38 to 40 weeks, both younger foetuses and older infants were also buried at the site.

Number	Dental Development	Long Bone Measurement
2117	6 to 9 months	3 to 6 months
2118	<6years	5 to 6 years
3117	<6years	2 < 5 years
6061	6 to 8 years	4 to 5 years
9016	2.5 to 3 years	1 to 2 years
S.F.251	<3years	2 < 4 years

Table 13: Children and infants showing discrepancy between age estimates by dental development and long bone measurements.

Stature

The average attained stature in any population can be an indication of the general health and well being of that population; aside from genetic factors, nutrition and exposure to illness can affect the adult height of some individuals. The most commonly used method for estimating stature is based on regression equations taken from complete long bones, with those of the leg, the femur and tibia providing the most accurate results (Trotter & Gleser, 1952&1958). Unfortunately, many of these bones from Knowe of Skea were either fragmented or missing from some of the articulated skeletons and this made accurate calculations difficult for some individuals. As the calculation of stature requires measurements of fully mature bones, stature is calculated for adults only.

Fifteen of the adults at Knowe of Skea had long bones complete enough to calculate stature, though in some cases it was necessary to use measurements from the less reliable bones of the upper limb. Based on the results for the females with measureable bones, the average female stature for the Knowe of Skea group is 154.7cm with a range from 152.9cm to 159.1cm. The average male stature is 165.41cm with a range from 157cm to 174.5cm. The stature of the middle adult individual (3118) for whom sex was undetermined was calculated to 162.13cm+/-4.45 for female and 167.69cm+/-4.57 for male based on measurement of the humerus.

Context	Sex	Stature(cm)	Bone
3118	?	162.13+/-4.45(F) / 167.69+/-4.57(M)	Humerus
2098	F	153.7+/-4.45	Humerus
6065	F	152.9+/-3.72	Femur
SF625	F	153.4+/-3.55	Fem+Tib
6032	F	159.1+/-3.55	Fem+Tib
2114	?M	165.6+/-4.0	Tibia
4045	?M	163+/- 2.99	Fem+Tib
2011/2012	M	173+/- 2.99	Fem+Tib
2100	M	164+/- 2.99	Fem+Tib
4019	M	166+/- 2.99	Fem+Tib
6072	M	157+/- 2.99	Fem+Tib
6030	M	176.36+/-4.57	Humerus
7015	M	161.9+/-4.57	Humerus
7039	M	161.9+/-4.57	Humerus

Table 14: Stature calculations

Pathology

All forms of disease or trauma identified on the bones were recorded. Pathology which occurred on single bones in the larger mixed collections and in the disarticulated bones extracted from the general finds were few in number. The majority of incidences of pathology recorded in these parts of the collection related to endocranial lesions on perinate/neonate skull fragments and signs of possible periostitis on shaft fragments of long bones. The most commonly recorded incident of pathology in the bones from isolated bones among the general finds occurred on the 1080 loose teeth recorded; the majority of these dental pathologies were in the form of severe attrition which in some cases left only stubs of roots that were difficult to identify.

Though a full assessment of health and the identification of diseases present are often not possible from skeletal remains, broader categories of conditions such as metabolic disease and infectious disease can be used to assess the health of the population under examination. Examining pathology is restricted to those illnesses or injuries that affect the skeleton. Many diseases are fast-acting and may have caused early death. Skeletal evidence of disease therefore reflects chronic disease or conditions which impacted on an individual for long enough to cause an effect on the bones. Table 15 shows the types of diseases that were identified in the collection.

Skeleton/ Bone Number	Dental	Joint	Metabolic	Infectious	Trauma/ perimortem damage	Congenital	Other
106		X	X				
2011/2012/2021		X					
1014				X			
2114	X	X		X			
2115		X				? – M3 missing	
2098		X			X		
2100	X	X			X		
2121				X			
2099	X				?		
2118			X				
2117				X			
2124		X					
3111		X			?		
S.F. 32	X						
3015(adult skull)	X						
4015	X	X					
4036	X				X		
4038	X			X			
4019	X	X			X		
4045	X	X					
6072	X	X		X	X	X – M3 missing	
6071 (F)			X				
6055 S.F. 625	X	X	X				
6055 S.F. 443		X	X				
6061			?				
S.F. 424				X			
S.F.417			X				
6030	X	X	?				X-(hydatid cyst)
6043	X		X				
S.F. 448			X				
S.F. 639			X				
S.F. 263			X				
6096		X			X		
6032	X	X	X		X	X – (genu valgum/knock knees)	
7015	X	X					X osteoblastoma)
7037			X				
7039		X			X		
7067			X	?			
9010		X					
9003	X					X – (genu valgum/knock knees)	
9016 (1)	X						
9006 S.F. 1500					X		

Table 15: Pathology

Dental Health

A total of 65 dental samples were recorded: 23 were mandibles only, 11 were maxilla only and 31 included matching mandibles and maxillae. Many of the dental samples were recovered from the disarticulated collections (S.F.) or from isolated bones among the general finds rather than from intact burials. Table 17 represents the dental samples discussed and greater detail is available in Appendix 3. A total of 588 in situ teeth were recorded, 412 permanent and 176 deciduous. Loose teeth found in the mixed collections were recorded individually. There were 1080 loose teeth in the collection: 431 were recorded as permanent and 549 as deciduous; none of these could be confidently reattributed to particular individuals.

Dental disease includes caries, abscesses, ante-mortem tooth-loss and periodontal disease, each of which can be affected by the age of an individual and by diet which may have an adverse reaction on the teeth.

Caries

Nine of the 412 permanent teeth had caries, representing three individuals, (3015), (4015) and (7015) and one of two adult mandibles in (2114); the number of teeth and caries are represented in Table 16. Skeleton (3015) was the burial of an adolescent, but with the skull fragments and mandible of an adult male. The adult's upper dentition showed caries in the left first premolar, left first molar and left second molar (Plate 20). (4015), an adult who was possibly female, had very poor dental health with caries in the upper left first and second molars, and the lower left first molar. The individual from burial (7015) was a mid/older adult male with widespread ante-mortem tooth loss; the remaining teeth showed interproximal caries on the lower left and right second molars.

Context	Age	Sex	Teeth Present	Caries	Teeth Affected
2114(2) mandible	Adult	-	4	1	LM1 mandible
3015	Middle Adult	?M	15	3	LPM1, LM1, LM2 maxilla
4015	Middle Adult	?F	16	3	LM2, LM3 mandible; LM1 maxilla
7015	Mid/Older Adult	M	13	2	LM2, RM2 mandible

Table 16: Caries

Mandible Only	Maxilla Only	Matched Man/Max
2114(1)	SF32	106
2114(2)	SF31	2021
2098	SF144	2115
2099	4014B#6680	2100
3111	6071(C)	2118
3118	SF436;B#11,775	2117
3117B#2269	SF265;B#11,776	3036/53 (=3054)
3022	SF242	3015 (adult skull)
4036	SF910	4015
SF144	SF910	4038
4014B#6677	SF407;B#10,429	4019
SF135;B#7415		4045
6071 (F)		SF117
6071B#9287		6071 (A/G)
SF625		SF443
SF627		6061
SF266;B#12,928		6076
7037		SF417
SF1050;B#14,287		SF262 (=6030)
SF1472;B#14,549		SF251
9016(2)		6043
Gen.Finds 6014B#2603		SF448
Gen.Finds 9016B#5629		SF639
		SF242
		6032
		7015
		SF910
		9010
		9003
		9023
		9016(1)

Table 17: Dental samples. The assemblage included isolated or fragmentary maxillae and mandibles. Matching maxillae and mandibles were usually from articulated burials.

Dental Abscesses

Four individuals in this collection had dental abscesses. The maxilla and mandible from (3015), an adult who was possibly female, showed two abscesses, one in the maxilla over the left first molar which was also affected by caries, and another in the mandible at the sockets of the molars and in particular in the bone below the second molar. The individual (4015) had five dental abscesses with a large area of infection around the left and right upper molars. An adult male skull and mandible (6071 A/G) from the large collection of mixed remains in (6071) had three abscesses, in the areas of the upper right third molar and lower left and right first molars; this individual also had widespread ante-mortem tooth loss. (9003), an adolescent had a small abscess visible on the labial side of the mandible at the base of the first left incisor. One mandible from (2114) also showed dental abscess at the roots of the first left molar (Plate 21).

Ante-mortem Tooth Loss and Periodontal Disease

Ante-mortem tooth loss was noted in the permanent dentition only; 702 permanent tooth places, empty sockets, or in situ teeth, were present in the collection and 81(11.5%) of these had been lost during life. Of these 81, 38 (46.9%) were from the upper dentition and 43(53%) from the lower. This tooth loss occurred in sixteen individual dental samples from across the collection; seven were mandibles only, one was represented by only a maxilla, eight had both upper and lower dentition and were from, or associated with, articulated burials.

As can be seen in Figure 8, of all teeth lost ante-mortem the highest percentage occurred in the first molars (M1), then second premolars (PM2). Interestingly, the first incisors (I1) showed a high percentage of loss which maybe as a result of occupational wear (discussed in greater detail below).

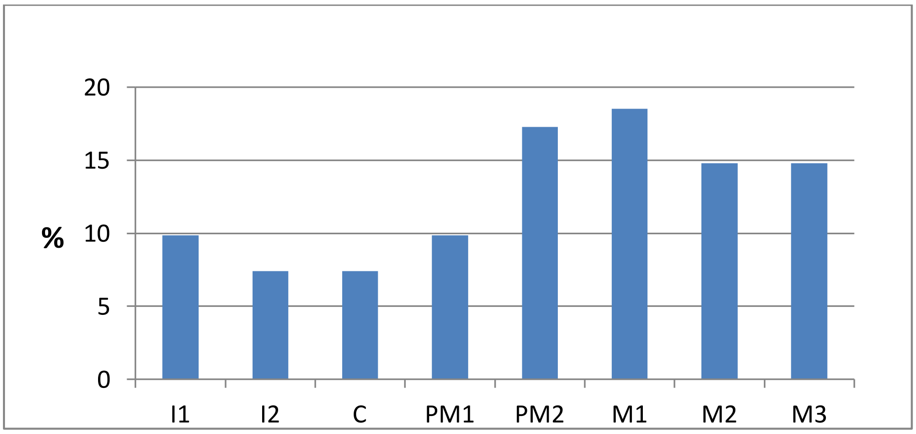


Figure 8: AMTL percentage by tooth; total of 81 teeth lost during life.

The burial (2114) contained the mixed remains of two adults and so included two adult mandibles, both of which had ante-mortem tooth loss. One individual, (2114/1), had lost the left second premolar and the right first premolar, possibly following from the development of an abscess at this site, and the third molar. The other adult (2114/2) had lost four teeth, the first incisor and all of the molars of the right side. The older adult male (2100), with only fragmentary right side dentition remaining, had lost at least twelve teeth during life and the alveolar bone that held the teeth had completely remodelled, indicating the teeth were lost some time before death (Plate 20). The disarticulated remains from (2098) included a fragmented mandible of a young adult who had lost the left first incisor during life. Another disarticulated collection (2099) included the mandible of a young adult who had lost the left second premolar. S.F.32 included the fragmented skull of a possible female who had ante-mortem loss of the upper right second premolar where the alveolar bone was healing. As described earlier, (3015) had poor dental health with caries and abscesses and also had lost the lower left second premolar during life. Skeleton (4015), also described above with caries and abscesses, had lost the upper right second premolar and first molar. The upper left third molar and upper right second and third molars were not present and were most likely missing due to the large abscesses in these areas. Individual (4036), an adolescent, was represented only by the mandible which showed crowding of the anterior teeth, possibly due to the retention of the deciduous second molar, which was still in situ. The alveolar bone in the area of the left anterior teeth shows the loss of at least one of the anterior teeth. Skeleton (4019), a middle adult male, had lost the upper right third molar, though a fragment of root remained in the socket around which the alveolar bone was in the process of healing, suggesting that this had been lost a short time before death.

All of the teeth of skeleton (4019), an adult male, were high in the sockets with the roots exposed through recession of the alveolar bone; though this can be a natural occurrence with age, together with moderate pitting visible in the area of the upper canine, this points to periodontal disease (Hillson, 1996, 263). (4045), an older adult with fragmented skull and mandible showed massive ante-mortem tooth loss. Only the anterior area of the maxilla was present and showed that the upper incisors had all been lost and the alveolar bone completely healed. In the mandible, both canines and both second premolars had been lost, along with the left second and third molars and the right third molar. The alveolar bone in the area of the mandibular canines was in a more advanced state of healing than that of the molar areas suggesting that the canines were lost earlier than the molars. S.F.144 included a fragmented adult mandible which showed ante mortem tooth loss of the first incisor. Individual (6071 A/G), as described earlier, had very poor dental health with three abscesses and also showed loss of at least ten, possibly twelve teeth during life. The upper right second incisor and second molar, lower right side incisors, premolars, first and second molars and lower left side incisors, first premolar and first molar had all been lost. The sockets of the lower canines were actually healing over, indicating that the canines were held in place only by the soft tissues that suggests advanced periodontal disease. S.F. 443/625 included the mandible of an adult, probable female, mandible, who had lost the right second molar during life. The maxilla and mandible of (6030), an adult male, showed massive ante-mortem tooth loss of thirteen teeth. Though the majority of the teeth had been lost post-mortem, it could be seen that all upper molars and the upper left second premolar had been lost, and in the lower dentition the left molars and right first molar were all missing ante-mortem. Those teeth that remained were merely stubs and roots. Individual (7015), previously described in the section on caries, also showed massive ante-mortem loss of sixteen teeth. The upper dentition was more affected with all molars and premolars and the right canine lost during life; in the lower dentition the left second premolar, first and third molars and right first incisor and first molar had been lost.

Calculus

Little calculus was recorded in the collection, although whether this is an indication of diet or poor survival due to the fragmentary nature of many of the remains is unclear. Four individuals showed slight calculus, (3111), (3015), (4015) and (6032); one showed moderate calculus (7015) and one showed advanced calculus (6071 A/G), which extended over the occlusal surfaces of those few teeth that remained. All were adults and in four cases, (3015), (4015) and (7015) and (6071 A/G) had poor dental health overall.

Broken Teeth

A large number of broken teeth were recorded in the collection, in most cases however, it was not possible to determine when these teeth had been damaged. Owing to the rubble nature of the deposits in which the burials were placed and the amount of disturbance that occurred due to subsequent burials and later construction, the most of the damage is likely to be post-mortem. In two cases however, it was noted through signs of healing and attrition that the damage was done during life.

The middle adult male (4019) had lost the upper right third molar during life; however a fragment of root remained in the bone socket around which the alveolar bone was healing. It is possible that this tooth was knocked out deliberately or became rotten with caries and so broke leaving the fragment of root in the socket. Individual (4038), an adolescent had upper anterior teeth in extremely poor condition (Plate 22). The incisors and canine were worn down to the root on the left side and the right side anterior teeth were crooked leaning towards the left side. Part of a root of a deciduous tooth remained in the bone between the left first molar and premolar and another part of root fragment was present in the bone on the buccal side of the left canine. This could possibly be evidence some early but healed trauma to the left side of the mouth which perhaps broke the deciduous teeth and caused the permanent teeth to grow in crookedly.

Dental Attrition and Occupational Wear

The Scott system was used to score attrition on the molars; the molars were divided into their four quadrants, the rate of attrition for each quadrant scored separately, then the total for that tooth calculated by adding the results (Scott, 1979, 213). A mean for each age group, only including those individuals with the relevant tooth present, was then calculated. The results for the left first lower M1 and left second lower M2 molars are illustrated in Figure 9.

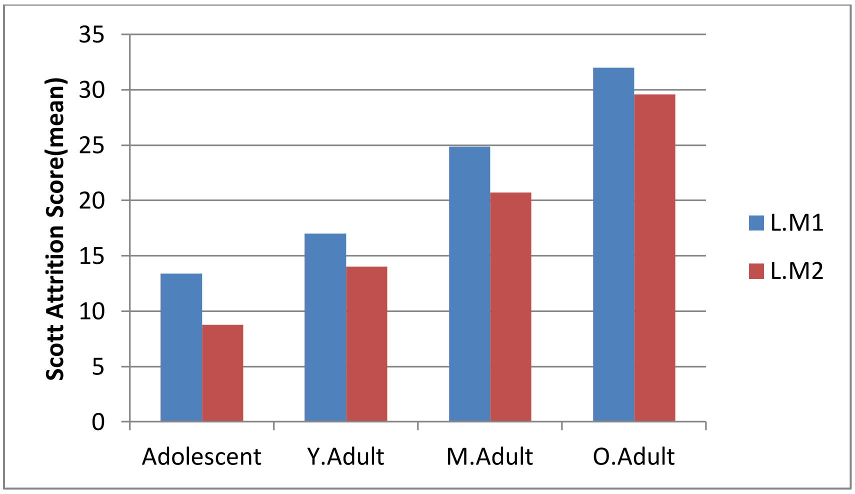


Figure 9: Attrition recorded for first and second left side molars.

The absence of third molars among some of the adults, either through impaction or congenital absence caused discrepancies in the recording of attrition for this tooth and so are not included in Figure 9. Dental attrition for the most part correlated with advancing age in this collection. Adolescents and younger adults were found to have less wear on the teeth than middle and older adults. The high degree of ante-mortem tooth loss amongst the older adults can affect the degree of attrition on the remaining teeth and made the recording of the later stages of attrition difficult however. Attrition was also noted on the deciduous teeth among the child remains, but was difficult to rate due to the lower number of deciduous teeth in situ and to the fact that many of those children represented had mixed deciduous and permanent dentition.

Wear, which most likely had an occupational cause, was also noted on a number of individuals. Skeleton (6043), an adolescent, showed wear on the lingual surfaces on the surviving upper anterior teeth with corresponding wear on the labial surfaces of the lower canines, indicating that something was habitually being drawn out of the mouth in a downwards direction over the surfaces of the anterior teeth. This same pattern was noted on the anterior teeth of children in collections (7037) and S.F.910 and in (9010), an adult female, suggesting that these individuals were carrying out very similar activities. Such patterns of wear on the anterior teeth may explain the high rate of ante-mortem tooth loss of first incisors.

Many of the loose teeth recorded in the collection also showed signs of attrition, some of which was extreme with just the tooth root remaining. As none of the loose teeth in the collection could be reattributed to particular individuals however, use of this information is unfortunately limited.

Joint Disease

Eleven locations across the adult skeletons were examined for evidence of osteoarthritis. This category includes all pathological changes to the larger joints. The presence of eburnation can be pathognomonic of osteoarthritis and indicates bone rubbing against bone. In the absence of eburnation two of the following changes must be recorded in order to diagnose osteoarthritis; marginal osteophytes or new bone growth on or around the joint surface, pitting on the joint surface and changes to the contour of the joint surface (Waldron, 2009, 34). Osteoarthritis identified in this way was recorded as 'positive'; those joints that showed no sign of osteoarthritis were recorded as 'negative', (Figures 10 & 11).

	FEMALE				**MALE**			
	L		R		L		R	
	N	n	N	n	N	n	N	n
temporo-mandibular	4	3	5	5	4	2	5	4
sterno-clavicular	0	-	2	-	5	2	4	2
acromio-clavicular	0	-	2	-	5	2	3	1
gleno-humeral	3	-	5	-	7	2	4	1
elbow	2	1	4	1	7	1	8	1
wrist	2	-	1	-	6	2	6	2
hand	1	-	1	-	4	2	4	1
hip	1	1	3	2	4	2	5	3
knee	1	-	3	1	5	4	6	4
ankle	1	-	1	-	8	5	9	7
foot	1	-	1	-	1	-	1	-
costo-transverse	1				11			
vertebral body rim	-				7			
Schmorl's nodes	3				4			

Table 18: Osteoarthritis/Sex. N=number of complete joints present; n=number of joints affected.

Unfortunately in the skeletal collection from the Knowe of Skea, the stone and rubble nature of the deposits in which they were buried caused a high degree of fragmentation of the bones. Much of this damage occurred at the ends of the bones where the bone is less dense and more likely to fragment, and is where the joint surfaces are found. The incomplete state of many of the skeletons also meant that some parts of the joints were not available for examination. This affected the recording of the presence or absence of osteoarthritis in a number of cases and such joints are recorded as 'incomplete/missing'. Figures 10 and 11 illustrate the recorded joints from the left and right side of the adults in the assemblage and show the high number of incidents of incomplete or missing joints.

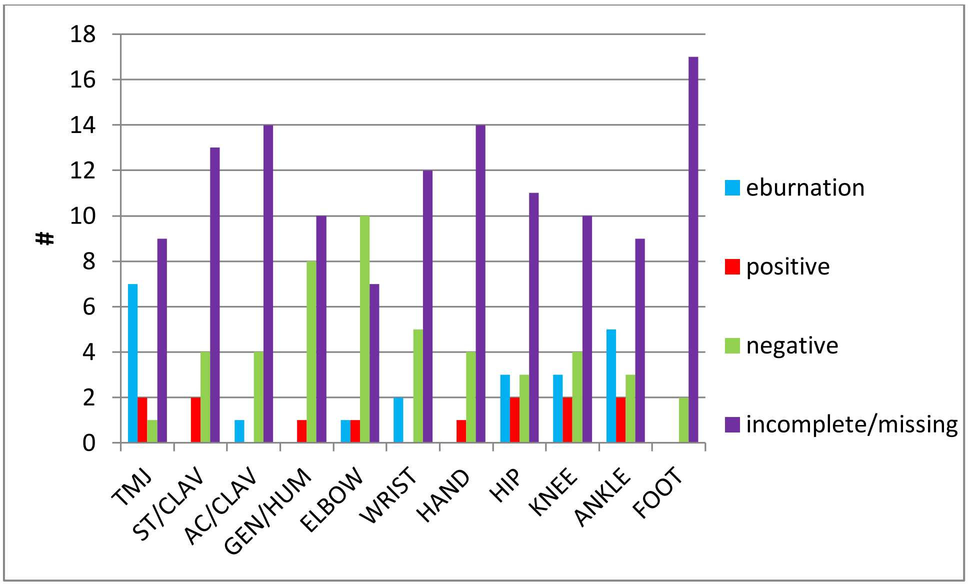


Figure 10: **Right side joint disease.**

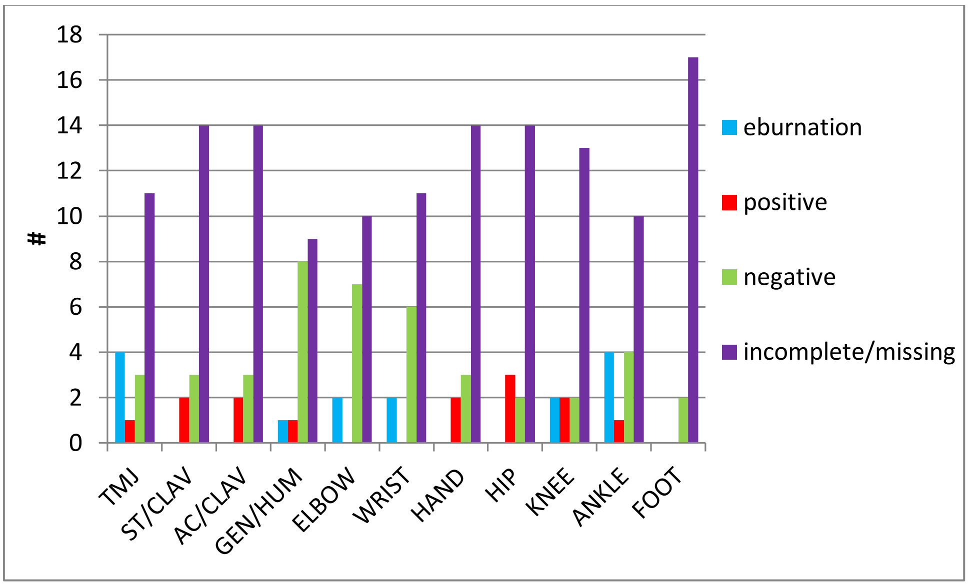


Figure 11: **Left side joint disease.**

The vertebrae of each of the articulated individuals were also examined for evidence of degeneration related to osteoarthritis. Due to the fragmentary condition of the majority of the vertebrae in the collection, osteoarthritis of the costo-transverse and vertebral facets was recorded merely as ‘present’ when identified. Eburnation of the costo-transvere joints was found mainly on the ribs though pitting and splaying of these joints surfaces also indicating osteoarthritis was common. Twelve individuals showed osteoarthritis of the costo-transverse joints. Eburnation on the inferior or superior vertebral facets was noted mainly in the cervical and lumbar vertebrae and was recorded on seven individuals.

The vertebrae were also examined for signs of intervertebral disc disease, which is recognized through the presence of pitting on the surface of the vertebral body and marginal osteophytes (Waldron, 2009, 43).

Nineteen individuals had spinal degeneration of varying degrees of severity. As these conditions primarily affect adults and are generally progressive, it is unsurprising that the majority of individuals with joint disease were in the adult age categories. However, two individuals for whom spinal degeneration, though slight, was recorded were adolescents - (106) and S.F.443. Two individuals, (7039) and (6030), showed marked osteophytic spurring on the margins of the bodies of the lumbar vertebrae which may have been as a result of spinal trauma. Seven individuals, (2021, 2098, 2100, 4015, 6030, 6032, 7039), showed evidence of stress on the spine in the form of Schmorl’s nodes.

Metabolic Disease and Non-specific stress markers

This disease category concerns pathology identified in the assemblage attributable to any form of dietary or immune insufficiency, which expresses itself on the skeleton.

Vitamin C deficiency / Scurvy

Prolonged Vitamin C deficiency leads to scurvy and will affect the skeleton in its more advanced stages. None of the adult remains in the collection from Knowe of Skea displayed any clear evidence of scurvy, however some lesions identified on infant remains may be indicative of the disease. Infant bones in a number of the larger concentrations of bones show pathology suggestive of illness; all of these bones show irregular new bone formation suggesting subperiosteal haemorrhage which occurs in scurvy (Lewis, 2007, 132).

Table 19 lists those contexts in which infant bones showed evidence of possible scurvy as outlined by Ortner, (1997/2001) and Brickley & Ives, (2006). These studies involved examination and recording of all cranial bones, scapulae and long bones for abnormal porosity; and the recording of proliferative bone growth on any other bones, though this may be a symptom of a number of conditions or natural growth process (Brickley & Ives, 2006, 164). Endocranial lesions, more often discussed in connection with infection (see below) have also been identified in individuals thought to have suffered from scurvy (Brickley & Ives, 2007; Brown & Ortner, 2011).

The presence of such conditions on the bones of infants and children in the Knowe of Skea collection was recorded; unfortunately, due to the commingled nature of the majority of the infant bones, the identification of such illness on individuals was not often possible. Skeleton (2117), an infant aged by dental development to between 6 and 9 months showed abnormal porosity in the maxilla and ilium; together with the proliferative new bone growth seen on the other bones of this skeleton, it is probable that these are indicative of scurvy. The other bones identified with such lesions in the collection are of much younger infants and may be more indicative of maternal health and nutrition.

Context	S.F.	Age	Bones Affected
2107	-	Perinate	Mandible, Rx1
2117	-	Infant (6-9mnth)	Maxilla, Lx1
2124/2117	-	Infant (7-12mnth)	Ilium, Lx1
2118	-	Foetal (c32wks)	Ilium, Lx1
2121	-	Perinate	Maxilla, Rx2; Lx2 Scapula, Rx1; Lx1 Ilium, Rx2; Lx2
3011	-	Neonate	Parietal, R Sphenoid
3015	-	Perinate	Maxilla, Rx1
3107	-	Perinate	Maxilla, Rx2; Lx2 Mandible, Rx1 Sphenoid, x1 Ilium, Rx1; Lx1
3023	42	Perinate	Maxilla, Rx1; Lx1
3024	43	Perinate	Maxilla, Lx1
3036	51	Perinate	Scapula, Lx1
3036	52	Perinate	Sphenoid, x1
3066	63	Perinate	Mandible, Lx1
4036	-	Perinate	Maxilla, Rx1 Mandible, Lx1
4038	-	Perinate	Maxilla, Rx1; Lx1 Ilium, Rx1
6055	424	Perinate	Maxilla, Rx1; Lx1 Mandible, Lx1
6076	-	Perinate	Scapula, Rx1
7067	-	Perinate	Parietal fragment Ilium, Rx1

Table 19: Infant Bones showing signs of possible metabolic illness; (2117) and (3107) represent two possible cases of scurvy.

Porotic hyperostosis/Cribra orbitalia

Anaemia in childhood, usually caused by nutritional deficiencies (Walker et al, 2009), often results in pitting or raised areas called porotic hyperostosis on the surface of the cranium and reaction in the orbits called cribra orbitalia, and so the incidences of these lesions have been included here.

S.F.417 included the skull fragments of a child with the right side parietal showing advanced and active porotic hyperostosis (Plate 23). S.F.448 included the skull fragments of a child with healing cribra orbitalia in both orbits and a raised area on the occipital indicating possibly healing porotic hyperostosis. S.F.639, an infant of around 2 years, showed signs of metabolic-related pathology; active cribra orbitalia was present in both orbits (Plate 23), and there were signs of healed porotic hyperostosis on the skull fragments and endocranial pathology following the sulcii in the occipital. All are probably metabolic or dietary related, and given the age of the individual could be due to the stresses of weaning. Little cribra orbitalia was identified amongst the adolescents and adults in the collection though some showed light pitting in the orbits, which may indicate early signs of the condition.

Dental enamel hypoplasia

Also included here are those individuals with dental enamel hypoplasia, lines or pits in the enamel of the teeth. These are evidence of an arrest in the growth and development of a tooth through nutritional deficiency or illness (Lewis & Roberts, 1997).

Dental hypoplasia was identified in nine individuals: (3015) adult dentition, (106) an adolescent (Plate 24), S.F.443/625 adolescent, (6043) an adolescent, (9013) an adolescent, (2118) a child, (6071F) a child, (7037) a child, and (9016 skull/mandible1) an infant. The child’s mandible fragment found in S.F.135 was from a collection of mixed bones and could not be more closely associated to an individual. The poor state of dental health among many of the adults, including some severe attrition and antemortem tooth loss, may have destroyed further evidence of enamel hypoplasia among the older individuals in the collection.

#	age at death	teeth affected	timing of stress
2118	child - 4-6yrs	unerupted M1s; roots of i's	late first year-18months
S.F.135	child- mandible fragment	unerupted molars	12-18months
6071F	child - c8yrs	unerupted C, absent from fully erupted M1	3-7years
6071G	child – c5-7years	loose teeth	<5 years
7037	child – 6-8years	C /M2	c4years onwards
S.F.1051	child – 5-6years	C/PM	4yrs onwards
9016	child – 2.5-3years	m2	c6 months
106	adolescent – 14-16years	I's/C's	4-6years
6043	adolescent – 16-19yrs	M1/C; M3	4-6years & 10-12years
S.F.625	adolescent – 14-16yrs	C/PM/M2; absent on M1	3-8 years
9013	adolescent – 14-16years	PM's / M2	c5years
3015	adult	C	c4-6years

Table 20: Dental enamel hypoplasia

The adult dentition found with the adolescent (3015) had visible lines of hypoplasia on the left mandibular canine from around midway on the crown; as there was no hypoplasia visible on the incisors, this suggested disruption occurred at around four to six years of age. The adolescent, (106) showed hypoplasia on the canines and incisors indicating disruptions in enamel production between four and six years. In S.F.443/625 the adolescent dentition showed lines of hypoplasia on the canine, premolar and in the lower half of the crown of the second molar suggesting disruption in the laying down of enamel occurred between three and eight years. Skeleton (6043) showed two periods of change in enamel production on the second and third molars but nothing on the other teeth which suggested two occurrences of disruption, one between four and six years and another between ten and twelve years. A number of loose teeth collected with the adolescent (9013), including mandibular premolars and second molars, showed a disruption in enamel production occurred at around 5 years.

On (2118) hypoplasia was evident midway on the first molar crowns and also on the root of loose deciduous incisors, which indicated that enamel growth was disrupted at around one year to eighteen months, perhaps at the age of weaning. In (6071F) an unerupted canine crown showed three lines of hypoplasia but none on the erupted first molar suggesting at least three disruptions in enamel production between three and seven years. The child (7037), aged between 6 and 8 years at the time of death, showed lines of hypoplasia on the permanent canines and second molar but not on the incisors which suggests that disruptions to the enamel production occurred from around age 4 years onwards. (9016 skull/mandible1) had pits of hypoplasia on the second molar crowns and at the cemento-enamel junction of the first molar which suggested a period of disruption during the first six months of life.

Two further examples of enamel hypoplasia were identified in the collection. In (6071G), a mixed collection of child remains included a number of loose teeth of a child aged between 5 and 7 years, which showed disruptions in enamel formation. Also, child skull fragments S.F.1051, aged 5-6 years at the time of death, showed enamel hypoplasia on the permanent canine and premolar, which indicated incidences of stress from around 4 years onwards.

The indications from the presence of hypoplasia in this collection would suggest that childhood, in particular between the ages of four and six years, was a period of stress on the health of individuals in this community. These stresses may have contributed to the deaths of those children whose remains have been identified in the collection. However, the individuals described with dental hypoplasia survived long enough for the evidence to present itself on their teeth. The cause of this stress cannot be identified but could be related to poor nutrition and/or disease.

Infectious Disease

It should be pointed out that the majority of infectious diseases in prehistory would have been virulent fast-acting and deadly illnesses that in most cases resulted in early death. Skeletal evidence of infection therefore indicates chronic slow-acting disease, or that the individual may have survived the initial attack of infection or disease and lived long enough with the illness for a reaction to occur in the bones.

Endocranial lesions

Among the infant remains, given the fragmentary nature of many of the bones, only the most obvious of pathologies could be recognised. It was possible however to identify endocranial lesions on many skull fragments (Plate 25). The occurrences were calculated for the most identifiable skull fragments: 7% (15 of 213) of frontal fragments; 20% (13 of 64) parietal fragments; and 10.5% (6 of 57) occipital fragments showed endocranial pathology. These lesions are thought to be connected to meningeal infections, nutritional deficiencies or trauma among children (Lewis, 2004). None of the older children in this collection showed these same endocranial pathologies however, suggesting that the infections that caused them were exclusive to newborns and may be related to the high infant mortality rate.

Non-specific infection

In some cases, evidence of a disease process can be seen on the skeletal remains but the origin of these markers cannot be identified. Periostitis occurs on the surface of bones in reaction to an infection or disease, its presence is recorded but little in the way of a diagnosis can be reached without other indicators on the skeleton to point towards a particular disease or infection. Numerous perinate, neonate and infant bones in the collection showed periostitis on the bones suggesting infection was contracted at, or very soon after, the time of birth and this is also supported by the presence of endocranial lesions, as discussed above. Normal apposition of bone can also appear on the bones of rapidly growing infants and children however and diagnoses from this evidence alone could not be definitive (Lewis, 2007, 135). Periostitis can also heal completely leaving only slight evidence that a previous infection has occurred. The burial (2114) included the leg bones of two adults, one set of which showed evidence of previous infection (Plate 28). The entire diaphyses of both tibiae (B#666 & 667) had a thickened, swollen appearance with spicules of bone on the surface; this was probable osteomyelitis but the surface of the bones showed little or no active infection.

Parasitic infection

During excavation, a calcified cyst measuring 24x30mm was found in the thoracic cavity of skeleton (6030), a middle adult male (Plate 26). On closer examination it was found that this was a probable calcified cyst from hydatid disease, ‘a parasitic disease caused primarily by infection with the dog tapeworm Echinococcus granulosus’ (Waldron, 2009, 111). Infection with the parasite indicates the close association of dogs and other animals with humans and might suggest poor levels of hygiene in domestic areas. Roberts and Cox discuss the incidences of such parasitic infections in Britain in association with greater population concentrations of the Roman period and later, suggesting that sanitation at the sites where they occur 'was not particularly good' (Roberts & Cox, 2003, 125).

Neoplastic disease

This section describes pathologies such as cysts or tumours in the bone. Tumours can be primary or secondary, benign or malignant (Waldron, 2009, 168) and while many might only be identified through x-ray, some can be identified on the bone surface though full diagnosis is not always possible.

The right tibia of (6072), an adult male, had a large lesion 21.35mm long and 6.4mm deep on the surface of the medial malleolus. This was possibly a chondroblastoma (a benign tumour) or even benign cyst as there was little sign of active bony change. Probable evidence of osteosarcoma (a highly malignant bone tumour) was found on (7015), a middle adult male. The right palate showed a small 'sunburst' pattern growth of bone characteristic of osteosarcoma. Whether this was the original site or a metastatic reaction could not be determined, but is most likely linked to the cause of death.

Trauma

Trauma is generally considered any sign of injury or violence that might occur on the bones. Fractures from accidents or violence can be identified on the dry bones and any absence of healing can indicate that the injury occurred around the time of death and may even point towards a cause of death in some cases.

Fractures

Some of the bones associated with the incomplete skeleton of (3111), an adult male, could not be confidently assigned to that individual and included one well-healed but poorly realigned fracture of a left second metacarpal. Two individuals showed healed fractures in the ribs, (6072) and (7039). (6072), a middle adult male, had two fractured ribs on the right and one on the left with signs of reactive bone growth in the form of calluses and signs of healing. (7039), a middle to older age adult male, had very robust ribs though this skeleton was incomplete. One left rib had a fracture which given the robustness of the ribs must have been caused by strong force (Plate

27). The fracture shows signs of healing well, with little sign of infection, but has realigned poorly. (6032), a young adult female, showed one small possible ante-mortem trauma to the left parietal which was well-healed with no associated infection or damage to the skull. (6071A), the adult male skull, showed possible blunt force trauma to the left fontal bone, 8x10mm in size which was well-healed with no associated infection or damage to the skull. As described earlier, (4038), an adolescent who was possibly male, had upper anterior teeth in extremely poor condition. The incisors and canine were worn down to the root on the left side and the right side anterior teeth were crooked leaning towards the left side. Part of a root of a deciduous tooth remained in the bone between the left first molar and premolar and another part of root was present in the bone on the buccal side of the left canine. This could be due to some early but healed trauma to the left side of the mouth.

Spinal Conditions

Spondylolysis is caused when the poor or disorganized union of the vertebral arch during development results in the fracture of the vertebral arch away from the vertebral body, and is "..due to the stresses and strains of upright bipedal posture" (Roberts & Manchester, 1995, 36). This condition is also thought to have some hereditary influence. This is most commonly seen in the lumbar vertebrae of the lower back where the majority of pressure from physical labour and activity is felt. The two parts of the vertebra are generally held close together by ligament and muscle attachments but can become instable, allowing the vertebra to move which can result in pain when nerves or the spinal cord become compressed. Two individuals at Knowe of Skea showed spondylolysis. (4036), an adolescent, showed spondylolysis of a lumbar vertebra and S.F.1500, a mix of fragmented spinal parts with the sacrum and pelvis of an older adult, possibly male, included a fourth lumbar vertebra with the condition.

One individual, (2098), an adult female with Schmorl's nodes indicating intervertebral disc herniations also had lesions on the inferior surfaces of three thoracic and one lumbar vertebra suggestive of damage to the intervertebral discs and endplate in the form of avulsion fractures. Such injuries can be caused by seemingly insignificant accidents through normal activities and may cause some discomfort but minimal loss of mobility (Maat, 2000, 147).

Two individuals in the collection showed possible trauma to the lumbar vertebrae. (6030), a middle adult male, showed a fracture to the inferior facets of the fifth lumbar vertebra which had caused the neural arch to separate from the rest of the vertebra. Unlike the cases of spondylolysis, the immediate area of the fractured bone showed signs of proliferative reactive growth and all of the lumbar vertebrae showed osteophytic spurring on the margins of the vertebral bodies. (7039), the partial skeleton of an older adult male showed a probable compression fracture to the first lumbar vertebra with osteophytic spurring on the anterior margins of the vertebral bodies. This individual also showed fractures to the ribs.

Osteochondritis dissecans

Osteochondritis dissecans was identified on the distal femur of the disturbed burial of (6096), an adult male (Plate 29). Osteochondritis dissecans is the failure or fracture of part of the joint in which the affected fragment of bone may become detached and remain in the joint. Though the condition is usually asymptomatic, the joint may become swollen with limitation of movement, and osteoarthritis can be a long-term complication (Waldron, 2009, 154). In the case of (6096), both the distal femur and corresponding proximal tibia showed arthritic lipping of the articular areas and eburnation of the articular surfaces indicating this was a long-term condition that had developed into osteoarthritis of the knee which would have been painful and affected mobility.

Trepanation / Trephination

"Trephination involves the production of a defect in the skull vault to create communication between the cranial cavity and the environment, whose success depends upon avoidance of injury to the meninges, brain and blood vessels" (Aufderheide & Rodriguez-Martin, 1998, 31).

One older adult male, (2100), portrayed evidence of a probable trepanation, the deliberate removal of a piece of bone from the skull (Plate 30). There was a large area of reddish-brown staining on the left parietal and a large, roughly oval-shaped, depression 48.3mm x 26.6mm in size. The sides of the depression were regular though two areas were slightly deeper than others and the interior of the skull at this point showed pits in the inner table, possibly due to the trepanation or to slight infection.

The shape and appearance of the depression suggest that the method used to carry out this trepanation may have been either the ‘scraping’ or ‘push-plough’ method described by Parry, (1923, 458). The appearance of the depression seems to suggest that though the procedure may have penetrated through the inner diploe of the skull and a section of bone may have been removed, little of the brain was ever exposed.

There was also a second area of possible old trauma running in an anterior-posterior direction along the left parietal through the area of greatest staining. It has been suggested that trepanations were carried out for various reasons, including ‘relieving headache, cure epilepsy or let out evil spirits’ (Waldron, 2009, 161). With the large area of staining on the skull and possible early trauma, it is possible that trepanation was attempted to relieve pain after a head injury. It was unclear whether the trepanation was completed through the bone as the area was in an advanced state of healing at the site. The evidence of healing indicates that the individual survived the operation that must have been performed a considerable length of time before the individual eventually died.

Congenital conditions

The more pronounced congenital disorders visible on the skeleton are rare in most archaeological assemblages. Such congenital disorders include spina bifida, osteogenesis imperfecta and anencephaly; the occurrence of these disorders in the past was most likely much as it is today, however the fact that many of these conditions were “incompatible with life” (Roberts & Manchester, 1995, 31) would have resulted in the death of infants soon after birth. Those disorders that can be identified on archaeological skeletal remains tend to be less pronounced and may not have been noticed during life.

Absence of third molar

The non-eruption of the third molar is not uncommon and has been shown to be a hereditary trait (Hillson, 1996, 114), though it is difficult to determine without x-ray whether the teeth were never formed (agenesis) or if they have become impacted. Three individuals in the Knowe of Skea collection showed a lack of third molars. (2115), a middle adult female, lacked both upper third molars and the lower left third molar. (6071 A/G), the skull of a middle adult male, had very poor dental health with massive ante-mortem tooth loss. The mandibular dentition showed that the lower third molars had been lost post-mortem; the upper third molars however were not present and were possibly congenitally absent. The third individual was represented by a mandible, (9002, B#1472) which showed no third molars. As the dentition however was that of a late adolescent or young adult based on the slight attrition on the other molars, it is possible in this case that the third molars simply had yet to erupt.

Knock-knees

Two individuals had knock-knees or genu valgum whereby the knees were orientated inwards and the lower legs bend outwards. This usually occurs as a phase of normal growth in childhood but some may retain the condition into adolescence and adulthood. Genu valgum may be caused by metabolic bone disease such as rickets but are usually the result of hereditary or genetic conditions (Sharrard, 1976). Neither of the Knowe of Skea individuals, (6032), a young adult female and (9003), an adolescent, showed any other evidence of metabolic illnesses; the straight and healthy appearance of the other bones indicates hereditary influence in the occurrence of the condition.

Non-metric traits

The majority of skeletal features that are thought to have possible genetic or hereditary influences on their occurrence are described as non-metric or discrete traits. These are normally minor and asymptomatic skeletal anomalies that are identifiable by eye rather than measurement. The most commonly observed non-metric skeletal traits can take four forms: ossicles, small bones which occur between the cranial sutures; abnormal proliferations of bone such as bridges or spurs;

ossification failure which results in bony defects like septal apertures of the humerus; and variations in the number or location of foramina (Buikstra & Ubelaker, 1994, 85). These skeletal variants are asymptomatic and may often only be visible on x-ray in the living, or on skeletal remains. The recording of many of the traits of the skull is often adversely affected by the fragmentary nature of many skulls recovered from archaeological contexts, as was the case with much of the material from the Knowe of Skea. Only those more prominent traits identifiable in fragmentary skulls are reported here.

Metopic suture

The metopic suture divides the left and right sides of the frontal bone in infancy but fuses and is usually obliterated in childhood. Retention of the suture into adulthood is thought to be controlled by genetic factors, similar to those that control the incidence of cleft palate, and can be a dominant trait in families (Thorgersen, 1951, 203). Three individuals at Knowe of Skea had retained metopic sutures; (4015), an adult female, (4019) an adult male and (9003), an adolescent.

Wormian bones/ Bathrocephaly

The occurrence of Wormian bones in the skull is believed to be caused by a disturbance during the growth and development pattern of the skull, though the cause of this disturbance is not fully understood (Barnes, 1994). Five of the individuals at Knowe of Skea showed this trait; (2115) and (2118) had ossicles in the lambdoid suture, (4019) had ossicles in the coronal suture while (4045) and (6071 A) showed ossicles in both the lambdoid and coronal sutures. Wormian bones are often present in the condition known as bathrocephaly, which causes a bulging outwards of the occipital region of the skull (Miles, 1989). Two individuals at Knowe of Skea, (2115) and (6071 A), displayed both Wormian bones and bathrocephaly (Plate 31).

Proliferations of bone

Abnormal proliferation of bone in the form of a supratrochlear spur, a process arising from the medial supracondylar ridge above the medial condyle of the humerus (part of the elbow) (Buikstra and Ubelaker, 1994, 94), was located on the left humerus of (6030), an adult male. Two individuals, (2100) and (6072), both adult males, showed abnormal proliferation of bone in the spine in the form of atlas bridging; both displayed posterior bridging whereby bony spicules joined the superior articular facet with the posterior arch. Thirteen individuals showed both complete and partial accessory transverse foramina of the cervical vertebrae, and several perinate neural arches in (4017) and S.F.200 already showed this trait.

Ossification failure

Ossification failure in the form of septal apertures, a perforation in the distal humerus, and sternal foramen, an opening in the body of the sternum, were identified in five individuals. S.F.625, an adult female and (7015), an adult male, had sternal foramen. (4036), an adolescent, had large septal apertures on both the left and right humerus. (4045), an adult male, had a pinhole septal aperture on the left side and (6032), an adult female, showed a septal aperture on the right humerus.

Spinal anomalies

Numerical error of segmentation, (NES), and cranio-caudal border shifting, (CCBS), result in the changing of the normal sequencing or spacing of the vertebral column (Buikstra & Ubelaker, 1994). NES simply means that there are unusual numbers of vertebra. Rather than the usual twelve thoracic vertebrae, an individual can have thirteen with no ill-effects. CCBS results in the shifting of the limit of the different regions of the vertebral column so that instead of having five lumbar vertebrae, an individual can have six lumbar and four sacral vertebrae; or the fifth lumbar vertebra could be fused to the sacrum.

Two individuals (6030) and (7015) displayed six sacral segments. (6072) showed partial lumbarisation of the first sacral segment; while one individual (3015) had thirteen thoracic vertebrae. This may be associated with (3015)'s abnormal first rib which may in fact be the first rib and a supernumerary rib which had fused together during development.

Squatting facets

Squatting facets occur on the distal tibia and are extensions of the distal articular surface and are said to have possible hereditary or occupational origins. Such facets were recorded on the right and left tibia of (2011/2012), an adult male, with corresponding facets also occurring on the superior surface of the talus. The right tibia of (6030), an adult male, also showed a squatting facet.

Vastus notch

Vastus notches occur on the superolateral edge of the patella and occur quite frequently in this collection given the number of individuals. (3118), an adult who was probably female, had vastus notches on both left and right patella; (4045), (6076) and S.F.274 each showed a vastus notch on the right patella only though both right and left were present. Three patellae with vastus notches also occurred in the disarticulated bones from general finds examined separately; a left and right patella from context (3113) and a left patella from context (8104).

17.Rodent gnawing on fibula fragment of burial (106).

18.Two mandibles from burial (2114). Mandibles of both males and females were robust and angular, particularly in the chin. Left, female; Right, male.

19.The most complete skull in the assemblage; (4019) a middle adult male.

20.Ante mortem toothloss; (2100), mandible, (above left). Caries; (3015), maxilla, left molars, (above right).

21.Abscess: (2114), female mandible showing abscess at the roots of first molar.

22.(4038), left maxilla showing broken fragments of tooth and signs of remodelling in the alveolar bone. The broken anterior teeth are also visible.

23. Cribra obitalia; left orbit of infant S.F.639(above left). Porotic Hyperostosis; parietal S.F.417 (above right).

24.Dental enamel hypolpasia; (106), upper left canine.

25.Endocranial lesions. Perinatal parietal, (above). Frontal bone from infant (2117), (left).

26.Hydatid disease; calcified cyst possibly of tapeworm *Echinococcus granulosus* found in the thoracic area of burial (6030), (above left)
27.Fractured rib; adult male (7039). The fracture was healing well with no indication of infection on the bone though it had realigned poorly, (above right).

28.Nonspecific infection; (2114) tibia showing infection has altered the shape of the shaft of the bone, (above left).
29.Probable osteochondritis dissecans; (6096) adult male distal femur fragment, (above right).

30.Trephination; (2100) left parietal.

31.Wormian bones; ossicles in the lambdoid suture of adult female (2115).

6. Radiocarbon Dates and Stable Isotope Analysis

A total of 40 samples of human bone from the collection were submitted to the Scottish Universities Environmental Research Centre (SUERC) AMS Facility between 2005 and 2012; of these samples 19 were chosen from the most complete burials identified during the excavations and 19 were selected during the skeletal analysis. Samples from burials (106) and (2021) were dated in the early stages of the excavation as part of a separate study and the available information is provided to the author by EASE Archaeology Ltd. Human bone samples were taken from 17 adults, 7 adolescents, 4 children, 4 infants and 8 late foetal/perinates (see Table 21).

Male	Female	Adolescent	Child	Infant	Late Foeal/ Perinate
6030	6055/625	4036	6061	2117	7094/1064
6096	6065	4038	6071(H)	9023	4030/188A
2100	9010	9003	6071 mix	9016	4030/188B
6076	2098	3015	6014/251	6055/417	4030/188C
6072	6032	6055/443			4030/188D
2114		6043			6055/440
4045		106			4002/126
7015	? 3118				9007
4019					
3111					
2021					

Table 21: Human bone samples sent to SUERC for radiocarbon dating and isotopic analysis.

It was found during analysis that one of the samples, SUERC-8396 burial (2098), from the first set of radiocarbon dates had been incorrectly identified as human and was in fact a cattle bone. A new sample of human bone from (2098) was subsequently dated (SUERC-35313), and a number of samples of animal bone were also purposefully dated, including one sheep burial, one cow burial and a dog burial (Table 22).

Radiocarbon Dates

Results showed that burial activity took place on the Knowe of Skea from as early as the fourth century BC to the fifth century AD with burial activity concentrated between 200BC-200AD.The early date returned for the perinate S.F.1064 prompted closer examination of this burial; once the stratigraphic context and location of the burial had been identified it became clear that this was in fact a much earlier burial than the Phase 16 cemetery. This infant had been placed in material used to build up the level of the ground onto which the wall of Structure H was built and so predated the cemetery phase of the site by hundreds of years.

The dates provided for inclusion in this study form part of a larger ongoing programme of sampling, dating and statistical analysis being carried out by EASE Archaeology Ltd and SUERC. Greater investigation and discussion of these dates will be provided in any forthcoming publications that may arise from that research (G.Wilson *pers comm*., Feb.2015).

Lab No.	Context	B.P.	+/-	Calibrated Date (68% probability)	Calibrated Date (95% probability)	$\delta^{13}C$‰	$\delta^{15}N$ ‰	C/N ratio
SUERC -8404	3112 cow	1740	35	245AD(68.2%)340AD	220AD(95.4%)410AD	-22.1	4.8	3.2
SUERC -8396	2098 cow	1720	35	250AD(29.6%)300AD 310AD(38.6%)390AD	240AD(95.4%)410AD	-21.8	4.8	3.1
SUERC -8395	1095 sheep	1585	35	420AD(27.5%)470AD 480AD(40.7%)540AD	400AD(95.4%)560AD	-21.2	6.4	3.3
SUERC -27909	9048 dog	2530	30	790BC(25.6%)740BC 690BC(14.7%)660BC 650BC(25.7%)590BC 580BC(2.3%)570BC	800BC(32.1%)740BC 700BC(63.3%)540BC	-17.5	10.4	3.3

Table 22: List of radiocarbon dates from animal bone samples.

Lab No.	Context	B.P.	+/-	Calibrated Date (68% probability)	Calibrated Date (95%probability)	$\delta^{13}C$‰	$\delta^{15}N$‰	C/N ratio
SUERC-8400	2100	2065	35	160BC(14.1%)130BC 120BC(54.1%) 40BC	180BC-20AD	-19.0	12.5	3.1
SUERC-8401	2114	1950	35	0 - 85AD	40BC-130AD	-19.2	13.0	3.4
SUERC-8402	3015	2060	35	160BC(11.8%) 130BC 120BC(54.2%) 30BC 10BC (2.3%) AD	180-20AD	-18.0	12.2	3.2
SUERC-8403	3111	1665	35	340 – 425AD	250AD(91.1%)440AD 480AD(4.3%) 530AD	-20.9	9.1	3.5
SUERC-8406	4036	2130	35	340BC(1.4%) 330BC 210BC(66.8%) 90BC	360BC(14%) 290BC 210BC(81.4%) 40BC	-20.7	11.0	3.4
SUERC-8410	4038	2095	35	170- 50BC	210-20BC	-19.0	13.0	3.3
SUERC-8411	4045	1915	35	55-130AD	AD(92.8%) 180AD 190AD(2.6%) 220AD	-21.1	11.2	3.4
SUERC-8896	4019	1875	35	70AD(59.1%) 170AD 190AD(9.1%) 210AD	60 -240AD	-18.9	13.1	3.3
SUERC-27910	9010	2030	30	90BC(6%) 70BC 60BC(62.2%) 20AD	160BC(3%) 130BC 120BC(92.4%) 60AD	-18.5	10.7	3.2
SUERC-27911	6030	2085	30	160BC(20.3%)130BC 120BC(47.9%) 50BC	200 – 30BC	-18.7	11.7	3.3
SUERC-27912	6043	2010	30	46BC-25AD	100BC-70AD	-18.3	11.2	3.2
SUERC-27913	6032	1905	30	65 – 130AD	20AD(92.1%) 180AD 190AD(3.3%) 220AD	-19.3	11.1	3.3
SUERC-27914	6076	2025	30	55BC – 25AD	160BC(1.5%) 130BC 120BC(93.9%) 60AD	-18.3	11.2	3.2
SUERC-27918	6065	2050	30	110BC – 0AD	170BC – 20AD	-18.4	11.4	3.3
SUERC-27919	6072	1960	30	0AD – 75AD	40BC(91.5%) 90AD 100AD(3.9%) 130AD	-19.3	10.9	3.1
SUERC-27920	7015	1905	30	65 – 130AD	20AD(92.1%) 180AD 190AD(3.3%) 220AD	-19.6	11.0	3.6
SUERC-27921	6061	2000	30	40BC (64.1%) 30AD 40AD (4.1%) 50AD	60BC – 80AD	-19.0	11.6	3.3
SUERC-27922	6096	2070	30	160BC(12.6%)130BC 120BC(55.6%) 40BC	180BC-0AD	-18.4	12.6	3.6
SUERC-27923	9003	2070	30	160BC(12.6%)130BC 120BC(55.6%) 40BC	180BC-0AD	-18.6	12.5	3.5
SUERC-35303	SF625	2100	30	170BC(60.8%) 90BC 70BC(7.4%) 50BC	200-40BC	-18.9	12.6	3.2
SUERC-35304	SF443	2060	30	160BC(8.1%) 130BC 120BC(59.3%) 30BC 10BC (0.8%) 0AD	170BC-10AD	-18.3	12.9	3.2

Lab No.	Context	B.P.	+/-	Calibrated Date (68% probability)	Calibrated Date (95%probability)	$\delta^{13}C$‰	$\delta^{15}N$‰	C/N ratio
SUERC-35305	SF440	2180	30	360BC(44.7%)280BC 240BC(23.5%)190BC	370-160BC	-17.9	13.7	3.2
SUERC-35306	SF188A	2140	30	350BC(11.3%)320BC 210BC(56.9%)110BC	360BC(19.9%) 290BC 230BC(75.5%) 50BC	-19.8	12.3	3.2
SUERC-35307	SF188C	2220	30	370BC(7.8%) 340BC 310BC(60.4%)200BC	380-200BC	-18.3	12.5	3.2
SUERC-35308	SF188D	2125	30	200-100BC	350BC(7%) 310BC 210BC(88.4%) 50BC	-19.1	14.2	3.3
SUERC-35309	2117	1815	30	135AD(43.5%)200AD 205AD(24.7%)240AD	120AD(91.2%) 260AD 290AD(4.2%) 330AD	-21.7	10.9	3.2
SUERC-35313	2098	1945	30	15 – 85AD	20BC – 130AD	-19.9	11.4	3.2
SUERC-35314	9023	1950	30	15 – 85AD	40BC – 130AD	-19.9	12.1	3.3
SUERC-35315	SF188B	2170	30	360BC(40.3%)290BC 230BC(4%) 220BC 210BC(23.8%)170BC	370BC(92.6%) 150BC 140BC(2.8%) 110BC	-18.3	15.3	3.2
SUERC-35316	7074 (SF1064)	2680	30	890BC(7.8%) 875BC 845BC(60.4%)800BC	900-800BC	-20.4	10.3	3.2
SUERC-42223	6071H	1878	37	75AD(49.7%)140AD 150AD(10%)170AD 194AD(8.5%) 210AD	58-233AD	-20.5	13.8	3.2
SUERC-42227	6071mix	1858	37	90AD(6.1%) 100AD 72AD(62.1%) 239AD	72-239AD	-19.9	13.3	3.2
SUERC-42228	SF251	2003	37	44AD (62.2%) 139AD 39AD(7.4%) 50AD	104BC-77AD	-20.0	13.5	3.4
SUERC-42229	SF417	1892	37	60AD(62.2%)139AD 160AD(1.8%)165AD 197AD(4.2%)208AD	28AD(2.1%)39AD 50AD(93.3%)225AD	-20.6	13.8	3.3
SUERC-42230	9016	2077	37	162BC(19%)131BC 119BC(49.2%)47BC	196BC-2AD	-19.7	14.0	3.2
SUERC-42231	9007	2028	37	91BC(9.5%) 71BC 60BC(58.7%)25AD	161BC(5.5%) 133BC 117BC(89.9%) 57AD	-19.6	13.5	3.3
SUERC-42232	SF126	2094	37	167BC(54.5%) 89BC 76BC(13.6%) 56BC	340BC(1%) 329BC 204BC(92.3%)37BC 30BC(1%) 20BC 12BC(1.1%) 2BC	-18.8	14.5	3.3
SUERC-42233	3118	1854	37	93AD(2.9%) 98AD 125AD(65.3%)220AD	75-240AD	-19.7	14.1	3.4

Table 23: List of radiocarbon dates and isotopic data received from SUERC between 2005 and 2012.

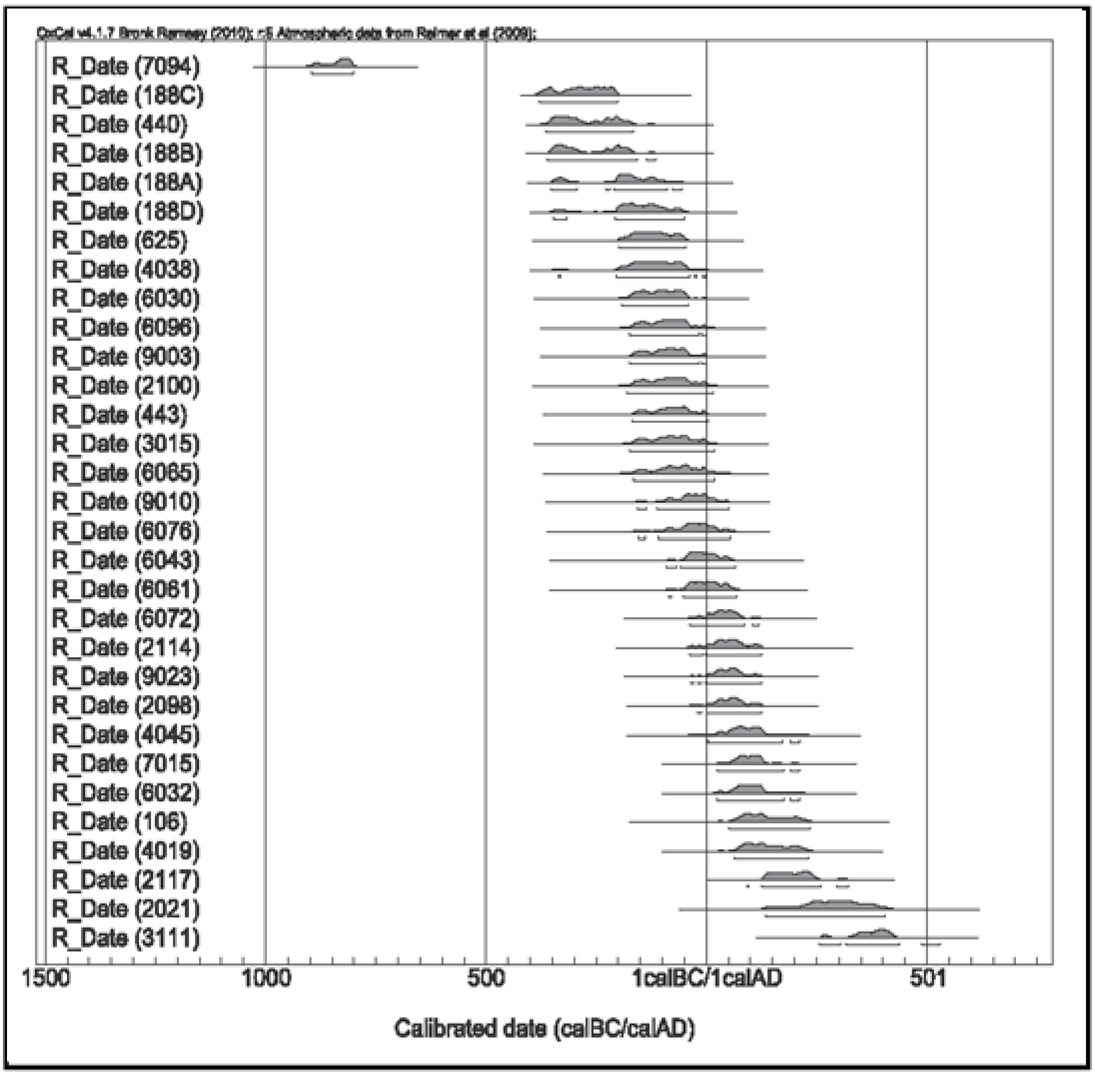


Figure 12: Calibrated dates from human bone samples using OcCal 4.1.7. Chronological order.

Stable Isotope Analysis

Methodology

The results of this analysis were used for two purposes – to interpret the diet of the people buried at Knowe of Skea and to examine any evidence for breast feeding and weaning among the infants. All of the analysis was carried out at SUERC and methods of collagen extraction and standards employed are described in Sayle *et al*, (2013); further detail will also become available in future publications.

The ratios of carbon isotopes ($^{13}C/^{12}C$, expressed as $\delta^{13}C$) and nitrogen isotopes ($^{15}N/^{14}N$, expressed as $\delta^{15}N$) in bone collagen are analysed to provide information on past diet. Bone collagen is used specifically to reveal the protein part of the diet (Kellner & Schoeninger, 2007). $\delta^{13}C$ isotopes can be utilised to determine the proportion of terrestrial, marine or freshwater protein consumed; $\delta^{13}C$ values will become enriched as the diet becomes less terrestrial based (DeNiro & Schoeninger, 1983). $\delta^{15}N$ isotopes are indicative of where an individual is within a food-chain and due to trophic shifts, a consumer will have a $\delta^{15}N$ value approximately 3-5‰ more enriched than the source of protein consumed (Deniro & Schoeninger, 1983; Katzenberg, 2000). Marine plants and animals have more enriched $\delta^{15}N$ than terrestrial plants or animals; these values therefore can also provide further information on the levels of marine resources in the diet as these enriched values are carried up the food chain (Schoeninger, 1983). This is of particular importance when examining coastal populations such as those of Knowe of Skea and the surrounding islands.

The nitrogen (^{15}N) and carbon (^{13}C) component of bone collagen is a reflection of dietary proteins and is used to investigate the diet of past populations. Analysis of the nitrogen component of bone collagen has been used in many studies to estimate the age of weaning in skeletal populations by comparing the isotopic values of female bone collagen with that of infants; a newborn infant will show $\delta^{15}N$ values almost the same as that of its mother (Katzenberg et al, 1996). The source of dietary protein of breast-feeding infants is breast milk from the mother, and so the infant should show a nitrogen component higher than that of the mother. Isotopic results are reported in parts 'per mil' (‰) and an infant feeding solely on breast-milk will show $\delta^{15}N$ values 2 -3‰ higher than the mother, effectively one level above the mother in a food chain (Schurr, 1998). Once breast-feeding is stopped the $\delta^{15}N$ values of the infant should become lower until it resembles that of the mother and other members of the population, assuming weaned infants have the same diet as older individuals (Katzenberg et al, 1993). The $\delta^{13}C$ component of bone collagen is also examined in the attempt to understand the diet of past populations. The $\delta^{13}C$ values from bone collagen samples of breast-feeding infants have been found to be around 1‰ higher than that of mothers and though this area needs more research, it may help in creating a better understanding of the weaning process (Fuller et al, 2006). δ^{15}N values of infants who are provided with supplementary foods alongside breast-milk will change slowly. For infants who display δ^{15}N values that remain high, but δ^{13}C values closer to that of females, it is possible that weaning has begun with the introduction of solid foods to supplement breast-feeding (Fuller et al, 2006).

Results and Discussion

Figure13 plots the δ^{13}C and δ^{15}N values for all of the samples from Knowe of Skea, including the small number of animals also analysed. The five individuals within the circle, (2117), (3111), (4036), (4054) and (7094) are worthy of note as the isotopic values here suggest a more terrestrial diet than other individuals and are discussed further below.

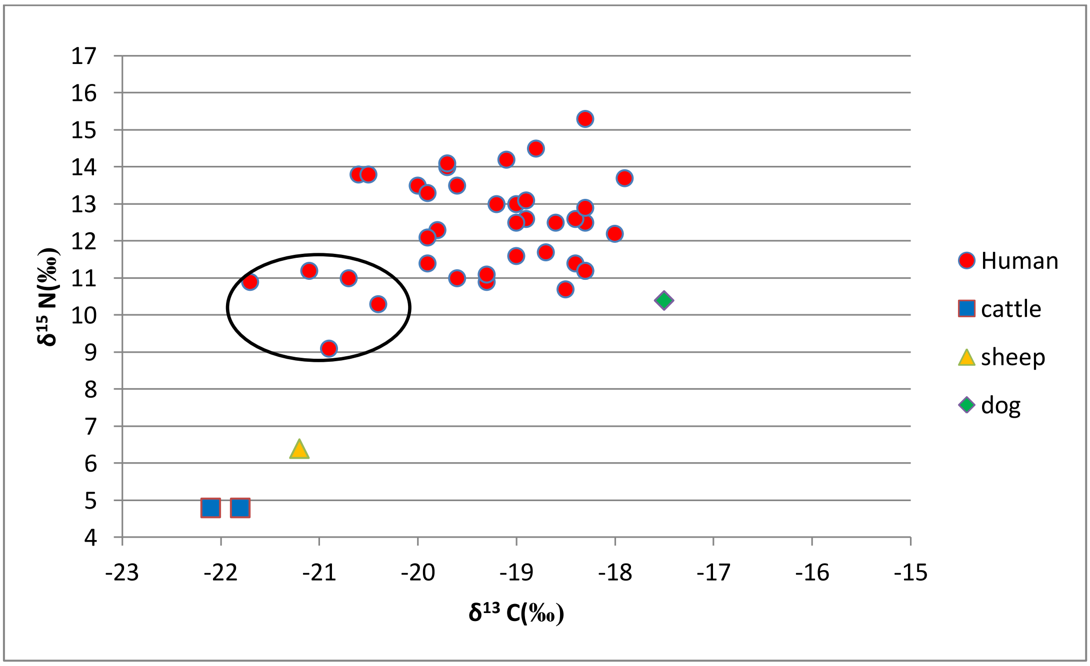


Figure 13: Plot of ALL samples from Knowe of Skea

As bone collagen replenishes during life, the isotope composition will reflect the last few years of an individual's life (Tykot, 2004). To investigate past human diet, it is important to establish a baseline of local contemporary isotopic values, usually from animals exploited for food (Jay & Richards, 2007).

Figure 14 shows the $\delta^{13}C$ and $\delta^{15}N$ values of the animals sampled from the Knowe of Skea with those from published studies of Iron Age diet (see Table25). The plot indicates that the values for the Knowe of Skea cattle are very close to those of animals from the terrestrial sites of Hampshire and Wetwangslack (Jay & Richards, 2006 & 2007) and those of the Western Isles (Mulville et al, 2009). The $\delta^{15}N$ values for domestic herbivores from Broxmouth, East Lothian are somewhat higher than for the other sites and may reflect an environmental influence, or differential feeding practices at this site (Jay & Richards, 2007). The $\delta^{15}N$ values for sheep from Newark Bay, Orkney (Richards & Barrett, 2006) and Knowe of Skea are higher than for the other herbivorous animals, perhaps reflecting the possible free-range, shoreline grazing of these animals, while the values shown for pigs reflect their more omnivorous diet.

Just as faunal analysis showed little variation across Iron Age Britain, stable isotope analysis of human and animal bone samples yielded similar results. Jay & Richards, (2007), analysed bone samples from sites across Britain and found that the diet of the majority of individuals included foods high in animal protein, with little evidence for aquatic resources, even from sites in close proximity to the sea or major rivers. This study included samples from burials at Broxmouth and Winton House in East Lothian, Scotland.

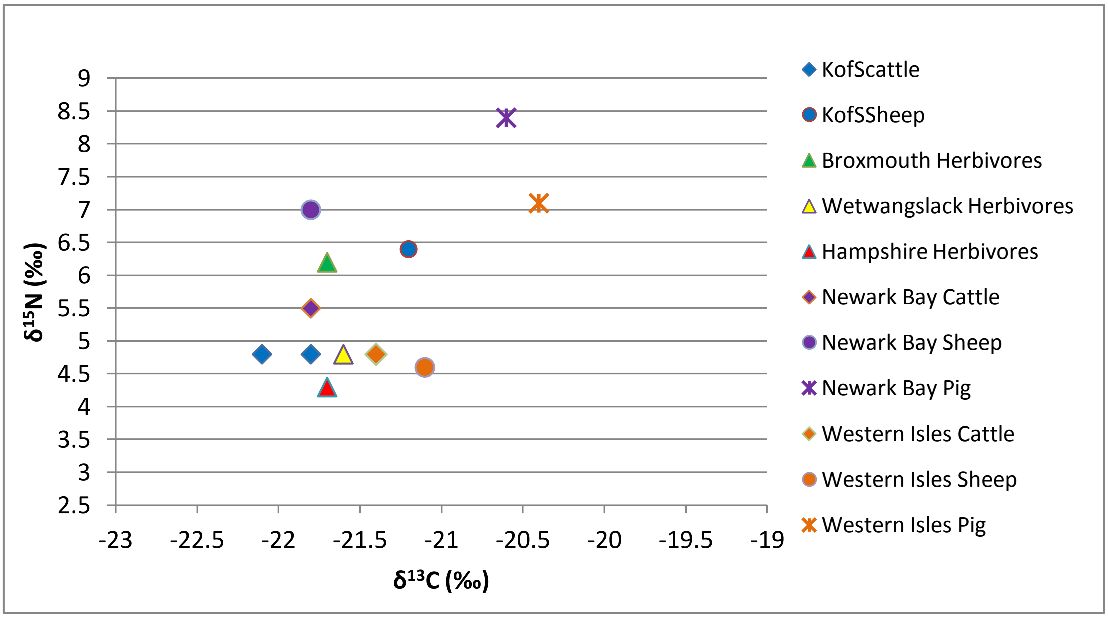


Figure 14: Plot of isotopic values for animals from published studies of Iron Age material (see Table25).

In projects investigating diet, marine resource exploitation, and the influence of Viking colonisation in Orkney (Barrett & Richards, 2004 & Richards et al, 2006) it has been shown that late Iron Age communities had a diet which contained mostly terrestrial foods and little marine resources. This was particularly the case at Westness, Rousay where the analysis of stable isotopes yielded very strong terrestrial results (Barrett & Richards, 2004, 260) though there was evidence in the stable isotope values of individuals from the later Iron Age cemetery at Newark Bay that marine resources had formed part of the diet. Here, it was suggested that marine resources of low trophic levels may have caused the more marine δ^{13}C values while the δ^{15}N values remained low (Richards et al, 2006). This appears to be substantiated by the evidence from faunal analysis which indicates that the fish exploited were small and young examples of close to shore species.

The δ^{13}C value (-21.8‰) from the cattle bone at Knowe of Skea was used as an example of a 100% terrestrial diet. To determine a 100% marine diet, in the absence of suitable samples from Knowe of Skea, a value of -12 ± 1‰ was taken from a seal bone at late Iron Age and Viking cemetery at Newark Bay, Orkney Mainland

(Barrett & Richards, 2004). These $\delta^{13}C$ values were used to calculate, by linear interpolation, the proportion of marine protein in the diet of individuals at Knowe of Skea (see Table 24).

	$\delta^{13}C$ (‰)	**$\delta^{15}N$ (‰)**	**% Marine Protein**
adults (n=16)	-19.2 ± 0.8	11.7 ± 1.1	25.9 ± 8.4
males (n=10)	-19.3 ± 0.9	11.6 ± 1.2	25.1 ± 9.7
females (n=6)	-19.1 ± 0.6	11.8 ± 1.2	27.3 ± 6.3
adolescent (n=6)	-18.8 ± 0.9	12.1 ± 0.8	30.4 ± 10.0
child(n=4)	-19.8 ± 0.6	13.0 ± 0.9	19.8 ± 6.3
infant(n=4)	-20.4 ± 0.9	12.7 ± 1.4	13.5 ± 9.2
perinate(n=7)	-18.8 ± 0.7	13.7 ± 1.0	30.3 ± 7.2

Table 24: Average $\delta^{13}C$, $\delta^{15}N$, %marine proportion of the diet by age group.

The results are given as average percentages by age group. The percentage of marine protein among the adults might be considered low for what was an extremely coastal community in the Orkney Islands and this has been the focus of much research in recent times (Barrett & Richards, 2004 & Richards et al, 2006). The infant and child diet most likely reflects specialised weaning and early childhood foods. The perinate and adolescent percentages most likely represent an accurate reflection of actual diet at Knowe of Skea. Many of the very young babies were most likely still-births and will reflect the diet of their mothers. It could be assumed that the adolescent values reflect a more accurate view of the diet of older individuals at Knowe of Skea. Unlike the adult samples, less time has passed allowing for less dilution of the isotopic composition of bone collagen over time (Hedges *et al*, 2007); this is of particular interest when examining the possibility that exploitation of marine resources was a seasonal activity (Montgomery *et al*, 2013).

Interpreting diet at Knowe of Skea

Here, the results are examined to assess the diet of this population over time and to compare the diet of the population buried at Knowe of Skea with communities of roughly contemporary date.

The results are illustrated in Figure 15 where $\delta^{15}N$ and $\delta^{13}C$ values for the whole collection are plotted by age group, along with the values for the small number of animals also sampled. Here, it is clear that there are a number of samples with slightly enriched $\delta^{13}C$ values than others and there are a range of $\delta^{15}N$ values, which indicates that there are varying trophic levels and possible marine signals among the results. The results for samples of bone from infants and females were used to assess breastfeeding and weaning influences in this population and are discussed elsewhere (see Infant Health and Mortality). Four child bone samples were also tested, three of these showed elevated $\delta^{15}N$ values which is likely to be the effect of retained influence of breastfeeding. This discussion therefore is confined to adults and adolescents within the collection. Figure 16 plots the results for Knowe of Skea adults and adolescent only together with those for other sites of roughly contemporary date.

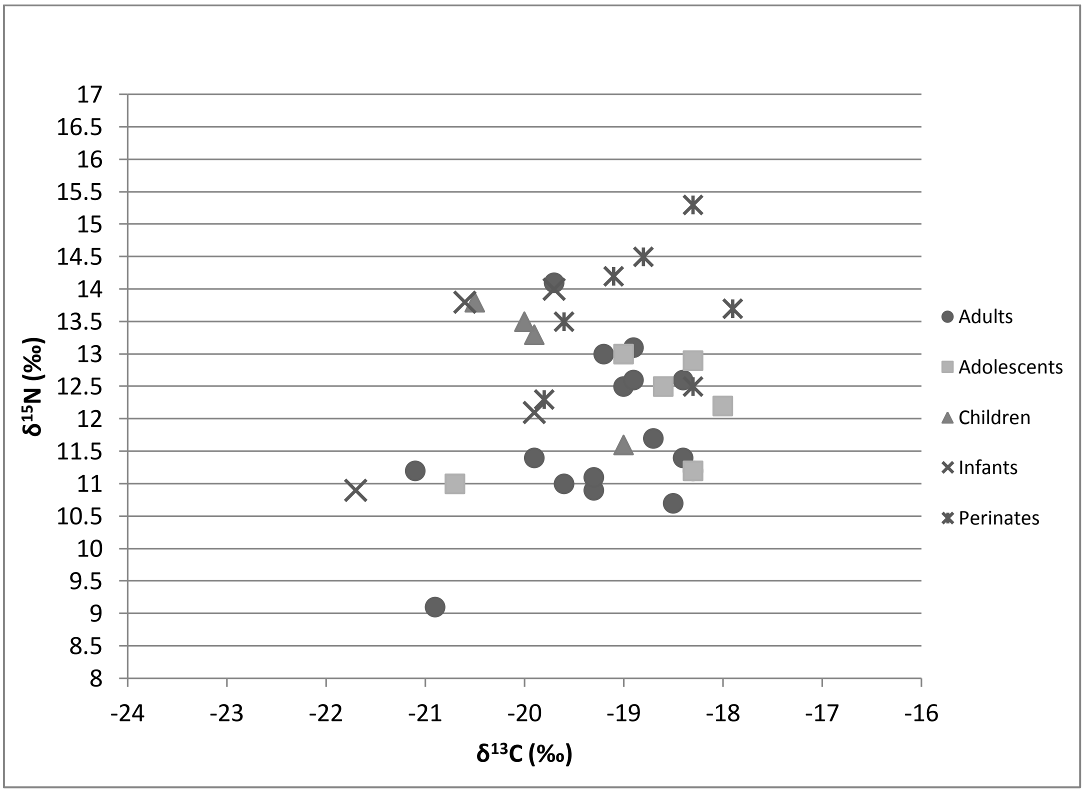


Figure 15: Plot of $\delta^{15}N$ and $\delta^{13}C$ values for all human samples from Knowe of Skea by age group.

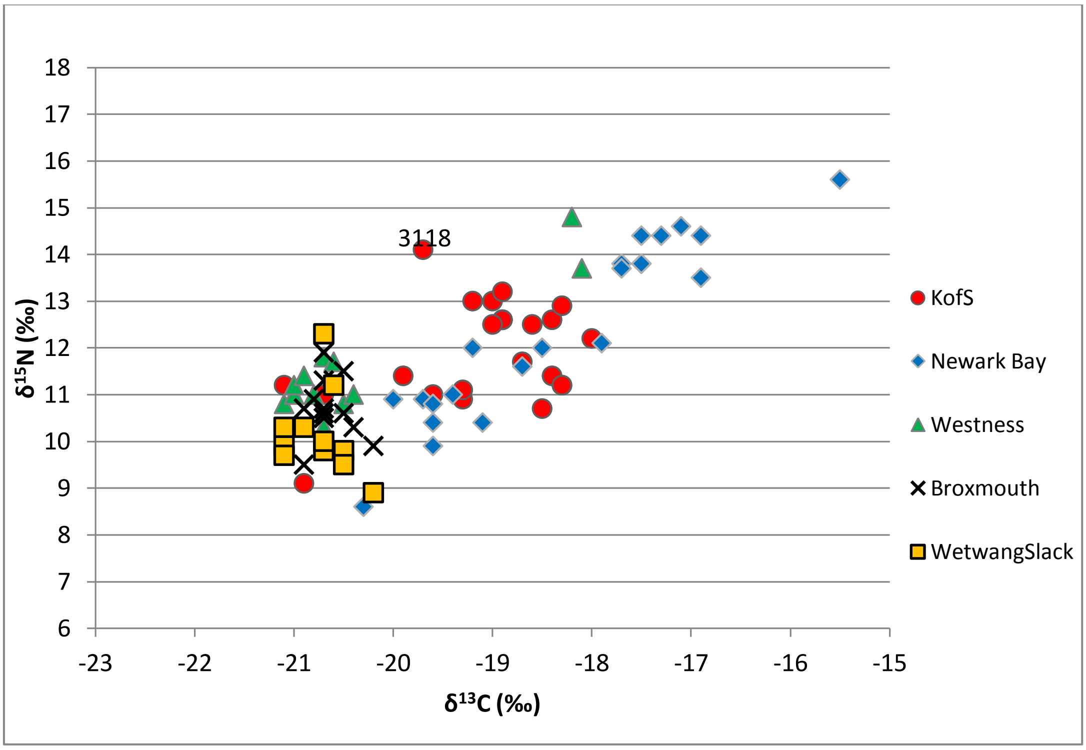


Figure 16: Plot comparing Knowe of Skea (KofS) isotopic values with those from published studies of Iron Age material.

As $\delta^{13}C$ values can be utilised to establish the proportion of marine protein in the diet, Figure 17 illustrates the $\delta^{13}C$ values for the Knowe of Skea individuals over time, together with the results from other similar studies, in particular for Westness, Rousay and Newark Bay, Orkney (Barret & Richards, 2004; Richards & Barrett, 2006) and Broxmouth, East Lothian (Armit, 2013). While Westness and Broxmouth show similar mainly terrestrial values, those for Knowe of Skea are more similar to the mixed results from the later site of Newark Bay, Orkney where the increased exploitation of marine resources was noted from the late first millennium AD (Barrett & Richards, 2004).

The earliest dated individual of adolescent or adult age was (4036) and this individual showed isotopic values similar to those from contemporary individuals at Broxmouth and Wetwang Slack rather than with any of the individuals from the earlier phase of burials at the Knowe of Skea. With such a different diet from the others, was this individual an in-comer, to the group? Though the results overall do not match the high marine diet of the Viking Age burials at Westness or Newark Bay, neither do the earlier Knowe of Skea values match those of the mostly terrestrial diet of Broxmouth, or Pictish Westness. Perhaps the results from the earlier Knowe of Skea burials reflect a seasonal exploitation of marine resources as suggested by the faunal assemblages examined, but rather than small, young fish, these individuals were fishing larger fish in deeper waters, such as was represented by the evidence of cod-fishing at Warebeth Broch, Orkney (Sellar in Bell & Dickson, 1989) and Pierowall Quarry, Westray (Sharples et al, 1984).

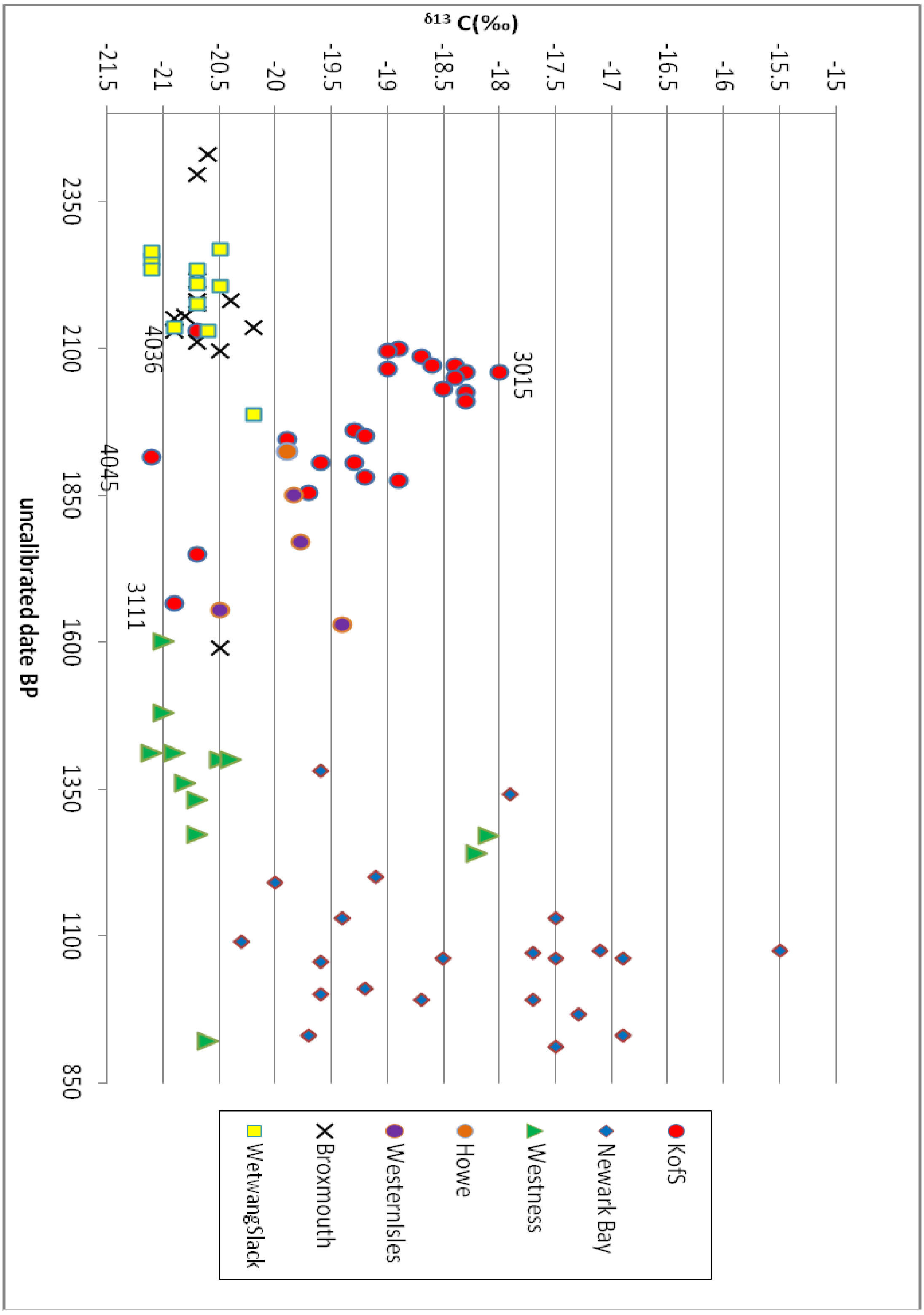


Figure 17: Comparison of δ[13]C values over time using dates provided in published studies of Iron Age populations (see Table 25)

The $\delta^{13}C$ values for individuals from the later burials at Knowe of Skea exhibit some marine influence, though the $\delta^{15}N$ values are not so high as to suggest that the marine resources exploited were high in the marine food chain, or that these foods dominated the diet. This may reflect the faunal assemblages, fish remains during this period showed small fish like saithe in the majority. The most marine values from the Knowe of Skea are similar to results from individuals in the late Pictish period cemetery at Newark Bay. In their analysis of human and animal samples from this site Richards & Barrett (2006) suggest that samples showing enriched $\delta^{13}C$ values but comparatively low $\delta^{15}N$ values may have been exploiting marine foods of low trophic level along with animals of higher ^{15}N values such as neonatal or unweaned animals. Such a diet would explain enriched $\delta^{13}C$ values paired with only slightly elevated $\delta^{15}N$ values and also reflects the results of faunal analysis at Howe, Orkney and Old Scatness, Shetland where evidence was found for young close-to shore fish and molluscs and at Warebeth where the majority of pig bones identified were from very young animals.

Over time the isotopic values indicate that the diet among the Knowe of Skea individuals became more varied, and more in line with values from contemporary burials found across Atlantic Scotland which indicate a mostly terrestrial diet with some inclusion of marine resources. Three adults (2021), (3111) who was the latest radiocarbon dated individual and (4045) show values indicative of terrestrial diet. In the case of (4045), this individual partook of a very terrestrial diet compared to the rest of the population at that time, and also compared to individuals from the Western Isles (Neighbour et al, 2000; Murphy et al, 2004) and the individual from Howe, Orkney (Tucker & Armit, 2010). For (2021) and (3111), perhaps this indicates the move towards a more terrestrial diet in the later phases of the cemetery's use and similar to that of neighbouring Westness, Rousay.

One individual, (3118), shows isotopic values unlike those for any other individuals on site. The $\delta^{15}N$ value is markedly higher than any other adult in the community, this could indicate a more marine diet however the $\delta^{13}C$ value is similar those of the other individuals which would appear to negate this. Higher $\delta^{15}N$ values can be a result of freshwater fish eaten as part of the diet (Schoeninger & DeNiro, 1984; Cook et al, 2001; Bonsall et al, 2004). Raised $\delta^{15}N$ values can also be a result of nutritional stress (Fuller et al, 2005), however this would need to be a prolonged period of nutritional stress to affect the composition of bone. Skeletal analysis also singled out this individual; assessment of sex by examining morphology and by measurements did not concur, which was very unusual for this collection. Given the very different isotopic values, perhaps these individuals, like (4036) earlier in the use of the cemetery, was an in-comer to the group and had spent considerable time in a region with diet and so isotopic values different from those local to the area in which they were buried? Jay & Richards (2007) preferred this explanation in their examination of diet in Iron Age Britain for individuals whose isotopic signatures were unlike those of the rest of the population with whom they were buried.

Unfortunately, there are very few burials of this date with which to compare these results and it is impossible as yet to determine if these results are unique to the population buried at Knowe of Skea or represent a more widespread dietary model during a limited period.

Weaning

The results of such analysis have been used to examine breast-feeding and weaning at a number of sites in Britain that included large numbers of infant burials. The site geographically closest to Knowe of Skea is Newark Bay, Mainland Orkney and the earliest burials from the site are of Iron Age date, though later than the latest dated burial from Knowe of Skea (Barrett et al, 2000). The analysis at Newark Bay revealed higher $\delta^{15}N$ values relative to females in infants up to the age of 1.25 years, indicating that infants were breast-fed up to this age. The high numbers of infants who died in the second year of life also indicated that infants may have been weaned onto a nutritionally poor diet (Richards et al, 2006). Results from the Iron Age site of Wetwang Slack in Yorkshire revealed that there may not have been any common age at which weaning began for infants in this population. The $\delta^{15}N$ values from infant samples at this site were lower than would be expected for exclusively breast-fed infants; this indicated that supplementary foods such as cereals/cow's milk as well as breast-milk may have made up the diet infants from a very young age (Jay et al, 2008). An isotopic study of the late Roman population of Queensford Farm, Oxfordshire revealed that weaning in this population was a gradual and prolonged process. Infants under the age of 2 years had higher $\delta^{15}N$ values compared to females from the site, but higher $\delta^{15}N$ values were also recorded for young children up to age 4 years (Fuller et al, 2006). This contrasts quite clearly with the medieval population of Wharram Percy which showed a quick drop in $\delta^{15}N$ values for infants from the age of 2 years, indicating that weaning was a much quicker process and perhaps even a common practice was adopted by the whole community (Richards et al, 2002).

A number of samples of perinate, infant and child bone were sent for analysis at SUERC (see Table 21). The number of samples taken from infants and females in the Knowe of Skea collection were low, due in part to the low numbers of individuals and also to the need to avoid cross-sampling from commingled and disarticulated sets of remains. It was impossible to determine any mother-infant pairs in the collection and so interpretations are based on general observations only.

Figure 18 illustrates the $\delta^{15}N$ values for females, infant and perinate samples from the Knowe of Skea population over time. The female values range from 10.7 to 14.1‰ with an average of 11.8 ± 1.2‰. The infant values show a wide range of results. The two 18-24 month old infants and three perinates have similar values, around 13.5–14.5‰ which most likely indicates that these were breast-feeding infants. Figure 19 illustrates the $\delta^{13}C$ and $\delta^{15}N$ values for the infants and females. The reason for a difference in $\delta^{13}C$ values for those infants showing similar $\delta^{15}N$ values may be that one of these infants was being weaned and fed supplementary foods while the other was not. The two infants of 37 weeks gestational age most likely represent infants who died at birth, as their values are almost identical to that of the female closest to them in date. The two foetal infants, 36.8 and 33 weeks gestational age, were most likely premature births with $\delta^{15}N$ values representing their mothers; in these cases, the mothers' $\delta^{15}N$ values may have been raised due to nutritional stresses (Fuller et al, 2005), or a difference in diet to those females of later date. Richards et al, 2006 reported some difficulty in their examination of breast-feeding and weaning at Newark Bay due to differences in female diet over time. Here there was evidence for increased marine exploitation over the years that the cemetery was in use, which created variations in $\delta^{15}N$ values and made comparison with heightened infant values more difficult (Richards et al, 2006).

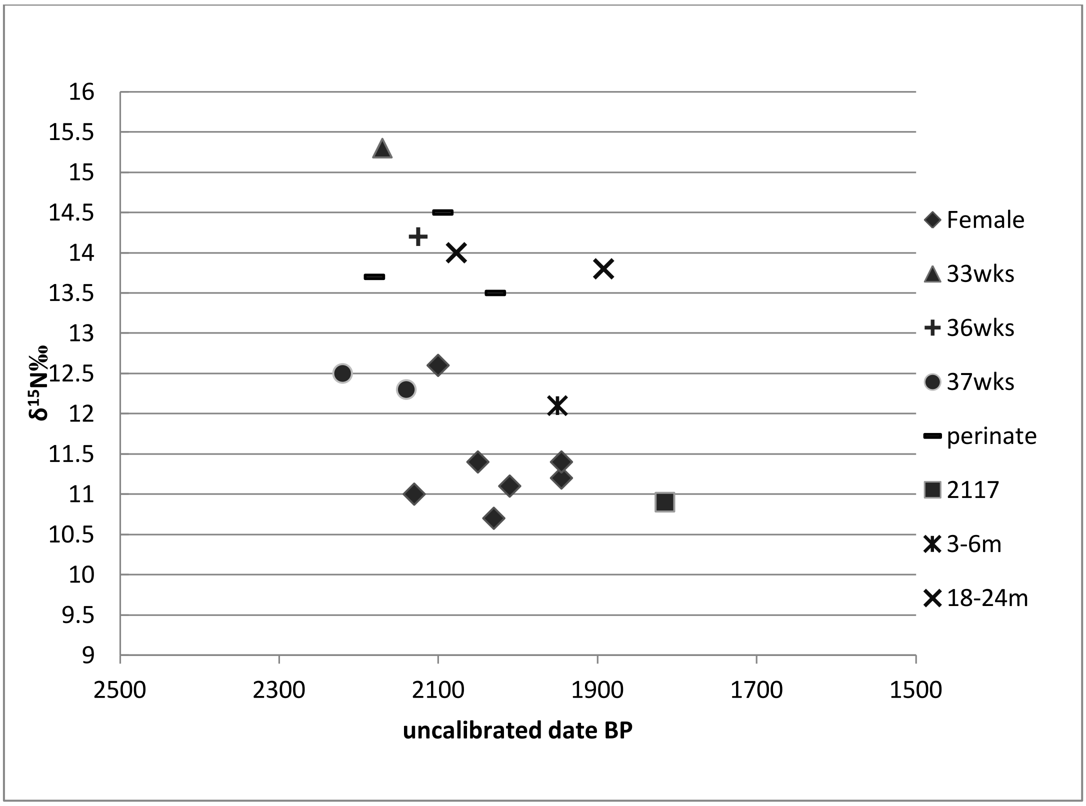


Figure 18: Plot of $\delta^{15}N$ values of females and infants from Knowe of Skea over time

Perhaps the most interesting results for the purposes of discussing weaning and infant health at Knowe of Skea are those for the 3-6 month infant (9023) and a 6-9 month old infant (2117). The values for the 3-6 month old infant (9023) suggest that this infant was almost completely weaned, even at this young age. The bones of this infant showed some evidence of nutritional stress and it may be that this infant was weaned earlier than was usual for this population, perhaps due to ill-health, malnutrition or death of the mother. (2117), was an infant whose remains were aged through dental development to 6-9 months however long bone measurements indicated an age of just 3-6 months. The bones showed extreme periosteal reactive bone growth suggesting that this infant suffered from metabolic illness, most likely scurvy. Also of note with this particular infant is the indication from the isotopic analysis that in this case there seemed little evidence for breast-feeding for some time before death. The $\delta^{13}C$ and $\delta^{15}N$ values were quite different from those of not only the other infants sampled but the adults also, suggesting that this infant was fed a very terrestrial based diet which varied quite drastically from the others, a diet which it appears was nutritionally inadequate.

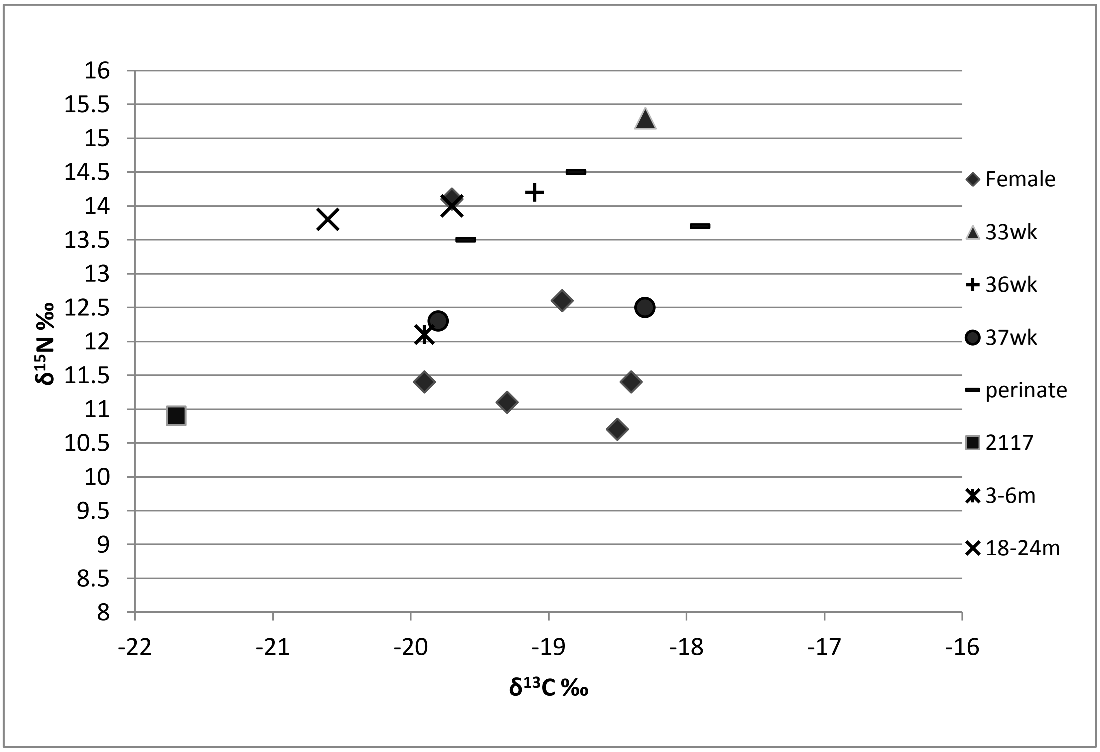


Figure 19: Plot of $\delta^{13}C$ and $\delta^{15}N$ values of females and infants at Knowe of Skea

This limited examination has allowed for only a slightly clearer understanding of the weaning process and the effect on the infants among the Knowe of Skea population. The values from two infants of 18-24 months indicate that there may have been some differences in how the weaning process was undertaken. Perhaps unlike the indications from Wharram Percy, there was no set method in this population.

Site/Location	References
Broxmouth, East Lothian	Armit, 2013 Jay & Richards, 2007
Bu Broch, Orkney	Hedges, 1987
Hambleden Hill & Wharram Percy	Mays, 2011
Hampshire	Jay & Richards, 2006 & 2007
Howe, Orkney	Tucker & Armit, 2010; Ballin Smith, 1994
Newark Bay, Orkney	Barrett & Richards, 2004 Richards et al, 2006; Barrett, 2000
Old Scatness Broch, Shetland	Bond et al, 2004
Pierowall Quarry, Westray, Orkney	Sharples et al, 1984
Pool, Sanday, Orkney	Hunter, 1990
Skaill, Orkney	Bureaux, 1997
Warebeth Broch, Orkney	Bell & Dickson, 1989
Western Isles (Animals)	Mulville et al, 2009; Campbell, 2000
Western Isles (Humans)	Neighbour et al, 2000; Murphy et al, 2004; Badcock & Downes, 2000
Westness, Rousay, Orkney	Sellevold, 1999
Wetwangslack, Yorkshire	Jay & Richards, 2006 & 2007

Table 25: Sites/ Locations mentioned in discussion of diet and stable isotope analysis.

Summary

The results of the stable isotope analysis revealed a level of marine resource exploitation not previously seen in Atlantic Scotland for this time period. However, the low number of burials at this time allow for little comparison between populations. The proportion of marine protein contribution to the diet appears low considering the proximity of this site to the sea and it seems likely that the exploitation of coastal, close-to-shore resources was a seasonal activity during lean times of the year. The evidence for breastfeeding and weaning habits from the stable isotope analysis suggests that in some cases infants were weaned at very young ages, possible due to maternal deaths or illness, and that the supplementary diet was nutritionally poor. The potential for further isotopic research was seen in the two individuals, (3118) and (4036), with isotopic values which stood out from the rest. The results of analysis of other isotopes such as strontium or oxygen, which can indicate geographical origins, would be of great interest.

7. Discussion

An examination of the circumstances of burial at the Knowe of Skea, together with the results of the skeletal analysis have allowed for a greater investigation of the funerary practice and lives of a population about which little has been known until now. A number of interesting features of the site and the results of the analysis arose, and so the following section has been split into four areas of interest. Firstly, the results of the skeletal analysis are combined with examination of the site archive and excavation records in an attempt to recognise any patterning or organisation in the layout of the burial ground. The remaining subjects discuss in greater detail some of the issues arising from the skeletal analysis: an assessment of the health of the population from their skeletal remains; an examination of infant and child health and mortality and finally an examination of the archaeological evidence for diet

Combining burial evidence and skeletal analysis

By combining the results of the skeletal analysis with the archaeological evidence and impressions of the excavators as held in the site archive, it was possible to resolve some of the issues surrounding the disarticulation of some burials caused by the construction of later buildings or by subsequent burials. On several occasions excavators noted that certain concentrations of bones were in close proximity to each other or to articulated remains. By comparing the results of analysis with the excavators' impressions it was possible to confirm relationships between certain groups of bones, sometimes finding that bone fragments in one context or Small Find (S.F.) actually found their match in another. This would not have been possible had the detailed site notes and the 'Daybook' recording day-to-day activities not been made available to the author.

The well-preserved burial of an older adult male, (2100) was located in the area of the entrance to the large central structure A. Examination of the site notes showed that two collections of disarticulated bone, (2122) and (2124) were located in this same area; (2122) consisted of loose bones from over the burial of (2100) and (2124) were bones recovered from around and below (2100). During skeletal analysis it was noted that fragments of lower limb bones and foot bones from (2122) and (2124) matched. It appears that the burial of (2100) may have disturbed an earlier burial of which (2122) and (2124) were a part. The collections of disarticulated bones (2098) and (2099) were found to represent two individual adults; the sets of remains were incomplete and the original location could not be confirmed though it is likely that these represent burials disturbed by later construction activity. The skull was missing from the burial of the adolescent (3015), again most likely due to later construction work in the area. The adult skull fragments and teeth could not be attributed to any of the other individuals in the area with any confidence. An adolescent mandible (3022) located towards the feet of the adolescent (3015) may in fact belong to this individual though this could not be proved.

During analysis, the set of remains assigned the number (6096) were found to include the small find S.F.284. Site notes recorded that the legs and pelvis of (6096) were partly articulated and that S.F.284 and S.F.627, which were collections of disarticulated bones, were in the immediate vicinity. Skeletal analysis found that the majority of the skeleton of (6096) was found mixed between the groups of bones S.F.284 and S.F.627 which also contained the disarticulated remains of two children and disarticulated perinate infant bones. A number of post-mortem cut marks were identified on the long bones of the adult (6096) which were interpreted as the result of blows from a sharp instrument during the construction of the wall which site notes report was built over these remains. The remains of the adult and two children then were gathered together to facilitate the construction of this wall in the western area of the site.

During analysis it was found that (2114) actually contained the leg bones of two individuals. Which of the sets of legs belonged to the individual (2114) could not be determined with any certainty as both were assessed as male and were of similar age to the rest of the skeleton. No mention is made in the site notes of a second individual. It seems most likely that the main articulated burial disturbed an earlier burial, the bones of which had been excavated and bagged together with those of (2114). This became of increased interest when it was found that the burial (2115) from the same excavation trench contained only the upper body of an adult. Analysis of these remains however indicated that unlike the leg bones found with (2114), the adult (2115) was probably female. On returning to the site notes, it was found that (2115) was located in the immediate vicinity of (2121). Skeletal analysis showed that (2121) consisted of the mixed bones of a number of young infants and adult leg bones which when examined were seen to be a good probable match for burial (2115). The extra leg bones collected with (2114) remain unaccounted for.

During excavation of the skeleton (6032), an adult female, it was suggested that the disturbance to the burial was particularly obvious in the displacement of the arm which was found at a higher position in the rubble deposits than the rest of the remains. Skeletal analysis, however, showed that the left humerus and scapula collected with (6032) did not match the rest of the skeleton in size or coloration and came from another individual. There were a number of individuals buried in close proximity in this area of the site and the discovery of isolated bones was not unusual.

The articulated partial burial of an adult male, (6076) was found in the area of the 'mass burial' (6071). The leg and pelvic bones of (6076) were found in a crouched position; however site notes show that the upper body was disarticulated. The arms bones of an adult found in the larger collection of (6071) were found to be a suitable match for the adult male (6076). This area of the 'mass burial' also included the disarticulated remains of a number of children. Two crania, one child and one adult, were found lying on top of the articulated burial (6072). The adult cranium was found to be that of the adult (6072) while that of the child was found to be of a similar age to the disarticulated child bones within (6071). It is likely that subsequent burials in such close proximity caused earlier burials to be disturbed though an effort was made to keep these disturbed bones as close to their original location as possible. These efforts were also seen in (2115) and were termed 'tidying-up' by the excavators.

During excavation a collection of disarticulated remains (3117) was recovered from the areas to the north and south of the burial (3118). The remains were recorded and marked (3117N) or (3117S) as appropriate. Skeletal analysis revealed that (3117) contained the disarticulated bones of a child with matching bones and fragments from the collections of bone to the north and south of the adult (3118). It is possible that either the burial of the adult (3118) disturbed an earlier burial of a child (3117), or that the construction of Structure E in this area was the cause of disturbance to both these individual burials. Of the two isolated crania discovered in this area, S.F.32 may be a possible match for the adult (3118) though this could not be definitively confirmed; the child cranium S.F.31 was aged by dental development to be older than the disarticulated child remains found in (3117). A number of adolescent bones were also found in the collection of disarticulated remains (3117) which were of similar age to the adolescent represented by (3054)/S.F.53, discussed below.

Also within the area disturbed by the construction of Structure E were two separate groups of bones, (3054) and S.F.53, identified within the larger spread of bones (3036). (3054) consisted of articulated vertebrae and arm bones and excavators noted that bones in S.F.53 may be from the same individual. Subsequent skeletal analysis was found fragments of bone from (3054) that matched fragments from S.F.53. In this way it was possible to identify (3054)/S.F.53 as the burial of an adolescent most likely disturbed during the construction of Structure E.

The commingled remains of an adult female and an adolescent were found in rubble deposits in the east of the site during excavations in 2006. A large flat slab of stone was found to lie between two collections of bones, S.F.443 and S.F.625. Skeletal analysis later revealed that the almost complete skeletons of an adolescent and an adult female were mixed between these two bone spreads. S.F.443, over the stone slab, consisted mainly of the partial and disarticulated skeleton of an adolescent. S.F.625 which was located beneath the stone slab contained the majority of the adult remains along with bones from the adolescent. It is likely that the burial of the adult is the original burial in this location as some articulation was noted in the adult remains below the large stone slab.

Large concentrations of commingled infant remains

Infant remains occurred in two main forms; large concentrations which contained the remains of a number of infants and smaller collections of bones that possibly represented the burial of a single individual. A number of collections of disarticulated infant remains which were thought to represent single infant burials by excavators were recovered from rubble deposit Context 6055. S.F.440 and 422 were two such collections of infant remains. Analysis showed that S.F.440 was the almost complete skeleton of a perinate infant aged 38-40 gestational weeks; S.F.422 was less complete but also represented a single perinate infant burial. Skeletal analysis showed that S.F.429 actually represented three perinate infants. Matching left and right long bones and the presence of some of the smallest bones of an infant skeleton were present in this collection indicating that this location was used for the burial of complete infants. The commingled nature of the remains suggests that this location was most likely used for successive burials perhaps over a long period of time. In a number of cases, the site records suggest that some articulation was noted between bones in some of the larger concentrations of infant remains. In (4017) some articulation is visible in site photos and referred to in site notes but unfortunately these articulated remains were not stored together in such a way that would have allowed the separation of individuals during skeletal analysis. What the sequence of these burials may have been could not be determined. When examined, the collection was found to contain the mixed bones of perinate infants and most likely represented the complete burial of two infants of very similar age. Site notes suggested that (4017) and S.F.135 might be associated; S.F.135 however contained a more mixed collection of bones including perinate and infant bones and also some adult long bone fragments and teeth. Similarly, site notes and excavator's comments indicated that there was some articulation within S.F.188. This large concentration contained the remains of a number of infants of late foetal or perinate ages. The presence of many of the tiny bones of the hands and feet of these infants in these concentrations and signs of articulation would suggest that these were primary burials of infants. Four femora from this group were radiocarbon dated (Table 21& 22) and were found to be among the earliest burials on the site. This concentration was located below are large slab of stone which possibly marked this location and returned to on a number of occasions.

What is obvious from these observations is that while the system employed on site in respect to excavation, recording and storing the human remains was very effective, the inexperience of the excavators when dealing with infant remains, particularly in the larger concentrations affected the later analysis. Keeping together those bones seen to be in articulation would have gone some way to resolving this. This is not however intended as a criticism, experience dealing with such volumes of infant remains is difficult to attain and there are few experienced osteologists who could claim to have been able to do better under such circumstances. The author's own involvement in the excavations was invaluable and greatly aided in the later analysis and interpretation. The intention here is merely to highlight the need for a blend of both archaeological and osteological experience when dealing with funerary sites outside of an orderly cemetery layout with neat individual graves containing a single burial.

Site organisation, body position and location

Site notes together with analysis revealed that there may have been some degree of differentiation between sexes when a body was laid down for burial; it is possible that some division according to sex may exist in whether the body was laid on the left or right side (Table 26). Of the burials laid on the right side for which sex could be determined, eight were male and one female; of those laid on the left the balance is more even with five males and four females. It seems that males were more commonly laid on the right side for burial. The side chosen for female burials was possibly of less significance, though with a smaller number of females overall, it is possibly even more significant that the majority were laid on the left side.

#	age	sex	orientation	crouched/flexed	side
106	adolescent	?male	sw-ne	legs C	R
2021	adult	male	e-w	?F	L
2114	adult	male	ne-sw?	C	?
2100	adult	male	se-nw	C	R
2115	adult	?female	ne-sw?	?C	L
3118	adult	?female	?e-w	C	?R
3015	adolescent	?	s-n	Legs C	R
3036/3054	adolescent			?C	?L
4045	adult	?Male	n-s	legs C	L
4019	adult	male	s-n	F	L
4038	adolescent	?male	e-w	F	R
4036	adolescent	?female	s-n	C	?
6072	adult	male	e-w	C	?R
6076	adult	?male	sw-ne	C	L
6061	child		n-s	?	L
6030	adult	male	se-nw	F	R
6043	adolescent	?female	s-n	C	L
6065	adult	?Female	se-nw	C	L
6096	adult	male	e-w	legs C	R
6032	adult	female	e-w	?C	?R
7015	adult	male	e-w	F	L
9010	adult	female	e-w	?C	L
9003	adolescent	?male	e-w	C	R
9016	Infant		e-w	?F	R
9023	Infant/Y.Child		n-s	?F	L
9013	adolescent	?male	s-n	legs C	R
9007	Infant(wi/sheep)	?	e-w	F	L

Table 26: Orientation and body position of the most articulated burials at Knowe of Skea.

An examination of the burials according to orientation, location on the site or by age and sex revealed little new information. Individuals of all ages and both sexes were buried at various locations across the mound. It would appear that some of the earliest burials may have been those placed in rubble deposits filling the interior of the abandoned Structure H, such as (4036), (4038), S.F.188. Perhaps the edges of this building were visible and created limits for the burial area which was later extended across the mound.

The construction of Structure E and Structure C on the site caused the greatest degree of disturbance and fragmentation of individual skeletons, some of which were found below the walls of Structure E in particular - (3111), (3118). There is no way to know how many burials may have been cleared to create the space required for the interior of these structures.

The position, orientation and location may have been overwhelmed by the necessity of creating spaces in the rubble deposits to accommodate new burials. Geometric survey and trial trenches revealed that no burials were placed beyond the limits of the stone mound. It seems that burials be situated within the rubble mound itself was of greatest significance. Whether this was an attempt to connect with the past occupants of the site and create a history for the community (Driscoll, 1998) or because of believed ‘sanctity’ imbued on the bones by the mound (Joass, 1890) or vice versa (Tucker, 2010) cannot be known; this is a common theme for similar sites across Orkney and north-eastern Scotland (*see Literature Review*) among which Knowe of Skea can now be placed.

Assessing health from skeletal remains.

Analysis of the skeletal remains from Knowe of Skea identified a number of pathological conditions which would have affected individuals during their lives. While the identification of disease or trauma on skeletal remains can help in determining the health of an individual, attempting to use this to portray the health of the living population that they came from is more problematic. Questions arise as to how well a dead population represent the living population it came from. It should be remembered that a skeletal assemblage is composed of 'individuals with varying life histories'(Larsen, 1997, 334), who died at different times and cemetery populations can span generations of a community's past. Does a prevalence of infection among the dead population reflect a prevalence of infection in the population as a whole? Or are the dead the unfortunate few who suffered infection and only a small portion of the population as a whole?

An examination of the mortality pattern versus the morbidity profile of a skeletal population can give a clearer view. Analysis of the mortality profile can indicate particular age groups at risk. High neonatal and young female mortality indicates the stresses involved with childbirth, whereas a high mortality rate for infants in the first year of life can be indicative of disease. Morbidity on the other hand represents the pathological occurrences in a population. Change in bone due to stress is a slow process and will usually only represent chronic conditions, the duration of which cannot be measured, especially in adults; 'The prevalence of disease in a skeletal population will be a reasonable estimate of the prevalence in the corresponding living population only in those diseases which do not cause death or contribute materially towards it', (Waldron, 1994, 56). The vast majority of the illnesses and diseases which killed thousands in medieval European urban centres, for example, leave no evidence on the skeletal remains due to the speed with which they could kill; a high number of individuals with no skeletal markers therefore cannot be used to suggest a perfectly healthy living population.

The problems faced when establishing health from a skeletal population are discussed by Wood et al in their article 'The Osteoarchaeological Paradox', (1992). The difficulty in assessing health from the presence/lack of skeletal markers is demonstrated by Wood et al by dividing a hypothetical living population affected by a disease into three sections. The first group consists of individuals who are unaffected by the disease; the second are individuals who are affected but survive the initial infection and live long enough to develop the bony changes visible on the skeleton, and the third are the worst affected, succumb to the infection and die quickly. As the first and third group will be represented by skeletons with no bony changes, the authors stress the importance of remembering that those skeletons which do have bony changes do not represent the only individuals to be affected by disease in the living population. Wood et al suggest that those individuals displaying skeletal change indicative of disease were in fact some of the healthier members of a population who were strong enough to fight the original onslaught of the infection and survived long enough for bony changes to occur. This is the source of their 'paradox', the fact that the skeletons which show evidence of disease could in fact have been healthier than many of those with no visible skeletal indicators of disease.

Though Wood et al made valid points regarding the difficulties in assessing health from skeletal remains, many of their arguments were declared flawed in an article by Goodman, (1993) who discusses such interpretations of health from the examination of stress indicators in archaeological assemblages. Goodman argues that much information is lost in their methods by not employing analyses of the biological processes behind disease and stress indicators on individual remains and by concentrating on population-wide indicators such as mortality rates and demographic profiles. Any number of factors, other than susceptibility to disease and age at death contribute to the accurate assessment of the health of past populations including the effects of nutrition, culture and environment on the development of skeletal indicators of stress. He argues that there is no 'paradox' between morbidity and mortality when a multi-factorial approach is employed and that health is not only important when establishing mortality, 'We are interested in health for a number of reasons, only one of which is its relationship to mortality. Health can provide information about local and political-economic conditions, and it can have a functional significance independent of its relationship to mortality. Interest in mild-to-moderate malnutrition is based not so much on its link to mortality as on its effect on functional capacity and quality of survival', (Goodman, 1993, 285). This topic has been greatly debated in the years since the ‘Osteological Paradox’ article was first published (Lucaks, 1992; Goodman, 1993) and it is clear that the interpretation of health of past populations from skeletal remains is not straightforward. The important point however, is that rather than concentrating on the health of individuals, it is necessary to examine the health of the group when estimating population health and to do this by assessing a number of different indicators of skeletal health and comparing them with each other.

It must be remembered that virulent diseases rarely leave evidence on the skeleton due to the speed with which they can kill. Despite their catastrophic nature, such illnesses were usually sudden, short-lived events in the lives of people in the past. Information on the everyday diet, disease and hygiene provide a greater opportunity of understanding health in the past. For information relating to the health of the population represented by the skeletons recovered from the Knowe of Skea, we must examine the types of pathologies which affected everyday life and activity. These “...low level, lingering, but non-lethal bouts of infection can reveal something about lifestyle and group living that the more virulent and epidemic infections do not.” (Goodman & Martin, 2002, 32).

In attempting to assess the health of a population from skeletal remains, it is important to choose indictors of health widely understood and commonly recorded as part of osteological analysis. Even then, it can be difficult to compare the health of one population with another because of differences in recording procedures, or in the reporting and publication of information. Each of these conditions and skeletal markers need to be examined in relation to each other to allow for the most accurate understanding of health possible (Steckel, 2003; Goodman & Martin, 2002). Indicators of stress suggested for use in estimating health of a past population are: - life tables, dental enamel defects, porotic hyperostosis, periosteal reactions, trauma, osteoarthritis, dental disease, adult stature and subadult size. (Goodman & Martin, 2002, 12).

Life tables

As deaths may occur as a result of accidents or sudden illness, merely examining the numbers of dead in each age group tells us little of the overall health of a population.

Examining the mortality pattern of a collection may however indicate age groups that were most at risk. For the collection from Knowe of Skea, it is clear that the period around the time of birth was a time of considerable risk. Through counting skeletal elements, it was found that up to 50% of the assemblage consisted of perinate remains. Together, foetal, perinate and neonate remains constituted roughly 70% of the whole collection. Table 9 shows a breakdown of the numbers of skeletal elements and estimates the numbers of individuals represented. Due to the sheer numbers of perinate and neonate remains in this collection, infant health and mortality is discussed separately (see Infant health and mortality), though this forms only part of the whole picture as it concerns just one specific section of the population – the infants. What of the older members of the community?

Unfortunately numbers of infants and children were difficult to calculate in this collection due to the degree of commingling and fragmentation of the remains. This was partly due to the rubble nature of the deposits on the site, partly to the fragile nature of the bones and in some cases due to the inexperience of some of the excavators when dealing with immature remains. The number of infants in the assemblage was reached by counting dental elements, mandible and maxillae numbers indicated that there were 10 infants; unfortunately in many cases these dental elements could not be attributed to post-cranial elements.

Age	**<4mnth**	**6-9month**	**9-12month**	**12-16month**	**18-24month**
Number	1	1	1	3	4

Table 27: number of infants in the assemblage represented by mandible and maxillae

Though just six articulated or semi-articulated burials were identified as children during excavation, when estimating numbers through counting skeletal elements the number rose dramatically. By counting the number of mandibles in the collection which could be aged through dentition, a total of sixteen children were identified. The majority of these were in the ‘early child’ age category between 2 and 6 years and of these most were around age 4 to 6 years. There were indications among the child remains in the collection of possible nutritional stresses and possible growth retardation among the children which is discussed in greater detail below.

There were a high number of adolescents in the collection; this was slightly unexpected. It might be anticipated that once the dangers of weaning and childhood illnesses have passed, adolescence should be a less stressful period. A number of these adolescents showed evidence of dental enamel defects (discussed below) indicating periods of stress during childhood.

Shapland and Lewis (2013) have proposed a method for determining at what point in pubertal development adolescent individuals may have been at the time of their death. Through analysis of the rate of development and maturation of certain skeletal elements it can be assessed whether the pubertal growth spurt has begun, reached its peak, or has slowed and passed. It is during the phase after peak height velocity has been reached that developmental markers occur, such as menarche in girls and breaking of the voice in boys, which would have acted as social indications of maturity. The fragmentation and the incomplete nature of many of the remains caused some problems in this analysis and therefore this method was implemented for the Knowe of Skea adolescents with the intention of providing added information when assessing possible causes of adolescent deaths rather than for any accurate assessment of pubertal development or social maturity. The results suggest that the adolescents in the assemblage were almost all in the acceleration phase of the adolescent growth spurt, which may provide an indication as to the cause of their deaths. Perhaps early stresses, as indicated by enamel defects, weakened these individuals leaving them with compromised immune systems and more vulnerable to illness and compounded the stresses of maintaining health during the growth spurt. The adolescent growth spurt requires extra energy to maintain health and sustain growth (Boggin, 1999); should inadequate nutrition be available then the adolescent will undoubtedly suffer low energy levels and become more susceptible to illness.

Among the adults, it was possible to determine a difference in the age profile based on sex. The young adults in this collection were all female, while the old adults were all male. While there are some considerations to be acknowledged regarding the small numbers and the condition and completeness of the remains, it is possible that females were perhaps more at risk due to the stresses of pregnancy and childbirth and so were dying at younger ages. It seems that males on the other hand did not experience these same stresses at younger ages and survived to live longer lives than females. Can it be assumed however that longer life indicates better health?

If this collection represents all deaths in the community who chose to bury their dead at Knowe of Skea, then this mortality profile creates an image of a population with high numbers of deaths at almost all ages. An examination of the morbidity profile, the occurrences of disease and illness may shed some light on why this was the case. Morbidity represents the pathological occurrences in a population, and will reflect chronic conditions, those which affected individuals perhaps for long periods during their lives. How does the mortality pattern compare to the morbidity profile of the skeletal population? The skeletal analysis identified a range of pathological conditions on the remains, some of which are suitable to aid in creating a clearer understanding of the overall health of the population.

Dental Enamel Defects

Dental enamel is a substance that is usually unaffected by nutrition or illness (other than by caries) once it is laid down during the formation of the tooth. Lines or pits in the enamel of a tooth is likely evidence of an arrest in the growth and development of an individual through nutritional deficiency or illness (Lewis & Roberts, 1997) These are one of the more commonly recorded skeletal indicators of stress, are ‘time specific’ and indicate acute periods of stress (Goodman & Martin, 2002). As they are formed during the development of the teeth, these defects are therefore a reflection of childhood health. These can occur more than once per tooth or per individual indicating successive incidences of disruption in enamel production; those on deciduous teeth indicating periods of stress *in utero* or in early infancy and those on permanent teeth suggesting that stress or illness occurred during childhood.

In the Knowe of Skea collection, the majority of these dental anomalies associated with illness or stress were recorded as having occurred most frequently during childhood (see Table 20). This would suggest that childhood, particularly around age 4-6 years, was a period of recurring stress for this population. The numbers of children of this age in the collection represented by dental samples also supports this. Those children showing disruption in infancy, (2118), (9016), S.F.135, perhaps already weakened by earlier illness, died in early childhood. It is possible that the presence of these defects indicates general and continued ill-health of these individuals who subsequently died at a young age. In fact, only one of the incidences of dental enamel hypoplasia recorded for this population was from an individual who lived into adulthood. This may be an indication that the majority of individuals who survived into adulthood had not suffered the same illnesses and stresses in childhood as those who had died at younger ages. The rate of dental disease among the adults was high however, and may have affected the recording of these defects on older individuals.

Porotic Hyperostosis

Porotic hyperostosis is associated with nutritional deficiencies and was once believed to be an indication of purely iron deficiency anaemia, but its occurrence is now known to be more complicated. A number of factors affect the formation of this condition on the bones. Walker *et al*, (2009), showed that iron deficiency alone was unlikely to cause such reactions in the bones of the skull and orbits; they put forward that these conditions are more dependent on the poor nutritional health of breast feeding mothers, weaning diets and plant based diets low in such vital nutrients as Vitamins B and C. Any nutritional deficiency which might lead to the formation of these lesions will usually cause fatigue, weakness, reduced immunity to illness and will have affected the ability of an individual to work (Goodman & Martin, 2002).

Evidence of metabolic disease was scarce among the adolescents and adults from the site but skull fragments showed at least two children and one infant with signs of porotic hyperostosis. These lesions were variously healing or active and occurred as both pitting on the external surfaces of the skull and within the eye sockets as cribra orbitalia. Unfortunately these were often found on isolated skull fragments or on skull fragments within commingled remains and were not confidently attributed to any one individual for whom the other parts of the skeleton could have been examined. That these incidences of porotic hyperostosis were found only on infant and child skull fragments does not however suggest that older individuals did not experience metabolic stress or nutritional deficiency. The presence of these lesions indicates that an individual had gone through an acute or severe period of stress (Goodman & Martin, 2002); adult bone reacts slowly and such metabolic stresses may have been of short duration. That these lesions were recorded on the skull fragments of children, together with the evidence of dental enamel defects suggests that early childhood was a period of stress in this population.

Periosteal Reactions

Evidence of infection can be found on skeletal remains with little evidence to indicate the original cause. Periostitis, which affects the surface of bone, and the more advanced osteomyelitis, can be caused by the spread of bacteria from an original source of infection via the blood (Aufderheide & Rodrigues-Martin, 1998; Waldron, 2009). Diagnosis of an original disease is usually not possible and such lesions are usually recorded as 'non-specific infection'. The state of the infected area, such as evidence of healing, can indicate the general state of health of the individual affected and it is often possible to identify episodes of past infection in the form of healed lesions on the long bones, which suggest that an individual has fought a particular period of infection and survived.

Lower leg bones found with the adult (2114) showed evidence of infection in an advanced state of healing. Given the location of this former infection it may be that there was some injury to soft tissue of the lower legs or a systemic infection which resulted in infection spreading to the bones. This would undoubtedly have been painful and perhaps affected this individual's ability to walk or work for a time. Unfortunately, these bones were found in a commingled group of remains and it could not be determined whether the rest of the skeleton showed signs of ill-health.

In their wide overview of health and disease in Britain, Roberts and Cox (2003, 93) report that there was little recorded evidence of infectious disease for the Iron Age period. Just nine individuals were noted with signs of infection in the form of periostitis or osteitis, there were no recorded instances of sinusitis and only one recorded individual with inflammatory lesions on the ribs, leading the authors to suggest that living conditions were most likely well ventilated. Conditions were seen to deteriorate with the changes to society brought about by the influence of the Romans. Aside from the signs of possible infection found in the endocranial lesions on the skull fragments of perinates and neonates in the collection (*see Infant*

Health&Mortality), there was little sign of active non-specific infection or communicable disease among the individuals buried at Knowe of Skea.

This is in contrast with the individuals from Westness, Rousay where two females were recorded with signs of probable tuberculosis (Sellevold, 1999). The cemetery at Westness is slightly later in date than Knowe of Skea and there are a number of individuals who represent the social and biological changes brought to the islands in the early Viking period. Perhaps as with the effect of Roman culture in the south of Britain, the later changes in domestic spaces and living conditions brought about by the Vikings in the north were enough to cause an increase in the occurrence of communicable disease?

Trauma

Trauma can be identified on the skeleton as any form of injury caused through accident, activity or violence and will represent single sudden or acute events. Trauma is usually easily interpreted on an individual level; a person's health and mobility can be seriously affected by a single fracture to the leg, for example. Interpreting trauma as an indicator of health across a larger group can be more problematic (Merbs, 1989). Roberts and Cox, (2003), report that 28 individuals with fractures were recorded in burials dating to the Iron Age period from across Britain; fractures of the clavicle, ribs and skull were the most commonly affected areas. There were also a number of weapon related traumas from this period (Roberts & Cox, 2003, 98), something which was not found among the skeletal remains from Knowe of Skea.

Few traumatic lesions were identified among the Knowe of Skea skeletons. Rib fractures, spinal conditions and possible healed skull traumas were recorded, some of which were most likely indicative of accidents and physical activity. (6072), a middle adult male, showed two fractures in the right ribs and one on the left. The areas showed signs of active healing which indicate the incident which caused the fractures may have occurred some days or weeks before death; it is very possible that the same incident caused damage or infection to the lungs, which after a time may ultimately have been the cause of death (Brickley, 2006). Spinal conditions such as spondylolysis can be indicative of heavy physical activity and those affected possibly experienced some discomfort. The adult males (6030) and (7039) whose spinal conditions were more advanced, and (6096) who showed eburnation and arthritis of the knees due to osteochrondritis dissecans, probably found everyday tasks painful. (4038), an adolescent had suffered trauma to the face during childhood which caused a number of the anterior teeth to be broken. This would undoubtedly have been a very painful injury and the child probably needed extra care, possibly even an altered diet for a time. It was not possible to determine whether this injury was caused by a blow, by a fall or accident but the child survived and lived for some years after the incident; the ultimate cause of death in adolescence could not be established.

(2100), an older adult male showed trauma to the skull and signs of attempts at 'medical intervention'. The left side of the skull showed signs of a probable trauma with an area of trepanation where part of the bone had been altered and removed, perhaps in order to clean the area of broken bones etc. All of this had occurred some significant time before the man died as the site was in an advanced state of remodelling and healing, suggesting that his overall health must have been good and that he was well-cared for during his recovery. As in the case of (4038) however, it was not possible to determine whether the injuries were caused through violence or as the result of an accident.

Roberts & McKinley (2003) identified sixty-two examples of trepanation from British contexts, 8 from the Iron Age period. Most occurred on males (64.5%), and for most (69.4%) there was no evidence for the reason for the trepanation; just 8 cases showed a head injury, 5 of which were healed. Four of the Iron Age examples identified were from sites on the mainland and in the Western Isles of Scotland, however none of the Iron Age examples appeared to have been removed from a formal grave (Roberts & McKinley, 2003, 65). At 3 Iron Age sites the trepanation was carried out post-mortem (*ibid*, 66). Two individuals with possible trepanation scars were recorded during analysis of the skeletons from the late-Iron Age cemetery at Westness, Rousay in the Orkney Islands. Grave 5, a middle-aged female, showed a depression on the frontal bone close to bregma which measured c1.2x1cm. "The cranial bone is smooth and slightly thickened on the internal surface. The depression is roughened in the middle, and there is a groove around the perimeter. The depression resembles a completely healed trepanation.” (Sellevold, 1999, 16). The second individual, Grave 21, a middle-aged male, showed depressions on the left parietal. There were “three small circular depressions with diameters of 2 to 3mm.”(*ibid*). Sellevold likens these to examples found in a case from ‘pre-Inka Peru’ where three unhealed trepanations were found on the skull of an adult male. It seems that intervening and attempting to aid in the recovery of injured individuals, or even some forms of medical procedures may have been common place among the Iron Age populations Orkney.

To what extent can traumatic lesions be used to interpret the overall health of a community? The frequency of types of fractures or other injuries can be used to establish activity patterns or inter-personal violence, but the healing of these traumas is perhaps more indicative of health, though this also is influenced on an individual level. The treatment and survival of injured or incapacitated individuals is perhaps more importantly indicative of ‘family’ or ‘community’ health-care.

Osteoarthritis / Degenerative joint disease

These are chronic conditions primarily seen on the remains of adults and are usually indicative of habitual activity, can cause pain and can affect mobility and in some cases will have ‘consequences for quality of life’ (Goodman & Martin, 2002). Though the causes of osteoarthritis are not fully known, there are a number of factors which affect its occurrence, including age, sex, trauma and movement (Waldron, 2009). Interpreting the presence of osteoarthritis as evidence of activity of specific occupations is problematic, and should be used mainly as an indicator of stresses ‘in high amplitude’ which begin early in life (Weiss & Jurmain, 2007).

Joint disease and spinal degeneration were present at high rates among the Knowe of Skea population. This would suggest that the individuals buried there were involved in heavy physical activity from a young age. The robust appearance of many of the muscle attachment sites on the upper and lower arm bones and the hands, particularly among the males, would also suggest that the upper body was most involved in these activities.

Glancing at the table of results for those affected with joint disease (Table 18) indicates that males were far more affected than females in this collection. However, there are a few caveats that preclude any simple interpretation of these results. The demographic make-up of the collection from Knowe of Skea does not allow for clear understanding of the differences in the occurrence of osteoarthritis by sex, or even by age. There are no younger aged males, and no older aged females, the highest number of individuals are middle adult males. The small numbers of individuals and the rate of damage or incompleteness of some of the skeletons also affect the results.

The higher number of males in the collection creates greater incidence of joint disease recorded amongst the males; also, that more males reached the older age ranges than females affects results as pathologies related to osteoarthritis and joint disease are progressively higher with advancing age. Also, the poor condition of many of the remains in the collection affected accurate recording of the condition of many of the joints.

The highest incidence of osteoarthritis was recorded in the costo-vertebral joints (12 individuals) and intervertebral facets (7 individuals); that just one of the individuals with osteoarthritis present on the costo-vertebral joints was female may be a reflection of differences in activity types between the sexes, though yet again it should be remembered that fewer females reached the older age ranges in which these pathologies are more common. Following in order of occurrence comes the temporomandibular joint -TMJ - (5 left, 9 right), the ankles (5 left, 7 right), the knees (4 left, 5 right) and the hips (3 left, 5 right). The lower recorded incidences of osteoarthritis in the upper limb may be due, not simply to a lack of its occurrence in the upper limb, but also due to the poorer preservation of the more delicate bones of the clavicle and scapula, and the more incomplete nature of this part of many of the remains. The crouched or flexed position into which the majority of these burials were placed also predisposed the shoulder and upper limb to movement during the decomposition process; the scapula and clavicle and upper humerus fall out of place, sometimes becoming damaged or lost in rubble deposits.

The examination of one joint or group of joints alone does not often lead to sensible conclusions however (Rogers et al, 1987, 183), and to interpret such conditions correctly it is necessary to examine them in relation to the complete skeleton. When examining the occurrence of osteoarthritis by individual, it appears that the older individuals, (2100) and (4045) show more sites affected, however cases of eburnation were more common in the middle aged males, especially in the knees and ankles, such as for (6030) and (4019).

The high rate of osteoarthritis in the tempero-mandibular joint (TMJ) is most likely related to a probable rough diet, reflected in the rate of tooth wear, and also in the possible occupational wear on some teeth. In a study on the rate of osteoarthritis in the TMJ among ancient British populations, Hodges (1991, 375) found that "attrition and age were the only factors significantly associated with osteoarthrtitis."

Schmorl's nodes were recorded in 7 individuals, 3 females and 4 males. There were also a number of individuals who showed osteophytic changes to the vertebra due to possible traumas such as compression and avulsion fractures. One of these individuals, (106), was an adolescent suggesting that activities which may have led to such degeneration or injury began at a young age. In a study on the impact of Schmorl's nodes on pain in a modern population, it was found that centrally located nodes on the vertebral body correlated with pain. Also, the presence of osteophytes together with Schmorl's nodes significantly increased the reporting of back pain. (Faccia & Williams, 2008, 41). When patients in the study group were asked what aggravated their pain, standing, repetitive movement, stooping, even sleeping were reported to aggravate pain; few methods of relief were reported, prescription medication being the main source of relief (Faccia & Williams, 2008, 39), something unavailable to the general populace until quite recently in our history. Such pain would undoubtedly have affected individuals at Knowe of Skea. Given that the impression of everyday life gained from the skeletal analysis suggests a lifestyle involving a lot of physical activity, these individuals with Schmorl's nodes among the Knowe of Skea population must have experienced regular, if not chronic, back pain.

Joint disease can be difficult to compare across different populations due to the differences in recording methods during osteological analysis and the condition of archaeological skeletal remains. Roberts and Cox, (2003), found that 130 of 398 sexed skeletons of Iron Age date had spinal joint disease and that extra-spinal osteoarthritis was more common in lower limbs than in the upper limbs. Osteoarthritis was also recorded on skeletal remains from across Scotland, though the condition of many of the remains was too poor in some cases to allow for accurate assessments. Both of the complete skeletons from Boreray showed joint disease and spinal degeneration. A middle adult male [002] showed osteoarthritis in the hips and the knees, particularly on the left side and eburnation on the left first metatarsal. This individual's spine also showed osteophytes and Schmorl's nodes. A middle-older adult male [003] had osteoarthritis of the hip and of the mandibular joint; and the spine showed osteoarthritic changes in the neck vertebrae and Schmorl's nodes in the lumbar vertebrae (Badcock & Downes, 2000). The two middle adult males reported in Neighbour et al, 1997 from Galson also had evidence of osteoarthritis. Gals93 showed degeneration of the shoulder joint, possibly associated with an unfused acromial process. The second male showed degeneration of the shoulder, eburnation in the left knee and the wrists and Schmorl's nodes in the spine. Both of the partial skeletons, one adult male and one adolescent, excavated at Loch Borralie showed osteoarthritis in the spine, the adolescent in the cervical spine (McGregor, 2003).

Analysis of the skeletal remains from Westness, Rousay showed that of the 32 burials, 15 individuals with some form of osteoarthritis, 8 females and 7 males (Sellevold, 1999). The majority of these individuals were middle to older aged adults. The more extreme cases of spinal degeneration were amongst these older individuals and one case was a middle adult male with signs of spinal damage in the form of compression fractures, Schmorl's nodes and spondylolysis. Two of the older females (Graves 30 & 32) suffered such spinal damage as to leave them with curved or bent features; the first, Grave 30, had ankylosis of several thoracic vertebrae and compressed vertebral bodies that would have left her permanently bent forward. The other female, in Grave 32, had such severe osteoarthritis of the cervical vertebrae that the neck was bent towards the left shoulder. The older age profile of the individuals at Westness has allowed for this greater occurrence of osteoarthritis and severe spinal degeneration amongst the females in particular.

Taken together with the evidence of osteoarthritis from other Iron Age skeletal remains in Scotland, the information from Knowe of Skea indicates a population involved in physical activity, most likely strenuous and often repetitive. Though the females at Knowe of Skea portrayed less osteoarthritic stresses than the males, and than females from Westness, this does not suggest that theirs was a life of ease. The older aged females from Westness portrayed some advanced spinal degeneration and the younger age profile of the females from Knowe of Skea undoubtedly affected the incidence of joint disease there. That some of the individuals with signs of spinal degeneration were young in age, some just adolescent, indicates that for many these activities were started at young ages and were carried out for life, the consequences of which sometimes led to discomfort or pain in later life.

Dental Disease

Of the dental conditions identified in a skeletal population, dental caries and antemortem toothloss are those most likely to affect the overall health of the affected individual over time. Though we routinely record the presence of caries and how many teeth may have been lost, the effects of the pain and the reduction in dietary intake is often overlooked. What can the types of dental disease recorded tell us about the diet, dental hygiene and overall health of a population?

The majority of dental diseases are related to dental plaque, the build-up of microorganisms on the tooth surfaces (Hillson, 1979). It is the mineralisation of this plaque that forms calculus and the mixing of these microorganisms with sugars and proteins that cause the demineralisation of tooth enamel leading to caries. Hillson, (1979) provides a simplified description of the processes involved; eating foods high in sugars such as carbohydrates will create acidic conditions in dental plaque which may lead to caries and conversely, proteins create a more alkaline condition leading to greater mineralisation of the plaque and the creation of calculus. “It is the relative balance between these highly acidic and alkaline periods that determine whether the dental caries occurs” (Hillson, 1979, 150). Factors affecting the build-up of plaque include poor oral hygiene and carbohydrate consumption, both of which may have had an influence on the occurrence of dental caries in the individuals from Knowe of Skea.

Dental disease was the most frequently recorded pathology among the Knowe of Skea collection and shows a direct correlation with the age of the individuals. Caries were recorded in only nine teeth of which all were molars (Table 16). Just four individuals showed these caries; all were adults, represented by one mandible from the general collection of loose bones, a fragmented but matching maxilla and mandible of an adult, one probable female individual and one male individual. No caries were recorded in the deciduous dentition of children or infants. This may be an indication that children were fed different foods to adults. It should be remembered however, that many of the remains of infants and children were in mixed concentrations of bones and the reattribution of teeth to individuals was not often a possibility, it may be that many teeth have been lost or unrecovered.

Antemortem tooth loss was frequently recorded in the collection from Knowe of Skea. Though the number of caries may seem low, should the loss of teeth in life be as a result of carious infection, it would appear that caries were in fact more common than at first glance. This tooth loss occurred in sixteen dental samples across the collection; seven were mandibles only, one a maxilla only and eight had both upper and lower dentition and were from almost complete or articulated burials. Causes of antemortem tooth loss can be either infectious OR degenerative (Lukacs, 1995); this collection showed both advanced attrition (degenerative) and caries (infectious), both of which could have led to pulp exposure which could lead to abscesses or resorption of bone which lead to tooth loss. It is difficult to tell which is the more likely cause of antemortem tooth loss here; each of the infectious and degenerative pathways is possible. Whatever the cause, the implications of caries, abscesses and tooth loss can be serious; severe abscesses may lead to septicaemia causing death. The pain caused by caries and abscesses and the loss of teeth can affect chewing ability which will reduce dietary options, sometimes drastically (Goodman & Martin, 2002). Lower dietary intake will have implications on everyday strength and health.

The number of teeth lost varied between individuals, some had lost just one or two, while others had lost many, such as (4045), an older adult male who had lost almost all of his teeth by the time of his death. By far the individuals worst affected by ante-mortem tooth loss were middle to older aged males. This may be a reflection of differences in foods consumed or habits between males and females. However, as the increased loss of teeth seems to correlate with older age, it should be noted that no females were recorded in the older adult age range, thus creating an immediate bias towards males when recording ante-mortem tooth loss.

Roberts and Cox, (2003,102) reported that dental disease was recorded in 44 individuals of Iron Age date in Britain; 19 individuals had caries, 32 showed calculus, 8 individuals had periodontal disease, 27 showed abscesses and 14 individuals had lost teeth during their life. They also report that Lunt, 1974 recorded an increase in caries in Scotland from the Bronze Age into the Iron Age. This Scottish Iron Age data was from a single site however, a large cist that held multiple individuals at Lochend, Dunbar. Dental disease has been reported from almost all reports of Iron Age skeletal material in Scotland in recent times, though the degree of information provided varies.

In the Lochend skeletal sample, Lunt (1974) reports that of the 301 teeth present, 20 (6.6%) showed caries. Of the 22 caries present, prevalence was greatest in the maxillary teeth and was present mainly in the molars. Early analysis of the skeletal remains from Broxmouth reported periodontal disease, abscesses, antemortem tooth loss, calculus and caries (Armit, 2013); two individuals had lost a canine, 3 showed evidence of periodontal disease, 5 had caries and one individual showed abscesses at both lower second molars (RCAHMS MS1019/53). The adult male from Howe showed abscesses in the maxilla and pulp exposure on the loose upper teeth. The mandible showed caries in the right third molar, and both first incisors. Unlike the evidence from Knowe of Skea where no carious lesions were found in the subadults, the teeth of the child buried at Howe showed one carious lesion (Ballin Smith, 1994; Tucker, 2010). The skeletons from Boreray both showed calculus and signs of periodontal disease. The older male had also lost four teeth during life, possibly due to periodontal disease (Witkin in Badcock & Downes, 2000). All three of the skeletons excavated at Galson showed attrition and poor periodontal health; Gals93 and Gals96 also showed dental abscesses (Neighbour et al, 2000).

The report on the skeletal analysis of the human remains from Westness, Rousay (Sellevold, 1999) provided more information than most others. The remains of 23 of the 29 individuals included teeth: 445 permanent teeth (439 in situ) and 60 deciduous all in situ. Nineteen individuals had intact jaws or fragments with teeth in place. Eight individuals showed one or more caries (42.1%). Of 445 permanent teeth 21 had caries (4.7%). The most frequently affected were the upper teeth, the upper right first molar in particular. The majority of those affected were females, perhaps indicating some sexual difference in food/carbohydrate consumption. Calculus was noted on seven individuals; in three cases it was present on the lingual side of the front teeth in particular. In contrast with Knowe of Skea, antemortem tooth loss was reported in just three individuals.

The high incidence of dental disease in general seems common across the collections of Iron Age date in Scotland. The higher incidence of caries, the presence of calculus and the lower rate of antemortem tooth loss at Westness, Rousay may indicate a difference in diet between the population there and the individuals buried at Knowe of Skea. The evidence of isotopic analysis carried out on bone samples from Knowe of Skea indicated that marine resources formed part of the diet, possibly just seasonally for some, but in greater amounts during the earlier phase of burial at the site. This was in stark contrast to the diet of the people at Westness where isotopic analysis showed an extremely terrestrial diet. Though the islands are in very close proximity and the difference in time is just a few hundred years, the changes which began during this period brought about social developments that affected domestic life, as hinted at in the presence of more communicable disease. These changes also seem to have extended to dietary habits, which in turn affected the dental health of the population.

Growth and Stature

The most rapid phase of growth takes place after birth and in infancy, after which growth slows down until there is a growth spurt at around age 5 to 7 years and another in adolescence. These growth spurts coincide with a number of developmental and social changes at these ages for most individuals; the eruption or completion of dentition, growing independence and mobility; puberty and growing involvement in social community (Boggin, 1999). A healthy maternal diet, nutritionally adequate breast-milk and a healthy environment should be enough to ensure growth after birth and in early infancy; once a child is weaned however it will become dependent on new foods provided to maintain nutrition and energy levels necessary for growth. Calorific intake must be enough to provide for maintenance, repair and activity and when these have been satisfied, what remains goes towards growth (Boggin, 1999). Disturbances in nutrition are most keenly felt by infants and children as it is these individuals who require the most energy to maintain growth and health. The major components affecting infant and childhood growth are diet and disease, and the relationship between these two is complex (Saunders & Barran, 1999; King & Ulijaszek, 1999). The growth and development of infants and children are most sensitive to changes in environment and studies of child growth and development have been used to assess the overall state of nutrition or health of a population as poor growth may indicate unfavourable conditions (Goodman & Martin, 2002)

Ageing methods for infants and children strongly depend on dental development and the length of the skeletal elements which are compared to standards created through the study of known age and size children (see *Data Recovery & Analytical Methods*). The majority of studies into growth and development will use comparisons between the dental development and long bone length of individuals. Dental development takes place at standard rates and is little affected by environmental factors; particularly the deciduous dentition which will only be affected by more severe undernutrition. The majority of illnesses will not affect tooth growth and will affect weight and height, and bone growth first (Konigsberg & Holman, 1999). Therefore, differences in the estimated age of an individual gained from dental development and long bone measurements may indicate some disturbance in the growth of that individual, perhaps through illness or poor nutrition. Lack of dental evidence will cause ageing methods to rely solely on long bone growth and as these can be affected by periods of under-nutrition or ill-health, it is possible that inaccurate, younger ages may be recorded (Lewis, 2007). Ageing individuals through dental evidence alone may provide more accurate ages but relies on teeth remaining in the bone which is not always the case in archaeological material. Also, any evidence of stress in infancy will be lost should the deciduous teeth have been shed and the permanent teeth grown in. For studies of growth and development therefore it is necessary to have both dentition and long bones for each individual; this was a particular problem when examining the children and infants from Knowe of Skea.

Overall numbers of infants and children in the Knowe of Skea collection were calculated by the counting of skeletal elements (*see MNI*). Commingling and/or disarticulation through disturbance of the remains were most obvious in the infants and children. Few infants or children were discovered undisturbed and the majority of the bones of younger individuals in the collection had been damaged or fragmented by the rubble deposits into which burials were placed, by the movement of these bones during the burial of other individuals, or the building of later structures on the site. Many of the maxillae and mandibles found had also lost teeth from the bone during decomposition or later disturbance, creating difficulties in the assessment of age through dental development. Confident matching of dentition and long bones to the same individual was only possible in a small number of cases. Among these it was possible to determine that some infants and children showed discrepancies between age at death estimated from dental development and that estimated from measurements taken on the available bones (Table 28). During a period of illness or stress, growth will slow down until normal nourishment is resumed and the extent of the slowed growth can reflect the severity of the stress experienced (Lewis, 2007).

Number	**Dental Development**	**Long Bone Measurement**
2117	6 to 9 months	3 to 6 months
2118	<6years	5 to 6 years
3117	<6years	2 < 5 years
6061	6 to 8 years	4 to 5 years
9016	2.5 to 3 years	1 to 2 years
S.F.251	<3years	2 < 4 years

Table 28: Age of infants estimated through dental development versus bone length.

Of these children and infants, (2117) had poor health overall and most likely was suffering from severe nutritional stress; (2118) and (9016) also showed dental enamel defects which indicate that these two had also experienced periods of stress, either nutritional or infectious, at an earlier age. While (2118) had most likely experienced a period of recovery and 'catch-up' growth, the younger child (9016) had not and died at a younger age.

Together with the evidence provided in the presence of dental enamel defects, there is a strong indication that childhood was a period of some stress for the population who buried their dead at Knowe of Skea. Unfortunately there are few Iron Age sites with sufficient numbers of child burials with which to compare these results. At Poundbury, it was found infants and children were invariably smaller than the modern standards. It was noted that for infants, growth seemed normal until around 3 months after which growth was hampered; the bones appeared very fragile and it was suggested that this was due to early weaning. Older children did not seem to recover from this 'poor start' and most were under-sized compared to modern standards and the overall health of children was poor, most likely because of inadequate diet (Molleson, 1989).

Similar signs of illness and stress were identified among the infants in the Knowe of Skea assemblage (see *Infant health and mortality*). This stress at Knowe of Skea was in some cases most likely nutritional, possibly due to the seasonality of fresh food supplies in the northern islands; such nutritional stress may have led to illness which caused death at a young age for many. Those who survived this period of stress to grow to adolescence may have caught up in height with others of the same age. However, given the high number of adolescents in the collection, it may be that these stresses continued into adolescence or that earlier periods of stress experienced by some continued to affect them in later years. If this was the case then the growth spurt usually experienced in adolescence may have been affected leaving the eventual adult height short (Lewis, 2007).

Adult stature can be seen as a reflection of the complex relationship between nutrition and health and the cumulative effects of these on an individual during growth and development. Health and diet during life can have a direct effect on the final attained stature of adults in any population. Many individuals adversely affected by illness or nutritional stress during childhood and adolescence will experience a period of recovery and rapid 'catch-up' growth that may eventually mask the effects of these former periods of stress. For 'catch-up' growth to be successful however, individuals not only need to recover their health, but will also require a sufficient diet to maintain growth. It might be assumed that for those lacking necessary dietary requirements, that their eventual attained stature may be shorter than expected. Stature was calculated for the adults in the collection from Knowe of Skea based on measurements taken on the available long bones; the bones of the lower limb are preferred for these calculations, and provide the most accurate results. In many cases in this collection however, these long bones were fragmented or missing and in these cases, when possible the bones of the upper limb were used (Table 14). The average stature calculated for males was 165.41cm and for females was 154.7cm.

Mean stature for males in the Iron Age Britain has been recorded as 168cm with a range of 164 to 174cm, and for females at 162cm with a range from 154 to 164cm (Roberts & Cox, 2003, 103). The average stature for each sex at Knowe of Skea was closer to the lower end of these ranges. Shorter stature evaluations for the Knowe of Skea may be a result of the small number of individuals or due to the bones available for measurement, but may also be a reflection of genetic, dietary or stress influences.

Infant health and mortality

Cause of Death?

Burials of infants in any cemetery may represent still births, infants who die very soon after birth and infanticide victims (Mays, 1993); as cause of death is usually difficult to ascertain on skeletal remains, burials may include infants who have died from any number causes. The presence of so many infants of similar age in a single collection indicates some external influence including infection, malnutrition, or infanticide.

There were a number of remains in the collection from Knowe of Skea that represented infants that would have been too small to survive long after birth. Today, medical intervention can help newborns as young as 24 weeks to survive; in the past however, it is usually accepted that no infant younger than 28 gestational weeks could have survived due to the immaturity of the vital organs (Lewis, 2007, 84). It can be assumed that the conditions in the Iron Age would have been such that even infants closer to full-term were at risk, perhaps reflected in the numbers of infants recovered from the excavations. Such high infant mortality might be expected of a prehistoric population (Goodman & Armelagos, 1989), though the age range of this particular collection with such high numbers of perinate infants of around 38weeks gestational age raises a number of interesting questions. What caused so many infants to die at or around the time of birth? Were these deaths natural? If not, was it infanticide? And if these deaths were due to natural causes, what might those causes have been?

Though Iron Age burials are low in number in Orkney, infant remains have been found on a number of sites of this date. At Pierowall Quarry, Westray, a roundhouse of Iron Age date, commingled human remains, including perinate remains, were found in the rubble deposits on site. Unfortunately, these remains were not radiocarbon dated - a common problem when examining remains from past excavations – and the remains were presumed to be from the interior of the earlier burial tomb also located on the site (Sharples *et al*,1984). Excavations at Bu Broch on Orkney Mainland revealed that the site was used for the burial of the dead during a phase of collapse and decline and the human remains from this site have much in common with those from Knowe of Skea. The remains from Bu included the bones of at least 7 infants and 3 children from rubble deposits (Hedges, 1987). Unfortunately the many remains from the site of Bu Broch were not dated as the process was deemed too expensive at that time. The remains of two small infants, one perinate and one neonate, were also found in the rubble of the site of Howe, close by the inhumation burial of an adult male and a child (Lorimer in Ballin Smith, 1994). A number of infant burials were also recovered from the recently excavated burial mound at Cantick, Orkney and though radiocarbon dating has revealed that the main burial is of Bronze Age date, it is possible that the infants buried in the rubble mound are later perhaps Iron Age date (Dan Lee, 2010). The burial of perinate and older infants therefore is not unusual in Orkney during this period.

The discovery of infant remains on sites of otherwise domestic nature has sometimes been interpreted as evidence of infanticide. Infants have been accorded differential burial treatment in many societies in the past however and infanticide should not be assumed. Infanticide is usually carried out immediately after birth or very soon after (Scrimshaw, 1984; Mays, 2000) and so collections with such high numbers of perinate infants have attracted attention and in recent times such collections have been seen worthy of closer investigation.

On the late Roman/early Byzantine site of Ashkelon, Israel (Smith & Kahila, 1992), skeletal remains of a large number of infants were found in a sewer. Analysis showed that the majority of the infants found were of perinate age. Excavations at the site of Hambleden Roman villa, England (Mays, 2011) revealed a large number of infants buried in one area of the villa complex. These remains were thought lost for many years until recently recovered and analysed. There proved to be a majority of perinate infants in the collection. The possibility of infanticide was highlighted by the burial location in both of these sites, and later through the examination of the age distribution of the infants recovered from the excavations. Mays (2011) compared data from Ashkelon and Hambleden with that from the cemetery of the medieval village of Wharram Percy, which included large numbers of infants but presented a different age distribution determined to be the result of natural deaths. By comparing the data from Knowe of Skea with the results from Mays' study, it was attempted to determine whether infanticide might have been a contributing factor to the deaths of such high numbers of perinate infants at Knowe of Skea.

These remains were in very good condition; however a large amount of disturbance and mixing of the remains had taken place over time. Unfortunately, due to the rubble nature of the deposits at Knowe of Skea, the majority of the infant remains were found in a seemingly disarticulated state and only in rare cases could single individuals be identified in the skeletal collection. Calculating numbers of infants was based on the recurrence of skeletal elements only. Ageing of infants was calculated by measurements taken on each bone where possible and comparison with measurements provided in Fazekas and Kosa (1978) and Schaefer et al (2009). For long bone measurements, age was also calculated using the regression equations of Scheuer et al (1980), though this was only possible for complete long bones. The use of the Scheuer et al (1980) equations is common for the majority of investigations of the possibility of infanticide in archaeological populations and so allows for the compilation of comparable sets of data.

	Humerus	**Femur**	**Tibia**
Ashkelon	63.2	70.9	62.6
Hambleden	64.1	74.1	62.4
Wharram P	67.4	75.2	61.1
KofSkea	63.98	73.57	63.98

Table 29: Long bone lengths (mm) calculated using Scheuer et al, 1980.

The age distribution of the Knowe of Skea infants does not quite equate with any of the other three sites, but rather contains elements common to each. The presence of foetal remains of just 26-34 weeks resembles Wharram Percy, for which a natural deaths distribution has been assessed. However, unlike Wharram Percy, the proportion of infants peaks in later gestational weeks. The high peaks at 38-40 weeks have been interpreted as evidence for infanticide for the collections at Ashkelon (Smith & Kahila, 1992) and Hambleden Hill (Mays, 2011) - can the same be said of Knowe of Skea? The Knowe of Skea shows an early peak in the proportion of infants dying at 35-37 weeks and a further peak at 38-40 weeks. It may be that the high proportion of the infant deaths at 35-37 weeks represents natural stillbirths. Could it be then that these 35-37 week infants actually represent perinates for this population and this time period? In this case, the 38-40 weeks infants would actually represent neonatal deaths in the first weeks of life perhaps due to infection or poor nutrition, for which there is some evidence, (discussed below).

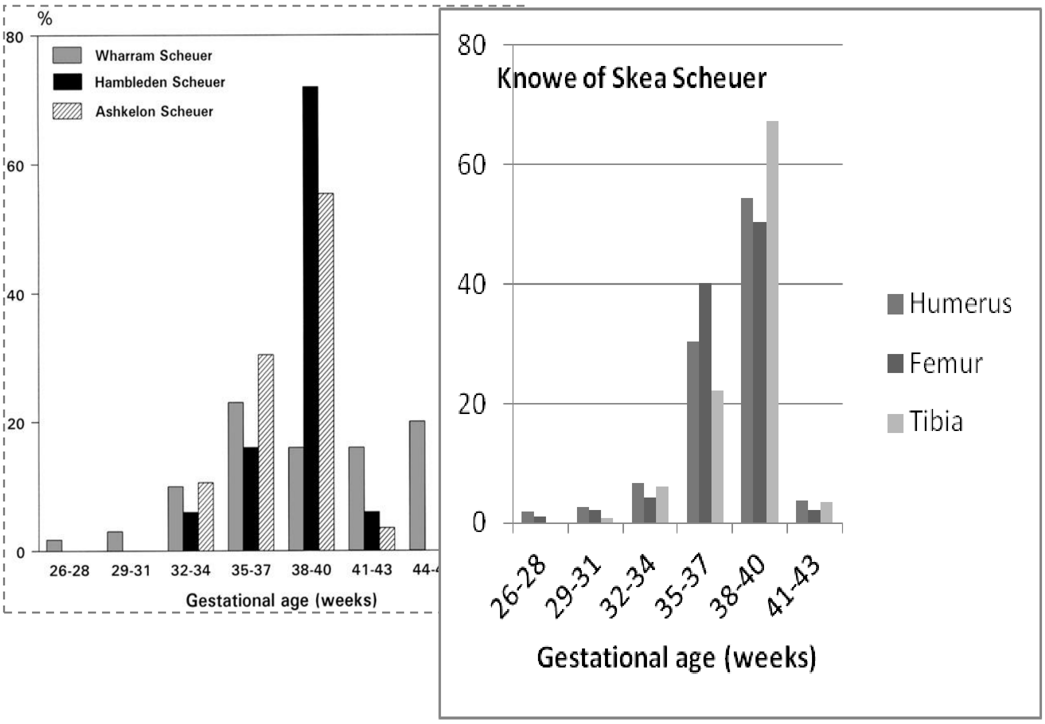


Figure 20: age distribution of infants at Knowe of Skea compared with those from Mays, 2011.

The perinatal and neonatal age stages have been divided in some studies into neonatal and post-neonatal stages in the attempt to establish the likely causes of death among very young infants (Lewis & Gowland, 2007; Saunders & Barrans, 1999). As infant survivability is largely dependent on the environment into which they are born, it is suggested that deaths in the first weeks of life (28-40 weeks) are due to endogenous factors such as prematurity, low birth weight, maternal health or congenital disorders. Deaths which occur in later weeks (41- 48 weeks) and months may be considered to be the result of exogenous factors caused by their environment, such as sanitation, infection or malnutrition. Examining the ratio of neonatal to post-neonatal deaths therefore, can potentially provide information on cause of death of infants (Lewis & Gowland, 2007). This theory was used to examine deaths of neonates and post-neonates from a number of late medieval cemetery collections in England. It was found that neonatal deaths outnumbered post-neonatal in each of the collections, and that there were notable differences between rural and urban sites. Though the number of neonatal deaths at the urban sites remained high they were slightly lower than the rural examples, possibly due to improved medical help during birth. However the numbers of urban post-neonatal deaths were higher than any other site and this was proposed a result of greater exposure of infants to communicable diseases and contaminants in the urban environment, not present in a rural setting (Lewis & Gowland, 2007). The majority of infant deaths are normally due to gastrointestinal or respiratory illnesses which can be seasonal in nature (Saunders & Barrans, 1999); spoiled food products and water supplies in summer lead to gastrointestinal infections and cold weather coupled with increased time spent indoors during winter months lead to respiratory illnesses. In an examination of the effects of raised grain prices on the population of Cumbria from AD1557-1806, Scott & Duncan (1999) found that post-neonatal deaths increased during times of hardship, caused by raised grain prices; but that perinatal deaths increased in the months after, suggesting that poor maternal health and nutrition during pregnancy was the major factor in these deaths. They suggest that falling infant mortality over 300 years from the 16th to 19th centuries was as much from the better nutrition of the mothers and so falling perinatal deaths as it was to improved hygiene, midwifery and overall nutrition.

By comparing the neonatal and post-neonatal infants in the Knowe of Skea collection, we can see that neonatal deaths occur most frequently. The number of post-neonatal infants in the collection is low in comparison, and this is most likely an indication that endogenous factors were influencing neonatal deaths in this population. Possible indications of nutritional stress among some of the older infants and children in the Knowe of Skea collection may indicate that under-nourishment was a problem for this population, at least among its younger members. Signs of nutritional stress were not common in the adult remains from the site, possibly due to the slower reaction times of adult bone to such stresses. Should nutritional stress have extended to older individuals, pregnant women were possibly experiencing periods of nutritional stress resulting in smaller and low birth weight newborns; perhaps this in part may explain the high numbers of newborn infants in the collection from Knowe of Skea.

Low numbers of females compared to males in a buried population has also been suggested as the result of the infanticide of female infants; should more female infants be the victims of infanticide there are fewer females to grow to adulthood. There are other reasons why female numbers might be lower than males however, such as the migration of women away from the area after marriage, or the immigration of men for extra labour or military strength or even the burial of males and females in different areas of a cemetery. The only way to confidently prove the theory of female infanticide is through establishing the sex of suspected infanticide victims through DNA analysis (Mays, 2000). This has been attempted for some collections and the results have actually shown a greater number of males in many cases (Faerman et al, 1997&1998; Mays & Faerman, 1998; Waldron et al, 1999). A higher number of males among perinate and neonate infants might be expected due to the greater vulnerability of male infants to stresses and the higher mortality among male infants of low birth weight (Stevenson et al, 2000). Rather than support the suggestion of female infanticide in these collections, the results of these DNA tests in fact point to a more natural cause of death being most likely in these cases. Given the mixed and disarticulated nature of most of the infant remains from Knowe of Skea, and the expense of DNA research at the present time; such a study for this collection is unlikely.

The possibility that infanticide was practiced in the population who chose to bury their dead at Knowe of Skea cannot be ruled out. It is possible to say however, that whatever the cause of death of these infants, natural or otherwise, unlike those from such sites as Hambleden Hill and Ashkelon, the dead at Knowe of Skea were seemingly all accorded the same status in burial as the rest of the community. Given the time period, the evidence for insanitary conditions in the form of parasitic infection and for infection in very young infants in the form of endocranial pathologies, it is possible that the death of such high numbers of newborns in this population was a natural occurrence.

Examining the age distribution together with the results of the pathological analysis sheds a little more light on what may have caused such high numbers of perinate and neonate deaths. There are signs among the children in this collection of metabolic disorders such as Vitamin and Iron deficiencies most commonly attributed to poor nutrition. Adult remains invariably show less evidence of such stresses due to the slow reaction times of the adult skeleton. Faster reaction times on the bones of infants and children therefore represent more immediate stresses in the community (Goodman & Martin, 2005).

Infection

Among the infant remains, given the fragmentary nature of many of the bones, only the most obvious of pathologies could be recognised. It was possible however to identify endocranial pathologies on many skull fragments. The crude occurrence rates were calculated for the most recognisable skull fragments: 7% (15/213) frontal fragments, 20% (13/64) parietal fragments and 10.5% (6/57) occipital fragments showed endocranial pathology. Unfortunately these are not a true reflection of the occurrence of these pathologies, due to the fragility of infant skull fragments, the parietal and frontal in particular; many small fragments showing pathology were recorded simply as unidentified skull fragments. The majority of these lesions take the form described as ‘capillary formations’ with others of the ‘hair-on-end’ form and are thought to be connected to inflammation or haemorrhage of the meninges caused through infection, nutritional deficiencies or trauma among children (Lewis, 2004). None of the older infants or children in this collection showed these same endocranial lesions however; suggesting that whatever the causes, they were exclusive to newborns and in part may explain the high infant mortality. In more recent times, such a high number of newborn deaths was seen in St.Kilda, the most westerly of the Western Isles of Scotland.

The tragic loss of newborn infants in very high numbers on the island of St. Kilda was first reported in the eighteenth century. Newborn infants were said to die of "eight day sickness", a description of which was provided by Rev. Kenneth Mccauley in 1764;

"the St.Kilda infants are peculiarly subject to an extraordinary kind of sickness. On the fourth or fifth day after their birth many of them give up sucking; on the seventh their gums are so clenched together that it is impossible to get anything down their throats. Soon after this symptom appears they are seized with convulsive fits, and, after struggling against excessive torments till their strength is exhausted, die generally on the eighth day." (Turner, 1896, 1191)

The early deaths of so many newborns created much debate among the medical profession and philanthropists at the time. By the late nineteenth century these symptoms were recognised as those of tetanus and were eradicated through more hygienic practices implemented by the island's minister Rev. Angus Fiddes following instructions received from Dr. G.A. Turner who recounted their success in his article to the British Medical Journal in 1896. It has also more recently been found that the tetanus bacterium was present in the soils on St. Kilda (Poxton, 2010), creating an even greater need for the "cleanliness in all the surroundings of newborn infants" advocated by Dr.Turner in 1896.

Is it possible that the symptoms of such infection, the convulsions in particular, would cause the type of pathology identified on the Knowe of Skea skull fragments? Could it be that the majority of these infants died too soon for such lesions to appear and those that do present endocranial lesions survived, or suffered, longer? This presents an alternative to traditional interpretations such as a difficult birth, a malnourished or weak infant or even infanticide when recording that death was 'at or around the time of birth'; we must consider that living conditions and sanitation also played a part in the life and death of infants.

Nutritional stress

Though little evidence of metabolic disease was noted among the adolescent and adult individuals in this collection, a number of young infant bones displayed pathologies that have been associated with scurvy in a number of studies into the occurrence of this disease in infants and children, (Ortner, 1997/1999/2001; Brickley & Ives, 2006). Few cases of scurvy have been recorded in prehistoric skeletal collections from Britain and it has been suggested that it is a disease that did not occur to any great degree until the post-medieval or industrial era (Mays, 2008). Possibly the earliest reported case was that of a child from a Bronze Age burial mound in Wiltshire (Mays, 2008). The child was aged through dental development to around 2 years and lesions indicative of scurvy were noted on the skull fragments, orbits and mandible.

Table 19 shows that in the Knowe of Skea collection, the majority of bones displaying lesions described in these studies are of perinate age, which in most studies is considered unusual, even unlikely (Brickley & Ives, 2008; Hirsch, 1976). Compared to the overall numbers of perinates from the Knowe of Skea, the numbers showing evidence of metabolic stress are relatively low. Their significance may be that they are present at all, and that they may indicate poor maternal nutrition especially as there is little evidence of such on the adult remains.

Young infants are usually supplied with sufficient nutrients from breast-feeding and signs of deficiencies should be rare in the first few months after birth, however scurvy has been identified in a number of cases in very young babies and has been termed 'congenital scurvy' – "When scurvy develops in the first month or two in a breast-fed infant, it is probably always of congenital origin, and perhaps all cases of scurvy in breast-fed infants have a congenital origin." (Jackson & Park, 1935, 753). In most cases, scurvy in such young infants is thought to reflect poor maternal nutrition, though the mother herself may display no obvious signs of the condition (Hirsch et al, 1976).

A number of factors may be the cause of poor maternal nutrition, perhaps the probable seasonal nature of the availability of fresh foods in the environment of the Orkneys was such a factor. If the main cause of such a disease in such young infants should be the poor health and nutrition of the mother, it seems logical therefore that the months of the year during which they were pregnant may have an effect on the health and possible life expectancy of the individuals at Knowe of Skea. Perhaps these are ‘spring babies’, adversely affected by the environmental and nutritional stresses felt by the mother during pregnancy in the winter months? Studies into the relationship between month of birth and life expectancy have shown that there is some correlation between these two. It appears that those born in spring have been shown to have shorter life expectancy to those born in the autumn months; it was found that experiences in early life, even prenatally, have greater influence on life expectancy than environmental or social factors in later life (Dobelhammer & Vaupel, 2001). Of course the time of year in which the infants buried at Knowe of Skea were born and buried in not something that can be determined from the skeletal remains. The results of faunal analysis from sites across Atlantic Scotland indicate that there was some seasonal exploitation of wild resources, in particular young close-to-shore fish and molluscs during spring and early summer (Locker in Ballin Smith, 1994; Barrett *et al*. 1999). As the exploitation of marine resources was very rare during this period elsewhere in Britain (Jay & Richards, 2007), perhaps this can be seen as evidence of periods of food shortages which may have resulted in nutritional stress in pregnancy (see *Interpretation of diet*).

Evidence of metabolic disease was scarce among the adolescents and adults from the site but skull fragments showed at least two children and one infant with signs of porotic hyperostosis. These lesions were variously healing or active and occurred as both pitting on the external surfaces of the skull and as cribra orbitalia. Unfortunately these were found on skull fragments and were not attributed to any one individual for whom the other parts of the skeleton could have been examined. Porotic hyperostosis and cribra orbitalia associated with nutritional deficiencies were once believed to be the result of a deficiency of iron in the diet but are now thought to be more complicated and associated with vitamin deficiencies caused by the poor nutrition of breastfeeding mothers or nutritionally insufficient diets (Goodman & Martin, 2002; Walker et al, 2009).

Weaning

Weaning is seen as the cessation of breast-feeding and the move to a more solid food diet. This can take place either over-time with the gradual introduction of solid foods, or more suddenly with the complete cessation of breast-feeding occurring at once (Katzenberg, 1996). Recognizing weaning patterns in archaeological populations is not straightforward, a number of methods are drawn together to build a greater understanding of the process and its effects. Recognising stresses in infants and children or concentrations of deaths at particular ages may indicate at what point weaning was begun in a skeletal population. During weaning there are dangers for the child as they are exposed to new possibly infected foodstuffs or water and the ensuing illnesses while the immunity and protection provided through breast-feeding reduces; such stresses may be evident on the bones and teeth.

Unlike many of the studies carried out to investigate weaning in past populations, the Knowe of Skea collection contains a very small number of infants, and only a small proportion of these were chosen for testing due to the possibilities of cross-sampling in the disarticulated remains. As a result, we cannot rely completely on any one method to determine the age of weaning and it is best to compile the results of a number of investigations. The age profile of the population, the infant and children in particular, together with examination of the skeletal indicators of stress and illness and the results of stable isotope analysis will create a clearer picture of the periods of greatest stress for children, including weaning.

Age profile - infants

The Knowe of Skea collection included the remains of a number of infants and small children; however in the majority of cases these were found in fragmented condition and often commingled with the remains of other infants. This was partly due to the rubble nature of the deposits on the site, partly to the fragile nature of the bones and in some cases due to the inexperience of some of the excavators when dealing with immature remains. The number of infants was best calculated by counting the number of skeletal elements, for example 28 femora were catalogued as ‘infant’;

however only eight could be measured to allow more accurate ageing. More reliable were the dental records; 10 infants were identified and aged more accurately through examination of mandibles or maxillae in the collection.

Age	**<4mnth**	**6-9month**	**9-12month**	**12-16month**	**18-24mnt**
Number	1	1	1	3	4

Table 30: number and age of infants identified by mandible or maxilla.

Though the collection included high amounts of perinate remains, there are low numbers of infants aged between the neonate phase and the end of the first year. This might suggest that some change in the lives of these infants, such as weaning, began early in the second year, which caused increased numbers of deaths. Evidence of stress might be seen on the teeth in the form of dental enamel hypoplasia. In this collection however, only two dental samples (2118 & S.F.135) with *in situ* teeth showed that some form of stress had occurred at around 12 to 18 months of age. This cannot be assumed as an indication of lack of stress at this age. Evidence of stress at such a young age is invariably found on deciduous teeth, which are replaced by the permanent teeth as children grow and so the evidence lost. There is also some indication that the stresses that seem to have begun in this age group may have continued beyond infancy; much of the dental enamel hypoplasia evidence found on older individuals indicates periods of stress in early childhood (see discussion of Dental Enamel Hypoplasia; Table 20). Disruptions in growth that result in dental enamel defects are normally the result of nutritional stress or illness. Should even limited breast-feeding have continued into late infancy or early childhood, the eventual disappearance of any immunity it provided may have affected individuals in early childhood.

Stable Isotope Analysis

The analysis of the chemical composition of bone collagen from infants has been used to establish breast-feeding and weaning patterns in archaeological populations from a number of locations and varying dates (Richards *et al*, 2002; Fuller *et al*, 2006; Richards *et al*, 2006; Jay *et al*, 2008). The results of stable isotope analysis on samples from the Knowe of Skea as outlined and discussed in Chapter 5 provided a slightly clearer understanding of the weaning process of this population. As the number of samples was small and no mother and infant pairs were identified the discussion was confined to general observations only.

The most interesting aspects of the results of the stable isotope analysis are the results from two infants (2117 & 9023) for whom pathological analysis had suggested some nutritional stress. These results indicate that nutritional and health stresses on both infant and mother may have had a large influence on the duration of breast-feeding and timing of weaning.
It is likely that though infants died in greater numbers during weaning, those who lived into childhood continued to suffer from nutritional and health stresses, most likely due to nutritionally insufficient foodstuffs and possibly from intermittent ill-health the evidence of which can be seen in the number of children in the skeletal collection and the presence of Dental Enamel Hypoplasia which formed on teeth in childhood (see discussion of DEH; Table 20).

Archaeological Evidence of Diet

As outlined in Chapter 6, the isotopic evidence from individuals from the earlier phase of burial at Knowe of Skea would seem to reveal that the diet of the individuals included more marine resources than previously seen during this period. The indication of a marine contribution to the diet during the earlier phase of burials is very interesting considering the almost extreme lack of evidence for such a diet elsewhere. It also seems that the contribution of marine resources to the diet of the Knowe of Skea individuals decreased over time. How do these results compare to the archaeological evidence for the diet of the population of the islands at this time?

Traditionally, information on prehistoric diets has been gleaned from analysis of the faunal remains recovered during excavation of settlements sites and has increased in accuracy with the more widespread adoption of sieving strategies allowing small fish and bird bones to be included in these analyses. The growth of archaeological sciences has allowed for the development of a number of chemical and biochemical methods which have drastically improved our overall understanding of prehistoric farming and diet. Through the analysis of lipid residues on ceramics it is possible to determine the foodstuffs once contained or cooked within pots found on excavations. It is also possible to use biochemical analysis of samples of human and animal bone to assess their diet. Unfortunately, the low number of human burials attributable to the Iron Age in Atlantic Scotland has hampered any true assessment of human diet, however comparing the results of these three methods has created a greater understanding of Iron Age diet in recent years.

Faunal Analysis

Analysis of faunal remains from Iron Age sites have shown that cattle, sheep/goats and pigs, were the most common domestic animals exploited for food across Britain (Hambleton, 1999). Though the “environment, marginality and dating” (Jay & Richards, 2007, 185) of many Iron Age sites in the Northern and Western Isles of Scotland might be expected to have affected farming in the region causing different animals to be reared or methods to be adopted, the opposite in fact appears to be the case. Though there are differences between sites and across the region, domestic animal bone assemblages from Iron Age sites in Orkney and those from across

Britain are essentially very similar. Though the site at Knowe of Skea allows us the rare opportunity to examine the diet of a group of humans, the animal bones recovered from the cemetery may not represent an everyday selection of animals normally used for food; the animals buried on site may have been specially chosen for sacrifice or feasting. The faunal assemblage from the site does however follow the general pattern of Iron Age animal bone collections; sheep were most numerous, followed by cattle and pigs. Analysis of the animal bones revealed that the butchery methods employed were similar to those found at contemporary Orcadian settlement sites (Fraser, 2012).

Faunal assemblages from Iron Age sites across Orkney at Skaill (Buteaux, 1997), Pool (Hunter, 1990), Pierowall Quarry (Sharples, 1985) and Howe (Ballin Smith, 1994) show similar profiles and proportions of animals with cattle and sheep/goat in the majority followed by pigs. Both cattle and sheep/goats have secondary uses and products other than their meat which would have formed important parts of the farming and food of Iron Age communities. Though evidence provided through analysis of faunal assemblages can provide numbers and percentages of which animal were present on settlement sites, these results can rarely provide information on how these animals were exploited; however this may be interpreted from the age profile of a faunal collection. The presence of neonate animals in a faunal assemblage can be interpreted as herd management due to fodder shortages in winter, or as evidence of culling in dairy farming. Large quantities of neonate cattle bones were recovered from middle Iron Age midden deposits at Old Scatness Broch, Shetland possibly due to the early development of dairying practices (Bond et al, 2004). In contrast, at Warebeth Broch, Orkney analysis of the cattle remains suggested that cattle were kept in small numbers, were older and were reared for more than just their meat, perhaps for traction in farm work or for dairying and bearing more calves (Sellar in Bell & Dickson, 1989).

Sheep provide valuable secondary products; meat, skins and wool and also perhaps milk. The sheep/goat bones at Warebeth Broch showed that sheep were killed at all ages, indicating that sheep were probably reared for each of these purposes and formed an important part of the subsistence of this community (*ibid*). Analysis of the animal remains from Howe, Orkney indicated that sheep farming grew in intensity in the later Iron Age phases of the site and this has been taken as an indication of the growing intensification of farming overall during this period (Smith et al in Ballin Smith, 1994).

Pigs are less well represented at most sites of this date (Jay & Richards, 2007). This is most likely for a number of reasons; pigs can be useful for working and manuring the ground in preparation for sowing, they are omnivorous and so easier to fodder over winter and have large litters which provide a valuable meat source. Large numbers of animals would not be necessary for any of these uses. The animal bones recovered from a well at Warebeth Broch, Orkney showed that the vast majority of pigs were killed when very young, or as old animals (Sellar in Bell & Dickson, 1989).

Though technically a wild species, the numbers of red deer represented in faunal assemblages indicate that this animal formed an important part of the meat resources of Iron Age communities in Orkney, at least for a time. It is possible that the herds of red deer on the mainland were managed, through culling of certain numbers or ages each year. The animal bone collection from Warebeth Broch also contained a number of red deer and it was suggested that hunting may have been an important activity which supplemented the diet during particular times of the year, particularly in winter (Sellar in Bell & Dickson, 1989). Early Iron Age levels at Howe showed a high number of young red deer and this profile changed over time as sheep farming grew and numbers of sheep increased in later phases on site (Smith in Ballin Smith, 1994).

Though all of the evidence gathered from examining faunal assemblages can tell us which species were farmed, in what numbers and even how they were butchered, none of this can reveal to us how the meat of these animals was actually eaten; this is an area of research which has been opened up through the identification and analysis of lipids in ceramic fragments.

Lipid analysis

Analysis of the lipids present in pot fragments from Iron Age sites has shown that animal fats, in particular those of dairy products, are common in all regions highlighting the importance of dairying across Britain (Copley *et al*, 2005). The importance of dairying in Iron Age farming has long been debated. Analysis of ceramic residues from the Early Iron Age site at Cladh Hallan, South Uist in the Western Isles revealed evidence of dairy products which together with the high numbers of neonatal cattle remains found at the site reinforce the theory that young cattle were culled to promote dairying and dairy products formed a major part of Iron Age diet (Craig *et al*, 2000). Lipid analyses have shown little evidence for pig fats in Iron Age pottery reflecting the low numbers of pigs in general (Copley *et al*, 2005), though it may also indicate that the meat of pigs was cooked in a way which did not utilise pots, such as roasting.

A comparison of the evidence from faunal remains and lipid analysis at the Sollas, North Uist showed a marked difference in the treatment of animals placed in pits on the site. While more cattle were cremated and more sheep were buried, the ceramic analysis showed greater amounts of cattle meat was boiled than sheep; in fact a number of sheep bones showed charring indicating that sheep meat may have been roasted rather than boiled (Campbell, 2000). Campbell considered that there may have been cosmological reasoning behind the different treatments of animals at the site. From a more mundane point of view, cattle which were buried rather than cremated were younger animals, perhaps culled to promote dairying, and the meat of younger animals would be more suitable for roasting than that of older, tougher and larger cattle. The site at Sollas was somewhat unique for the large number of animals represented and the placement of the remains in pits within the dwelling; these animals may have been specially selected for feasts or sacrifice associated with their placement in these pits and so, as with the animal burials at Knowe of Skea, may not illustrate a ‘normal’ diet.

There was a very high dependency on cereal crops grown in cultivated areas at this time (Jones, 1996). While evidence for plants in residue analysis tends to be overwhelmed by animal fats, Copley et al found that plant lipids were most often found on pot-sherds also associated with milk fats, suggesting that these pots had been used for the production of porridges or gruels (Copley et al, 2005, 491). At Howe, Orkney, the presence of grain impressions in ceramics allowed for tentative identification; barley grain impressions were indented onto burnt ceramics and identified in a large concentration of thousands of grains in a ditch fill. There was no evidence of dairy products with these grains and it was suggested that they were used for preparing broths or gruels (Dickson in Ballin Smith, 1994, 134). Barley was also identified in the analysis of human coprolites found in a well at Warebeth Broch, Orkney. Here it was noted that the barley was degraded to an extent that suggested that it had gone through a prolonged cooking process such as boiling in a broth or soup (Dickson in Bell & Dickson, 1989).

Wild resources

As mentioned previously, red deer were hunted throughout the Iron Age with indications that these animals may have formed an important seasonal resource in Orkney, however aside from deer there is little evidence for the exploitation of other wild species. The majority of Iron Age sites show little evidence of marine resources, or aquatic resources in general. This is a common feature across the British Iron Age for which there might be any number of reasons. “The environment is clearly not the sole determinant of a subsistence strategy. Of equal importance is the nature of the society itself, and the goals or guiding principles in operation. These goals will dictate which of the many options offered by the environment will be taken up” (Colley, 1983, 157). It is possible that supposed sacredness of water and the sea may have prohibited eating aquatic foods. Conversely, rather than sacred, it may be that food from the sea was considered unclean. The extent to which social taboos may have influenced diet cannot be known.

Though the faunal assemblages from Iron Age sites across Atlantic Scotland match those for the rest of Britain when comparing domestic animals reared for food, the majority of Atlantic Iron Age sites show evidence for some degree of fishing or gathering on the shoreline. Most evidence of marine resources indicates that close to shore fish, particularly saithe, and limpet molluscs were most commonly exploited in the Iron Age (Barrett *et al*, 1999) and indicated a degree of coastal fishing and gathering which though it may have formed an important part of the diet would have been a seasonal activity. Colley (1983) suggested that this close to shore, shallows fishing would create enough food to feed a family at minimum labour, time and risk. At Howe, Orkney, evidence of seasonal exploitation of sea birds and close-to-shore young fish and molluscs may have been a response to seasonal pressures on resources. In the case of fish remains, it was stated that should the evidence represent the total consumption of fish in the community, then it was an opportunistic activity rather than a specific strategy (Locker in Ballin Smith, 1994, 159). However, the frequency with which these same species occur on sites of this period would seem to indicate a more strategic exploitation of these resources. Similar evidence for close to shore fish and seabirds was found at Skaill and Pool (Buteux, 1997), while at Warebeth Broch and Pierowall Quarry there was evidence for larger cod which may have been fished at sea (Sellar in Bell & Dickson, 1989; Sharples et al, 1985). Evidence for similar exploitation of close-to-shore young fish was also found at Old Scatness, Shetland, where ethnographic sources told of such fish being eaten during lean winter months or boiled down for their oil which was used in lamps (Nicholson, 2004).

Archaeological evidence seems to indicate that certain marine (or perhaps more correctly coastal or shoreline) resources were an integral, if seasonal, part of the Iron Age diet in Orkney and appears to support the results of stable isotope analysis carried out on the individuals from Knowe of Skea. Unfortunately, there are very few burials of this date with which to compare these results and it is impossible as yet to determine if these results are unique to the population buried at Knowe of Skea or represent a more widespread dietary model during a limited period. By bringing together the various forms of evidence the diet of Orcadian communities in the Iron Age can be better understood. The diet was mainly terrestrial with foods from farming activities, such as barley broths with boiled meats, gruels with dairy products and roasted meat from younger animals such as suckling pigs. This diet was supplemented, at least seasonally, by venison from hunting red deer and close to shore fish such as saithe and limpet shellfish. The seasonal nature of the exploitation of marine resources may explain why contemporary sites in more southern regions, such as Broxmouth, do not show the same dietary evidence in faunal assemblages.

Better agricultural lands in southern areas may have allowed for increased stores of food and animal fodder for winter and spring while waiting for the next year's growth each year. Given the low numbers of human burials of this date from Atlantic Scotland, it is difficult to establish the true impact of this seasonal exploitation of marine resources. The dietary evidence from the individuals at Knowe of Skea and a comparison with what evidence exists may help, though contemporaneous burials are few in number.

Summary

The results of the skeletal analysis and the interpretation of those results have allowed for a greater understanding of the health and lifestyle of the people of Iron Age Orkney than has previously been possible. The numbers of infants and children in the assemblage from Knowe of Skea indicate that infant and mortality was high; on closer inspection, together with dietary evidence from archaeological and scientific sources, it appears that seasonal variations in food supply may have been a contributing factor. Evidence of nutritional stress was confined to the young but most likely all members of the population would have been affected. The exploitation of coastal resources, not seen elsewhere in Britain at this time was most likely a mechanism by which seasonal hardships were alleviated.

8. Summary and Potential Future Research

Summing Up

Burials

There has been much discussion regarding the formality of burial in the Iron Age. What should be taken from this and other recent research in Scotland is that there are a range of burial forms and funerary practices evident for this period, the extent and meaning of which is now coming to light.

An examination of the burials at Knowe of Skea reveals that there was a clear attempt to maintain the integrity of these individuals in death. Subsequent burials caused disturbance in a number of cases and there was obvious care taken to keep displaced bones together; crania in particular. It was during later building phases on the site that the greatest disturbance was caused to the burials in the mound. The construction of Structure E in particular caused the most damage; Structure E was found to have been built directly on top of two burials (3111) and (3118) and it can be assumed that the area of its interior originally held numerous burials.

The burial of humans within rubble mounds is not unusual in this region of Scotland and is evident from Orkney to Caithness. Unfortunately the excavation of many of the sites which included human remains took place before the age of radiocarbon dating, or before radiocarbon dating became an affordable and standard practice for human remains discovered during excavations. In Orkney in particular, this practice may have formed a burial rite during the Iron Age from the end of the first millennium BC and into the early centuries of the first millennium AD.

Health & Diet

There are a number of key points which can be taken from the investigation into the health/life/death of the population represented by the burials at Knowe of Skea.

Periods of stress were experienced by these people at a number of points during their lives, the period around the time of birth being the most obvious. Birth being a time of stress for both mother and infant must have been exaggerated by the obviously high likelihood that infants might die in the first week or two after birth. This was due to a number of factors. Poor maternal nutrition during pregnancy, particularly during late winter an early spring months, may have led to small and undernourished newborns. There was a possibility of infection affecting these young infants, perhaps something similar to that which caused very high infant death rate on the island of St.Kilda in the eighteenth and nineteenth century. Weaning was also a period of stress among this population, though there are signs that the full effect of the true cessation of breastfeeding may have been most obvious in early childhood; the majority of children represented were between the age of 4 and 6 years. This may have been when the final immunity provided by breastfeeding was lost and children were exposed to illness caused by new foods and the bacteria that they may have contained. Even then, once the trials of childhood were past, adolescence seems to have brought its own dangers. Among the Knowe of Skea population, it may be that some adolescents struggled to maintain the necessary energy to sustain a growth spurt and continue everyday activities, which would have resulted in fatigue and exposed them to illness. For those who survived to adulthood it appears that a physically active and sometimes demanding lifestyle awaited them. Pregnancy and birth were the periods of greatest danger compounded by possible periods of seasonal deprivation as seen in the signs of possible scurvy in the very young; the dietary evidence seems to support this (see below). Poor dental health/hygiene and arthritic conditions were the sources of greatest everyday discomfort.

An interesting outcome of this study is the indication of a dietary pattern which before now could only be assumed from the analysis of faunal assemblages. In the bones of Knowe of Skea skeletons lies the opportunity to investigate the diet of a population from a period about which we actually know very little concerning the people as opposed to their architecture or material culture. Faunal analysis and lipid analysis on ceramics have indicated that there was a preponderance of terrestrial animals and foodstuffs exploited by the Iron Age population of Atlantic Scotland. However, faunal analysis has also repeatedly indicated a probable seasonal exploitation of coastal resources such as limpets and particularly young close to shore fish like saithe. The isotopic analysis of bone samples from Knowe of Skea appears to support this with ^{15}N signatures approaching those of early Viking period burials at Newark Bay on Orkney Mainland. Other Iron Age burials from across Atlantic Scotland show similar isotopic signatures indicating some marine influence, however there are too few with which to draw accurate comparisons. There is no way of knowing for certain whether the evidence from Knowe of Skea is representative of this period however, given such similar faunal evidence from across the region perhaps it can be assumed that such a seasonal subsistence strategy was common across Atlantic Scotland.

Unlike areas of better agricultural lands in the south, the possibility of storing excess for winter was probably rare in Atlantic Scotland. During periods of shortages, perhaps late winter and spring or early summer while awaiting a new season's harvest, made the gathering of close to shore foodstuffs a practical solution. The complete lack of evidence for marine exploitation in the rest of Britain and the seasonal nature the exploitation of coastal resources in Atlantic Scotland perhaps indicate that this strategy was of greater necessity here than elsewhere.

Potential for Further Research

This site most likely represents the burial location of a small community, perhaps a family, over a long period of time. Just a small number of individuals stood out, either showing visibly different traits during skeletal analysis or through isotopic analysis. The only way in which to test for certain if this was a family group would be to conduct a DNA study of the collection. While the results might prove very interesting, at the current time this would be an expensive undertaking; perhaps such a study might be possible in the future.

The isotopic signature of the earlier burials at Knowe of Skea indicated a degree of marine resource exploitation not usually seen during this period. There are certain individuals for whom isotopic signatures indicate a diet different to that of the main group. Could these be incomers to the group, perhaps marrying in or moving into the area from elsewhere? Or, and this may be a more fanciful theory, perhaps this whole group are the incomers to this region? Is the increase in burials on sites similar to

Knowe of Skea across Orkney the result of a new group settling in the islands in this period? An extension of the isotopic analysis to those stable isotopes indicative of geographical origin might go a long way to further our knowledge of the population of the islands at this time. A similar study on the skeletal assemblage from Westness on Rousay showed a difference between Pictish and Viking period burials in terms of geographical origin (Montgomery *et al*, 2014) and a similar principle could be employed for Knowe of Skea. With the opportunity for comparison with other skeletal assemblages recently excavated on Westray, this is an area of definite potential.

From an archaeological point of view, perhaps the question of where these people lived is of greatest interest. There are a number of sites of assumed Iron Age date in the vicinity which could be the actual place. Of these the most likely candidates are Burristae Broch within walking distance of Knowe of Skea along the coast to the north, or St.Peter's on the far shore to the south. A souterrain and Iron Age/Viking era roundhouse was partially excavated as part of a rescue excavation by EASE Archaeology in 2005 and is also within walking distance of both Knowe of Skea and Burristae Broch. The potential for further research (and excavation?) into these questions is great. The archaeological potential of this one island is huge; already the excavations at Knowe of Skea have revealed a unique Iron Age cemetery and the Links of Noltland has revealed a sequence of settlement from the Neolithic through to the late Bronze Age. Perhaps the new information provided through the analysis of the human remains from Knowe of Skea will encourage a greater degree of investigation into Iron Age Westray in the future.

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Life and Death in Iron Age Orkney: Appendix

I: Phases of Activity at Knowe of Skea

II: Skeletal Examination Notes

Appendix I: Phases of activity at Knowe of Skea

The information for this section was taken from the interim report on the excavations at Knowe of Skea compiled by EASE Archaeology (Moore & Wilson, 2011).

Phase 1 - 3: these phases relate to the earliest phases of activity on site including possible building rubble and a period of abandonment seen in a windblown sand horizon.

Phase 4 - 5: this covers the construction of and all phases of activity within Structure A. This building was constructed in a dominant position on the highest point of the islet and was the earliest building to survive in 'recognisable form'. The structure was modified a number of times, which included the construction of an intramural passage with a lintelled entrance in the north-east side of the exterior wall. Though the later buildings and burials were clustered around Structure A, no burials were placed within the structure itself. Structure A remained in use until the latest phases of activity probably in the 8th century AD.

Phase 6 - 9: these are a number of poorly preserved and partially excavated structures which were truncated and damaged by later buildings.

Phase 10: a large circular building, Structure J to the north of Structure A. This building had two entrances to the north-east and south-east, internal radial divisions made up of upright slabs and a central hearth. Structure J was deliberately dismantled and the interior filled and levelled.

Phase 11 - 13: Structure F was a circular building slightly to the north-east of Structure A. This building had an entrance in the west side and probably saw a number of internal adaptations and layouts. A dog burial found in the entrance was dated to 800-500 calBC and most likely marked the final abandonment of Structure F.

Phase 14: Structure I was a wall which abutted the west side of Structure F and extended in a westerly direction to create an enclosed space which was most likely contemporary with Structure F.

Phase 15: a circular building, Structure H, was built over parts of Structure I and abutted the west side of Structure F. The entrance was in the south-west side with a central hearth; the interior had been radially divided by upright slabs during one period of use.

Phase 16: Structures F and H had fallen out of use by the late first millennium BC and the site was used as a burial ground thereafter. Burials were placed in the rubble deposits created in and around the deteriorating buildings. Burial continued on the site until the early centuries AD. Human remains were uncovered across the site, however examination of the contexts and deposits revealed that the burials belonged to just a single phase of the site’s history. The excavators assigned 127 contexts to this phase. Once it became clear that this phase of the site’s history had been dominated by burial activity, its importance for our understanding of Iron Age burial practices became clear. The site and the skeletal collection are an important source of information for both the archaeological and osteological study of the Iron Age population of the islands.

Phase 17: Structure C was constructed in the area of Structure F incorporating part of the walls of that early structure. Structure C remained in use for a long period of time and saw a number of adaptations.

Phase18: Structure E was built over the area of part of Structure H and revetted into surrounding rubble deposits. The entrance lay to the west and the interior was divided into two rooms, the larger of which contained a rectangular hearth. Construction of both Structure E and C disturbed a number of burials.

Phase 19 – 22: later activities on the site included a roughly constructed building, Structure D, evidence of fish processing and a kelp-pit.

Appendix II: SKELETAL EXAMINATION NOTES

The remains were examined in order of the year in which they were excavated as this was the order in which the collection was first delivered to the University of Edinburgh for analysis. The following notes describe each of the articulated burials and those collections of bones which were determined during excavation to be associated with burials, or to contain partially articulated or associated remains.

The Zsigmond System was employed to illustrate dentition and the following abbreviations were used:

/ = tooth lost post-mortem	c = caries
x = tooth lost ante-mortem	a = abscess
np = tooth not present	b = broken
- = bone not present	e = erupting
	u = unerupted

References to location in the original database are also provided as Sheet and Bone Numbers. In some cases, description of pathologies mentioned in the main report may be found in more detail here.

Skeletal Examination Notes 2000-2003

Context No: 106

S.F.No:

Year: 2000

Sheet No: 1 Bone Nos: 1- 248.

Condition: good, majority of bones including some epiphyses present.

Age: adolescent; 14-16years based on dentition though under 14years based non fusion of the epiphyses.

Sex: ?Male, based on the discrepancy between dental age and epiphyseal closure.

Stature: Adolescent, full stature not reached.

Dentition:

e 7 6 5 / 3 2 1	1 2 3 / / 6 7 u
u 7 6 5 / 3 2 /	1 2 3 / / 6 / u

Pathology: slight periostial reaction on lower limb bone surfaces, slight cribra orbitalia in Left orbit; pseudopathology on Right parietal most likely post-mortem damage; possible vertebral trauma with self on anterior rims of fourth and fifth lumbar bodies, fifth lumbar appears thinner to left side of body, indicating possible compression injury. Mandibular M2 has tubercle on mesio-buccal surface.

Comments: 106 was the burial of an adolescent; a number of disarticulated bones were also recovered. These included a substantial amount of perinate remains, 38 to 40 weeks.

Context No: 107

S.F.No:

Year:2000

Sheet No: 1 Bone Nos: 249-351
Condition: good
Age: perinate / neonate
Sex:
Stature:
Pathology:
Comments: f107 contained the remains of at least two infants of much the same age – one perinate and one most likely neonate. Also present are some fragments and disarticulated adult finger, vertebra and teeth.
* see also 3004 SF47.

Context No: 2011/2012
S.F.No:
Year: 2001
Sheet No: 1 Bone Nos: 354-393
Condition: good; though only R&L pelvis, and legs and feet present.
Age: adult / middle adult; based on the pelvis and presence of osteoarthritis.
Sex: Male
Stature: c 172cm (fem+tibia)
Pathology: some periostitis on the shafts of tibiae and fibulae. Bony projection on the proximal articulation of right tibia caused osteoarthritic lipping on right fibula. Squatting facets were present on anterior surface of both tibiae and on necks of both tali.
Comments: 2011/2012 was the foot bones, legs and pelvis of a middle adult male.

Context No: 2021
S.F.No:
Year: 2001
Sheet No: 1 Bone Nos: 394-466
Condition: very good. Though no cervical vertebrae, lower limbs or pelvis present. Skull fragmented.
Age: middle adult (35-50years); probably closer to the younger end this scale.
Sex: Male, based on measurements and visual assessment of skull fragments.
Stature: c170-175cm (radius)
Dentition:

b	
- 7 6 5 / 3 / /	1 2 / 4 / 6 7 8
8 7 6 5 4 3 2 /	/ / 3 4 / 6 7 8

Pathology: osteoarthritic growths and lipping beginning on borders of the vertebrae. Also, slight osteoarthritic reactions on most articular surfaces. Bridging between the coracoid and superior border of the left scapula, unclear whether morphological or perhaps result of long healed injury? There was a high degree of attrition on the teeth, particularly the anterior teeth and slight calculus on some teeth.

Comments: 2021 was the upper body of a middle adult male; the bone was in very good condition. Is it possible this contains the remaining parts of skeleton (2011/2012) also from 2001?

Context No: 1014
S.F.No:
Year: 2001
Sheet No: 1 Bone Nos: 467-506
Condition: very good
Age: mix - perinatal
Sex:
Stature:
Pathology: one perinatal tibia showed extreme periostitis on the shaft, particularly on the medial side.
Comments: (1014) mix bone. Contained adolescent mandible and a navicular. Remainder was a mix of at least 2 perinatal infants with skull fragments, and limb bones in majority.

Context No: 2114 (mixed up bones in bags; at least 2 adults + infant bones)
S.F.No:
Year: 2002
Sheet No: 1 Bone Nos: 507-720 (674-720 = infant)
Condition: good; however, bones and bags were badly mixed up, prior to analysis. This made it impossible to be able to assign bones to the correct individual.
Age: mixed perinate remains based on measurements and 2x middle adults based on the appearance of the bones and the presence of osteoarthritis and periodontal disease.
Sex: adults only – one Male and one Male?, based on the available measurements.
Stature: c 175cm (tibia); impossible to assign to correct individual due to the mixing of the bones in the bags.

Dentition: Mandible1:

x? 7 6 / x / / /	/ / / 4 x 6 7 8
a	

Mandible2:

x x x / / / / x	/ / / / 5 6 7 8
	c a

Pathology: one set of tibia/fibula with some infection, possibly healed osteomyelitis (bones666+667). Probable periodontal disease on mandibles (bones 507 +508); slight to medium osteoarthritis throughout.
Comments: 2114 contained the remains of one middle adult male and the legs of a second also middle adult probable male; unfortunately the leg bones have become mixed and could not be reattributed to the correct individual. Infant bones collected with 2114 indicate at least two individuals, one of perinatal age and one infant.

Context No: 2115
S.F.No:
Year: 2002
Sheet No: 1 Bone Nos: 721- 965 (792-965 assorted bone)
Condition: very good; though missing legs and lower arm bones.
Age: skull suture closure and fragments of auricular surface suggest middle adult age (35 to 50 years). Dental attrition however suggests a younger age range of 25 to 35 years.
Sex: ?-?Female ; fragments of pelvis appear female and though skull fragmented visible features appear female. Humerus measurements also suggest female. The mandible however is large and square chinned and appears masculine.
Stature: no fully measurable bones.
Dentition:

np 7 6 / / 3 / /	/ / / / / 6 7 np
8 7 6 5 4 3 2 /	/ / / 4 5 6 7 np

Pathology: wormian bones in the lambdoid suture causing occipital shelf or ‘bathrocephaly’, though this would have had no effect on the individual during life. The pattern of dental attrition on the upper and lower teeth matched perfectly, the molars in particular. Possible genetic noneruption of the third molars with only the mandibular right in occlusion.
Comments: 2115 lacked leg bones and lower arm bones, could these possibly be the extra limb bones found with 2114? Unfortunately they cannot be accurately reassigned. Context 2115 also included a large amount of extra bone collected during excavation representing one neonate and at least one other baby/infant. This context also contained a large amount of animal bones including sheep and otter.

Context No: 2107/2115
S.F.No:
Year: 2003
Sheet No: 1 Bone Nos: 1600-1612
Condition: good
Age: perinate
Sex:
Stature:
Pathology: periostitis on external surface of ribs
Comments: bones collected in 2003 from rubble 2107 in area of burial 2115 excavated in 2002. consists of pernate bones, scapula, Rmandible, ischia and ribs.

Context No: 2098
S.F.No:
Year: 2002
Sheet No: 1 Bone Nos: 966-1061
Condition: very good; though no femurs or tibia and few foot bones present.

Age: young adult (25-35yrs); from rib end morphology though not the 4rth rib, and dental attrition as well as the visible lines of fusion of epiphyseal rings on vertebrae and on sternal end clavicle.
Sex: Female-?Female; mandible appearance is female as are most measurements but greater sciatic notch is narrow.
Stature: c152-155cm (humerus); only complete arm bone to determine stature.

Dentition: mandible only:

- - - - - / 3 / /	x / 3 / / 6 / 8

Pathology: some Schmorl's nodes on the lower thoracic vertebrae and the inferior bodies of T11/T12 and L1 had lesions characteristic of damage to the endplate and intervertebral discs caused by probable avulsion fractures often caused by seemingly insignificant accidents and would have caused some discomfort but minimal lack of mobility (Maat, 2000, 147).
Comments: 2098 was not an intact burial on site but a collection of bones which had some parts in articulation and did appear to be from a single disturbed individual. RCD originally attributed to this collection was actually a cattle bone and a second sample from the human bones was dated later.

Context No: 2100
S.F.No:
Year: 2000
Sheet No: 1 Bone Nos: 1062-1184 (bones collected during exc 1170-1184)
Condition: very good, all elements represented but no right ribs; skull fragmented.
Age: older adult; assessed from suture closure and auricular/pubic surfaces.
Sex: Male, visual assessment of the skull and pelvis and overall rugose appearance supports male. However some of the measurements for example the femur/humerus heads fall in the female range.
Stature: Rfem+Rtib=c165cm
Dentition:

- - - - / x - -	x x x x x x x 8
- - - - - - - -	- - - x / x x x

Pathology: this individual had a very robust appearance; particularly in the upper body. Both humerus had massive deltoid tuberosities and fosse for attachment of the deltoideus muscle, and the abductor muscle on the anteriosuperior surface of the clavicle, the lateral and superior acromion and on the scapular spine. Osteophytes were present on the superior side of the coronoid fosse. The ulnae had a rugose appearance, osteoarthritic lipping of articular surfaces, and a bony spur in the distal articular surface anterior to the styloid process and a large fosse at the site of the brachial tuberosity for insertion of the brachialis muscle which is a flexor of the elbow originating on the anterior surface of the humerus. The radii had rugose, rough muscle attachments, signs of osteoarthritis on the borders of distal articular surface and a pronounced dorsal tubercle which is the area of attachment for extrinsic extensor muscles of the hand. The middle phalanges had strong muscle attachments on palmar side. The sternum was wide and short and the clavicles short and broad. The scapula had lipping on the borders of glenoid cavity and a rugged surface on the superior coracoid where it meets the clavicle.

There was also a lot of arthritis on this individual; the right knee had pronounced lipping of the articular surfaces of both the femur and tibia. The lumbar vertebrae also show pronounced osteopyhtic growth on the 4th and 5th bodies with compression of the bodies superior-inferiorly on the anterior side.

Overall these all point to a muscular upper body, due to physical activity which would have to have been carried out perpetually from a young age.

This individual suffered massive ante-mortem tooth loss resulting in only one maxillary molar being present at the time of death; though damaged the anterior mandible appears to have been losing the incisors and canines and the alveolar bone in a state of repair. Aside from some slight pitting in the maxilla there was no clear sign of infection in the mandible/maxilla.

There was a large area of reddish-brown staining on the left parietal. Also on the left parietal there was a large roughly oval shaped depression which was most likely the result of trephination. It was unclear whether the trephination was completed through the bone as the bone was in advanced state of healing at the site. The sides of the depression were regular though two areas were slightly deeper than others creating a large roughly oval shaped depression (48.3mm ant/pos x 26.6mm med/lat), the interior of skull at this point showed pits in the inner table. Brown coloured staining of the bone in the area of the posterior parietal is possibly old blood from an old trauma. Also a second area of possible old trauma ran in an anterior-posterior direction along the left parietal through the area of greatest staining. These old injuries may have been the reason for which the trephination was attempted.

Comments: 2100 was an older adult Male with possible trephination and osteoarthritis and massive ante-mortem tooth loss. This individual was recovered from a possible cist. A number of disarticulated remains were also collected including the tibia and other bones of a perinate infant.

Context No: 2121

S.F.No:

Year: 2002

Sheet No: 1 Bone Nos: 1191-1342 (infant mix); 1343-1353 (adult)

Condition: infant mix in excellent condition; included metatarsals and vertebral bodies. Contained at least 3 infants. Adult bones were damaged at ends in particular.

Age: infant mix contained remains of at least 3 perinate, one of which more likely neonate.

Sex: sex was not attempted for perinates at this time. The adult bones were fragmented but were probably female.

Stature:

Pathology: frontal bones showed new bone deposition from unknown infection on the inner surface at the site of the frontal eminence; this area usually sees bone changes due to growth but these deposits are unusual and evidence of some infection which, given the ages of the remains, must have occurred late in pregnancy.

Comments: 2121 was a large concentration of the remains of at least 3 perinate or neonate infants. Also in 2121 but bagged separately were the long bone fragments of an adult.

Context No: 2121
S.F.No:
Year: 2003
Sheet No: 1 Bone Nos: 1480-1515
Condition: excellent
Age: mix of two infants, perinate and neonate
Sex:
Stature:
Pathology: some periostitis noted on tibiae
Comments: 2121 excavated in the main in 2002 but this small concentration excavated in 2003 and thought to be same as that of 2002.

Context No: 2122
S.F.No:
Year: 2002
Sheet No: 1 Bone Nos: 1354-1359
Condition: good; small number of bones from scatter?
Age: adult tib/fib; infant femur of neonate
Sex: adult Male tibia
Stature: complete fibula measurement 165.98+/-3.86
Pathology:
Comments: bones from a scatter?

Context No: 2122
S.F.No:
Year: 2003
Sheet No: 1 Bone Nos: 1516 - 1533
Condition: excellent but mixed from scatter
Age: mostly adult
Sex:
Stature:
Pathology:
Comments: tibia fragment from this 2122 2003 concentration matches with tibia from the 2122 2002 concentration

Context No: 2099
S.F.No:
Year: 2002
Sheet No: 1 Bone Nos: 1360-1367 (1360 from ’03)
Condition: good; from concentration of adult bones.

Age: adult; young adult mandible in the collection.
Sex: Mandible and mastoid process suggest male
Stature:

Dentition: mandible only;

8 7 6 / / / / /	/ / / / x 6 - -
b	b

Pathology: both M1 on the young adult mandible were broken with part roots left in place. LPM2 was missing antemortem.
Ulna (bone1364) has cut mark on posterior midshaft, possible perimortem as no healing visible. Unlikely occurred during excavation though as this was a disturbed collection of remains, damage may have been caused to the bones when disturbed in antiquity.
Comments: 2099 is a concentration of adult bones including a mandible of a young adult.

Context No: 2118 and 2107/2118
S.F.No:
Year: 2002/2003
Sheet No: 1 Bone Nos: 1368-1479
Condition: a lot of mixing of skeletal elements and fractured long bones but in general excellent; included foetal remains and one perinate both in good condition.
Age: 2118 was in early child age range, under 6years based on the dental development and vertebral fusion rates. 2118 also included remains representing one c32week foetus and one c40week perinate.
Sex: sex was not assessed due to age.
Stature:
Dentition:

e d c - -	/ / / d e
e d / / /	/ / / d e

Pathology: dental hypoplasia on the unerupted M1s at about half way, also on the roots of two deciduous incisors about half way suggesting some interruption to growth due to disease or malnutrition late in the first year to 18months of life; possibly around the time of weaning. A depressed area on the left temporal of 2118 child with radial fractures may be perimortem but whether ante or post burial cannot be determined at this time.
Comments: 2118 was lifted partly in 2002-the skull and some bones; remainder lifted in 2003 along with the bones from the 32week foetus and c40week perinate. Though there is some mixing, there seems to be just these three individuals represented. Some animal bone fragments were also present in the collection.

Context No: 2117
S.F.No:
Year: 2002-03
Sheet No: 1 Bone Nos: 1534-76 infant and 1577-99 adolescent/adult
Condition: good though not all elements represented (see 2124/2117).

Age: 2117 was an infant of 6-12months based on long bone measurements and dental development; the deciduous first incisors were erupting which takes place between 6-9month; adolescent foot bones and adult hand bones also present.

Sex:

Stature:

Pathology: infant bones all show periostitis on surfaces, indicating infection or extreme nutritional disease such as scurvy.

Comments: 2117 consists of single 6-12month old infant and mixed hand and foot bones from older individuals. The infant showed active periostitis on almost all bone surfaces indicating high degree of infection.

Context No: 2124/2117

S.F.No:

Year: 2003

Sheet No: 1 Bone Nos: 1613-1677

Condition: very good

Age: infant; 6-12month from long bone measurements

Sex:

Stature:

Pathology: periostitis on most bone surfaces, the external rib surfaces in particular suggests high degree of infection.

Comments: 2124 was a concentration of bone below the cist which held (2100); labels say mix with 2117 and 2122 – proved to contain the remainder of infant 2117.

Context No: 3018

S.F.No: 40

Year: 2003

Sheet No: 2 Bone Nos: 1908-1924

Condition: good; concentration of perinate remains represents two individuals.

Age: perinate

Sex:

Stature:

Pathology:

Comments: SF40 was mix of perinate remains.

Context No: 3025

S.F.No: 45

Year: 2003

Sheet No: 2 Bone Nos: 1925-1931

Condition: poor; mix of single perinate bones and fragments

Age: 38-40 wks, perinate

Sex:

Stature:

Pathology:

Comments: mix of bones from perinate

Context No: 3023
S.F.No: 42
Year: 2003
Sheet No: 2 Bone Nos: 1932-2013
Condition: good; mix of perinate and foetal bones
Age: perinate and foetal; at least two individuals.
Sex:
Stature:
Pathology:
Comments: SF42 mix of perinate and foetal bones

Context No: 3111 (from under wall [3030] of Str.E)
S.F.No:
Year: 2003
Sheet No: 2 Bone Nos: 2014-2093
Condition: very good; only partial burial however, mandible, L&R shoulders, L&R ribs, R hand and upper vertebrae; though mandible and vertebrae were in a good state no fragments of the cranium were found.
Age: middle adult; from dental attrition; Rib end morphology suggests not later than phase5 so <45years though this not based on the 4rth ribs.
Sex: all available measurements suggest Male
Stature:
Dentition: mandible only;

8 7 6 / / / / 1	1 / / 4 5 6 7 /

Pathology: dental attrition was more pronounced on the left side of the mandible where M1 had complete dentine exposure, given lack of pathology this can be assumed a habitual or occupational reaction; some changes on the vertebral bodies with large osteophytes on one lumbar, unfortunately cannot fully determine extent due to lack of full lower vertebral column.
Comments: this partial adult male skeleton came from below the wall 3030 of Structure E. a collection of semi-articulated remains 3098 were found in the wall core and perhaps are the remainder of this skeleton but unfortunately 3098 could not be located in the collection as of 7/11/11.

Context No: 3118
S.F.No:
Year: 2003
Sheet No: 2 Bone Nos: 2094-2185 (2174-2185 misc collected with 3118)
Condition: poor, very fragmented bone
Age: adult, possibly middle adult based on dental attrition in the mandible.

Sex: ?; based on what measurements available this individual appears female, however the pelvis fragments showed narrow greater sciatic notches and the mandible fragment showed male characteristics.

Stature: based on humerus length. 162.13cm+/-4.45 (calculated for F); 167.69cm+/-4.57(calculated for M).

Dentition: mandible only; / / 6 5 4 / / / | / / 3 / 5 - - -

Pathology: advanced dental attrition on the insitu M1 and loose teeth in the collection which were probably from this individual. There was slight lipping on femoral distal articular surface edges and some sign of new woven bone indicating old infection healed at time of death.

Comments: badly fragmented probable female skeleton but all elements were represented except for the cranium of which no fragments were found in the 3118 collection.

Context No: 3117 – comprised of 3 groups; 3117 N of 3118, 3117 S of 3118 and general scatter 3117.

S.F.No:

Year: 2003

Sheet No: 2 Bone Nos: 2186-2232(N of 3118); 2233-2307(S of 3118) and 2308-2406(general scatter).

Condition: fair to good, consists of smaller bones such as hand/feet and teeth; fragments and infant/child bones

Age: mix; 3117 S of 3118 contained remains of an early child(<6years) bones2261-2307 including ribs, mandible, temporals, scapulae and vertebrae. General 3117 scatter included many bones of an adolescent around 14years aged by the many fusing phalanges and metacarpals.

Sex: no sex is assessed for such young individuals and such fragmented/disarticulated remains.

Stature:

Pathology:

Comments: 3117 was a scatter of human remains including those of an early child and an adolescent found in the area of burial 3118 beneath wall [3101] of Structure E.

Context No: 3054

S.F.No:

Year: 2003

Sheet No: 2 Bone Nos: 2407-2468 (2407-2418 infant bones)

Condition: fair to good, some fragmentation, disarticulated material.

Age: adolescent remains; fusing hand and foot phalange epiphyses suggest age around 14-16years, probably towards younger end of this range as most phalanges actually unfused. Distal humerus epiphyses also suggest age of under 16years.

Sex: not attempted for such young individual, also very disarticulated.

Stature: no complete long bones for measurements.

Pathology: some pitting noted on the proximal humerus epiphysis but little of note elsewhere.
Comments: 3054 was a collection of disarticulated adolescent remains probably aged 14-16years. The assemblage was incomplete with no lower long bones represented apart from the proximal epiphyses of femur.

Context No: 3036
S.F.No: 53
Year: 2003
Sheet No: 2 Bone Nos: 2469-2595 (bones2531-2564 of perinate).
Condition: fragmented adolescent long bones but included frequent epiphyses and smaller bones in good condition; perinate bones in very good condition.
Age: contained remains of an adolescent around 14-16years and a perinate.
Sex: not assessed
Stature: not assessed for adolescents unfused epiphyses.
Pathology:
Comments: 3036 SF53 contained disarticulated remains of an adolescent; excavation note records probably associated with 3054 which was the partial skeleton of an adolescent of same age; can confidently assume this was the same individual.

Context No: 3036
S.F.No:
Year: 2003
Sheet No: 2 Bone Nos: 2596-2604
Condition: fragmentary skull from context 3036, excavation note records that probably associated with 3054.
Age: adolescent; prob 14-16yrs based on dental development, roots of the M2s complete but M3s not yet erupted.
Sex: ?Male; sex not usually assessed for younger individuals but large size of the mandible and the mastoid processes at such young age suggest male.
Stature:
Dentition:

u 7 6 5 4 3 / 1	1 2 3 4 / 6 7 u
u 7 - - - 3 2 1	1 2 3 4 5 6 7 u

Pathology: non-carious pits on the buccal sides of both mandible M2s; slight pitting on parts of the temporals possibly indicate some ear infection?; uneven wear pattern on the teeth leaving almost a groove in the Max M2 suggests malocclusion of the mandible/maxilla which not surprising given the large size/wide appearance of the mandible Bone#2603.
Comments: skull fragments of an adolescent of same estimated age as 3054 and the adolescent remains in 3036SF53 suggests this all represents one adolescent individual.

Context No: 3036
S.F.No: 51
Year: 2003

Sheet No: 2 Bone Nos: 2605-2624

Condition: fair; fragments of skull, L shoulder and fragments of long bones.

Age: perinate; c38-40weeks

Sex:

Stature:

Pathology: periostitis on the superior surface of two 1st ribs L&R and also on the L scapula suggesting single individual perinate with some non-specific infection.

Comments: SF51 were the partial remains of a perinate with evidence of infection in form of periostitis on surface of some bones.

Context No: 3036

S.F.No: 52

Year: 2003

Sheet No: 2 Bone Nos: 2625-2628

Condition: fair; skull fragments including greater wing sphenoid and pars basilaris.

Age: perinate; based on measurements of pars basilaris.

Sex:

Stature:

Pathology: periostitis on the surfaces of the greater wing and the pars basilaris indicating some non-specific infection.

Comments: SF52 possibly same individual as SF51? This based on the presence of periostitis on skull fragments.

Context No: 3017

S.F.No:

Year: 2003

Sheet No: 2 Bone Nos: 2685-2827

Condition: good; concentration of infant remains; at least two individuals. Included maxillae, frontals, long bones, spinal parts. Also loose teeth most of a 6-9mnth old infant.

Age: at least 2 individuals; perinate/neonate; teeth of 6-9mnth old infant

Sex:

Stature:

Pathology: many bone surfaces showed periostitis suggesting some infection.

Comments: concentration of infant remains; at least 2 individuals, one perinate/neonate and the loose teeth of a 6-9mnth old.

Context No: 3019

S.F.No: 41

Year: 2003

Sheet No: 2 Bone Nos: 2828-2891 (4 separate bags)

Condition: good, concentration of infant remains; mostly skull fragments and long bones. 4 separate bags; B#2828-2835 skull fragments and long bones; B#2836-2841 humerus, femur,

skull and rib fragments; B#2842-2849 humerus, skull fragments; B#2850-2891 long bones, skull fragments and spinal parts.
Age: at least 3 individuals; one c34wk foetus; 2 perinate or neonate.
Sex:
Stature:
Pathology: some periostitis noted on bone surfaces.
Comments: at least 3 individuals in concentration. One c34week foetus and 2 peri/neonates.

Context No: 3024
S.F.No: 43
Year: 2003
Sheet No: 2 Bone Nos: 2892-2916
Condition: good, collection of infant remains included long bone fragments, skull fragments, ilium, scapula. 2 individuals from number maxillae.
Age: perinate/neonate remains
Sex:
Stature:
Pathology: periostitis noted on the palate of maxilla.
Comments: collection of perinate/neonate remains.

Context No: 3026
S.F.No: 46
Year: 2003
Sheet No: 2 Bone Nos: 2917-2942
Condition: good; collection of infant remains, at least 2 individuals. Plus adult atlas.
Age: at least 1 perinate and 1 late foetal.
Sex:
Stature:
Pathology: periotitis noted on the external surfaces of the ribs.
Comments: collection of at least 2 infants , 1xperinate and 1xfoetal; perinate with periostitis on the external surfaces of ribs. Adult atlas unfused at site of anterior arch.

Context No: 3067
S.F.No: 65
Year: 2003
Sheet No: 2 Bone Nos: 2943-2953
Condition: good, small collection of human bones; adolescent clavicle and humerus, perinate pelvis, scapula, frontal.
Age: 1xadolescent; 2xperinate
Sex:
Stature:
Pathology:
Comments: small collection of bones representing an adolescent and at least 2 perinate.

Context No: 3004
S.F.No: 47
Year: 2003
Sheet No: 2 Bone Nos: 2954-3036
Condition: very good; concentration of infant remains closely associated with f(107) from BNKS00. SF47 represents at least 3 individual infants of late foetal, perinate/neonate age. Also contained mix loose teeth and adult axis.
Age: at least 3 individual infants; 1xc36wk foetus, 2xperi/neonate.
Sex:
Stature:
Pathology:
Comments: 3004 SF47 closely associated with f(107) from 2000 excavation; contained incomplete remains of at lest 3 infants – one late foetus and 2 peri/neonates.

Context No: 3006
S.F.: 31
Year: 2003
Sheet No.: 2 Bone Nos: 3038
Condition: fragmented child cranium.
Age: older child, assessed by dental development, R.side Canine was erupting and fully erupted M1 suggests age around 11years.
Sex:
Stature:
Dentition: right side maxilla only; - - 6 / / e / / |

Pathology:
Comments: S.F.31 was a fragmented child cranium with right side maxilla.

Context No: 3009
S.F.No: 32
Year: 2003
Sheet No: 2 Bone Nos: 3037
Condition: fragmented; almost all parts represented. Dark stained colour and presence of roots suggest this cranium close to surface?
Age: middle adult; based on advanced suture closure at coronal and sagittal lines and attrition on teeth suggests age range 35-45yrs.
Sex: ?-?Female due to lack of nuchal crest and glabella, large mastoid processes however.
Stature:
Dentition: maxilla only; - - np x 4 / / / | / / / 4 5 6 7 /

Pathology: Rside maxillary PM2 lost antemortem, alveolar bone healing.
Comments: SF32 fragmented cranium of possibly female middle adult.

Context No: 3015
S.F.No:
Year: 2003
Sheet No: 2 Bone Nos: 3039-3155
Condition: very good; all elements of the main burial represented but no skull or atlas/axis. Also collected were max/mandible of an adult, adult cervical vertebrae and miscellaneous bones.
Age: 3015 was an adolescent probably between 13 and 16years based on epiphyseal fusion and development. 3015 also included the maxilla/mandible of a middle adult with significant wear on the teeth and gross cavities in the mandible.
Sex: sex was not estimated for the adolescent due to the young age and rate of fusion. The adult maxilla/mandible were visually assessed as ?Female, though the mandible was of large size, with flared gonials and squared mental eminence the overall size was small/medium and interior shape was narrow.
Stature:
Dentition: Adult:

	c ca c
	/ / 3 4 5 6 7 8
8 7 6 5 / / 2 /	/ / 3 / x 6 7 8

Pathology: no clear evidence of infection or trauma on the adolescent remains, slight signs of old periosteal reaction on the fibulae shafts. The adult teeth had a gross cavity on the maxillary M1 with an abscess at the site of the M1 roots in the maxilla and interproximal cavities on PM1 and M2. The mandible also had lost LPM1 antemortem and had abscess at the neck of the LM2.
Comments: 3015 was the almost complete skeleton of an adolescent between 14 and 16 years but also included a middle adult possibly female maxilla and mandible with dentition.

Context No: 3055
S.F.No:
Year: 2003
Sheet No: 2 Bone Nos: 3156-3175
Condition: fragmented; mix of fragmented remains found below flagstones in StrD.
Age: mix; child and perinate
Sex:
Stature:
Pathology:
Comments: 3055 was a mix of fragmented disarticulated remains from child and perinate.

Context No: 3069
S.F.No: 72? (SF# on DSR but not on bags)
Year: 2003
Sheet No: 2 Bone Nos: 3176-3201

Condition: concentration of mix of adult foot bones and incomplete perinate infant remains; adult bones very good; infant remains fragmentary.
Age: mix; adult foot bones and perinate infant.
Sex:
Stature:
Pathology:
Comments: 3069 was a concentration of human bone consisting of adult foot bones and the incomplete remains of a perinate infant.

Context No: 3068
S.F.No: 84
Year: 2003
Sheet No: 2 Bone Nos: 3202
Condition: fragmentary
Age: adult
Sex:
Stature:
Pathology:
Comments: SF84 was fragmented parietal of an adult.

Context No: 3068
S.F.No: 85
Year: 2003
Sheet No: 2 Bone Nos: 3203
Condition: fragment of fibula shaft.
Age: adult
Sex:
Stature:
Pathology:
Comments: SF85 was an adult fibula shaft.

Context No: 3101
S.F.No: 87
Year: 2003
Sheet No: 2 Bone Nos: 3204
Condition: fragments of adult skull.
Age: adult
Sex:
Stature:
Pathology:
Comments: SF87 was 2xfragments of adult skull.

Context No: 3101
S.F.No: 88
Year: 2003
Sheet No: 2 Bone Nos: 3205
Condition: fragment of ?perinate skull.
Age: ?perinate
Sex:
Stature:
Pathology:
Comments: SF88 were fragments of possible perinate skull.

Context No: 3102
S.F.No: 89
Year: 2003
Sheet No: 2 Bone Nos: 3206
Condition: good
Age: adult
Sex:
Stature:
Pathology:
Comments: SF89 was an adult maxillary Canine with some attrition.

Context No: 3106
S.F.No: 94
Year: 2003
Sheet No: 2 Bone Nos: 3207-3287
Condition: good; concentration consisted of mix of mostly perinate bones included 2xRmandible; 4xLmandible; 3xR pars lateralis; 2xR humerus : all points to at least 4 infants of 38-40weeks.
Age: mix of infants of about perinate age range c.38-40wks.
Sex:
Stature:
Pathology:
Comments: SF94 was a concentration of infant remains included partials of at least 4 individuals.

Context No: 3106
S.F.No: 95
Year: 2003
Sheet No: 2 Bone Nos: 3288+3289
Condition: good
Age: adult
Sex:

Stature:
Pathology:
Comments: SF95 consisted of two adult metatarsals.

Context No: 3113
S.F.No: 99
Year: 2003
Sheet No: 2 Bone Nos: 3290-3305
Condition: good; small collection infant bones; mostly perinate.
Age: perinate (mostly 38 to 40 weeks).
Sex:
Stature:
Pathology:
Comments: SF99 was a small collection of mostly perinate disarticulated bones.

Context No: 3113
S.F.No: 100
Year: 2003
Sheet No: 2 Bone Nos: 3306-3318
Condition: fragmented; small collection infant bones, perinate.
Age: mix of perinate bones, most 38 to 40 weeks.
Sex:
Stature:
Pathology:
Comments: SF100 was a small collection of mostly perinate bones.

Context No: 3010
S.F.No:
Year: 2003
Sheet No: 2 Bone Nos: 3319-3332
Condition: fragmented; collection of adult and adolescent foot bones; also pair of neonate ulna.
Age: adult/adolescent/neonate
Sex:
Stature:
Pathology: neonate ulnae showed active periostitis on surfaces of the bones.
Comments: 3010 small collection of adult and adolescent foot bones, and neonate pair of ulna. Notes suggest possible associated with burial 2117 but no clear indication of this as 2117 was infant.

Context No: 3022
S.F.No:
Year: 2003

Sheet No: 2 Bone Nos: 3333
Condition: good; adolescent mandible, missing part of the ramus.
Age: adolescent. M3 erupting but root incomplete suggests age 16<18years.
Sex:
Stature:
Pathology:
Comments: 3022 was found in same context as adolescent 3015 which had no skull; 3022 however slightly older in age/development than 3015.

Context No: 3007
S.F.No:
Year: 2003
Sheet No: 2 Bone Nos: 3334
Condition: eroded surfaces and articulations
Age: adult
Sex:?
Stature:
Pathology:
Comments: 3007 was an adult Rfemur collected from outside of cist f3020.

Context No: 3101
S.F.No: 92
Year: 2003
Sheet No: 2 Bone Nos: 3335 +3336
Condition: fragments
Age: ?adult
Sex:
Stature:
Pathology: excessive wear on tooth
Comments: SF92 consisted of adult skull fragments and a maxillary PM1 which was very worn.

Context No: 3091
S.F.No: 82
Year: 2003
Sheet No: 2 Bone Nos: 3337
Condition: adult humerus, missing proximal end.
Age: adult
Sex: epicondylar width only - ?F
Stature:
Pathology: large deltoid tuberosity; extreme arthritis of the distal end with gross osteophytic growth on the anterior side and a pseudo-facet for head of ulna; posterior side shows new

woven bone in the olecrannon fossa; also eburnation on the articular surface; all suggests extreme use of elbow, perhaps lifting etc.
Comments: SF82 was an adult L humerus with arthritis of the elbow joint.

Context No: 3101
S.F.No: 97
Year: 2003
Sheet No: 2 Bone Nos: 3338
Condition: fragment
Age:infant
Sex:
Stature:
Pathology:
Comments: SF97 was a fragment of infant skull.

Context No: 3068
S.F.No: 77
Year: 2003
Sheet No: 2 Bone Nos: 3339
Condition: fragment
Age:adult
Sex:
Stature:
Pathology:
Comments: SF77 was an adult parietal fragment.

Context No: 3068
S.F.No: 80
Year: 2003
Sheet No: 2 Bone Nos: 3340
Condition: fragment
Age: ?perinate
Sex:
Stature:
Pathology: signs of infection in form of new bone growth in internal surface of eminence.
Comments: SF80 was a fragment of infant frontal bone.

Context No: 3080
S.F.No: 76
Year: 2003
Sheet No: 2 Bone Nos: 3341
Condition: fragments
Age: ?perinate

Sex:
Stature:
Pathology:
Comments: SF76 was infant skull fragments.

Context No: 3113
S.F.No: 103
Year: 2003
Sheet No: 2 Bone Nos: 3342+3343
Condition: fragments
Age: ?perinate
Sex:
Stature:
Pathology:
Comments: SF103 were a fragment of greater wing of Sphenoid and skull fragment of possible perinate.

Context No: 3101
S.F.No: 93
Year: 2003
Sheet No: 2 Bone Nos: 3344
Condition: fragments
Age: ?adult
Sex:
Stature:
Pathology:
Comments: SF93 were fragments of adult occipital.

Context No: 3011
S.F.No:
Year: 2003
Sheet No: 2 Bone Nos: 3345-3448
Condition: fair; concentration of bones; mostly neonate, fragmented long bones and skull parts. Contained elements from at least 2 individual infants and some adult finger bones.
Age: adult finger bones; at least 2 individual infants, perinate/neonate.
Sex:
Stature:
Pathology: periostitis noted on several bone surfaces esp skull fragments.
Comments: 3011 was a concentration of infant bones; while long bone fragments may represent one individual, along with the skull fragments, more than one individual represented.

Context No: 3004
S.F.No: 50
Year: 2003
Sheet No: 2 Bone Nos: 3449-3461
Condition: fragmentary; small collection mixed human bone.
Age: mix
Sex:
Stature:
Pathology:
Comments: SF50 was a small collection of mix of human bone.

Context No: 3021
S.F.No:
Year: 2003
Sheet No: 2 Bone Nos: 3462-3464
Condition: fragments
Age: adult
Sex:
Stature:
Pathology:
Comments: 3021 was a small collection of human bone fragments.

Context No: 3066
S.F.No: 63
Year: 2003
Sheet No: 2 Bone Nos: 3465-3530
Condition: good; human bones collected with sheep burial; mix of peri/neonate and infant.
Age: mix of peri/neonate and infant.
Sex:
Stature:
Pathology: periostitis and new pitted bone growth noted on some bone surfaces, probably from single individual with non-specific infection.
Comments: SF63 was a small collection of mix bone collected with sheep burial; represents at least two individual infants, one perinate and one more likely neonate.

Skeletal Examination Notes 2004

Context No: 4015
S.F.No:
Year: 2004
Sheet No: 3 Bone Nos: 3531-3574
Condition: poor, upper body only and very fragmented.
Age: adult; probably younger adult based on appearance of articular surfaces.

Sex: ?Female – due to gracile appearance of the bones and assessment of skull fragments and epicondylar width which was the only measurement available.

Stature:

Dentition:

a	a													a	ac	ac
np	np	x	x	4	3	/	/	/	/	/	/	np	6	7	8	
8	7	6	/	/	3	/	/	1	/	3	4	5	6	7	8	
												c				

Pathology: This individual showed poor dental health; the maxillary molars were in a poor state, RM2andRM3 were present but did not fit in the alveolar bone due to large abscesses at site, only part root of M1 in place also abscess at PM2/M1. Interproximal caries affected RM2/RM3. Left side molars were missing and abscessed but with signs of healing in the bone. Mandibular molars show a lot of wear and interproximal caries at LPM2/LM1; teeth stand high in the bone, 3-5mm suggesting probable periodontal disease. Schmorl's node on the superior body surface of one lumbar fragment.

Comments: 4015 the partial and fragmented remains of an adult, possible female.

Context No: 4036

S.F.No:

Year: 2004

Sheet No: 3 Bone Nos:3575-3722

Condition: moderate to good; long bones fragmented but all elements represented except for missing cranium – the maxillary teeth actually present suggesting the cranium lifted when dry and teeth fell out of sockets.

Age: adolescent – 14-17years based on epiphyseal closure and dental development.

Sex: undetermined

Stature: long bones fragmented.

Dentition: mandible only:

u 7 6 5 4 np np np	np np x 4 5 6 7 u

Pathology: spondylolysis of lumbar vertebra B#3655, neural arch separated at inferior facets, base of superior facets similar to an epiphyseal face.

Crowding of the front teeth due to the retention of L&R m2; incisors and canines present but not insitu but alveolar bone shows signs of having lost at least one tooth in area of LC.

Surfaces of some bones appear shiny, similar to new bone deposition in particular on the lateral and medial sides of the distal femoral epiphysis possibly a reaction to some inflammatory process in the past, well healed at the time of death.

Comments: 4036 was the almost complete but fragmented burial of an adolescent; also collected were a number of animal bones and the remains of at least two infants – one perinate and one slightly older.

Context No: 4038

S.F.No:

Year: 2004

Sheet No: 3 Bone Nos: 3723-3986 (3899-3986=disartic/infant collected with 4036)

Condition: very good, though skull is fragmented all elements are present.

Age: adolescent. Based on dental development suggests around 15years (M3's crown complete and roots developing but not erupted) however the lack of epiphyseal fusion suggests a younger age, around 12years. Males fuse at a later age, perhaps this was a male however it also maybe due to illness that fusion was delayed though there were no signs of previous illness on the bones.

Sex: ?male – based on the later fusion of epiphyses versus dental development.

Stature: full height not reached.

Dentition:

	b b
u 7 6 5 4 3 2 1	1 2 3 4 5 6 7 u
u 7 6 5 4 3 2 1	1 2 3 4 5 6 7 e

Pathology: Upper anterior teeth in poor condition on left side, worn down to the root and right side anterior teeth crooked leaning towards the left side. Between LM1 and LPM1 part root of a deciduous tooth remains in bone also buccal side of LC, possibly due to some early trauma? M3 crowns unerupted and roots incomplete.

No obvious signs of infection or trauma on post cranial skeleton.

Comments: 4038 was the almost complete burial of an adolescent with damage to the anterior teeth; a large number of disarticulated infant bones were collected with this burial including skull elements, vertebral elements and hand/foot bones.

Context No: 4019

S.F.No:

Year: 2004

Sheet No: 3 Bone Nos: 3987-4119 (4085-4119 disarticulated bone)

Condition: excellent. Skull was complete and all elements were represented with right side long bones complete; left side arm fragmented.

Age: middle adult; calculated from skull suture closure, pubic symphysis and auricular surfaces and rib end morphology to between 35 and 50years.

Sex: All morphological features and measurements resulted in a confident assessment of Male.

Stature: femur = 167.37cm+/-3.94

Dentition:

x 7 6 5 4 3 2 1	/ 2 3 4 5 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

Pathology: This skeleton is robust and 'sturdy' in appearance. Advanced dental attrition on all teeth; anterior teeth in particular exposing secondary dentine. The teeth all sit high in the sockets probably to maintain the occlusal surfaces. Moderate pitting in the area of the maxillary canine possibly indicates some periodontal disease.

Spinal degeneration is in the early stages with some lipping and osteophytic spurring beginning on the lower thoracic and lower lumbars. The cervical vertebrae spinous processes show some slight malformation to the right side, possibly due to stress on this side.

The left radius shows a perimortem crushing fracture mid shaft, and a corresponding chip can be seen on the ulna; however these are most likely the result of injuries to the body during burial in the rubble deposits.

There is also a possible injury to the back of the skull. The right side of the occipital shows very slight indentation but the left side lambdoid suture has spilt with resulting spider fractures working out from the location suggesting it occurred while still 'green' – again though this appears peri-mortem it is most likely to have occurred during burial in the rubble deposits as it was this part of the skull that was most exposed by body position.

Comments: 4019 was a well preserved skeleton of a middle adult male; a small quantity of disarticulated bone was collected with 4019, some infant but most adult, and much represent parts of 4019 missing from the main collection eg patella/foot and hand bones.

Context No: 4045

S.F.No:

Year: 2004

Sheet No: 3 Bone Nos: 4120-4270 (4232-4270=disartic bone)

Condition: very good though skull badly fragmented.

Age: older adult; auricular surface phase 8(60yr+), advanced cranial suture closure, rib ends(not 4rth) phase 6/7(44-64yrs) – all suggest older age range.

Sex:?Male. Though majority of measurements do not allow for a confident assessment, the male attributes of the skull fragments and the pelvis suggest probably male.

Stature: calculated for male with femur to 162-164cm.

Dentition:

- - - - - / x x	x x / - - - - -
x / 6 x / x / /	/ / x / x 6 x x

Pathology: Maxilla fragment shows all incisors lost antmortem and alveolar bone healed completely. Mandible has antemortem tooth loss; RM3, RPM2,RC,LC,LPM2,LM2,LM3; alveolar bone healing more advance in Canine areas than molars suggesting they were lost earlier. The remaining M1s sit high in the bone suggesting periodontal disease.

Skull fragments showed coronal ossicle and wormian bones.

The lumbar vertebrae have advanced osteophytic lipping and a number of cervical vertebrae show eburnation on the articular facets; also the tubercle articular area of a number of ribs showed eburnation.

Also present were ossified thyroid and cricoid of the larynx. Overall this individual showed strong muscle attachments on the upper limb in particular.

Comments: 4045 was the burial of an older adult male with massive AMTL; disarticulated bone collected with this individual included some animal bone and perinate remains.

Context No: 4016

S.F.No: 179

Year: 2004

Sheet No: 3 Bone Nos: 4271-4371
Condition: mixed, concentration of disarticulated material.
Age: mix, mostly infant and young child.
Sex:
Stature:
Pathology:
Comments: SF179 was a concentration of mixed infant and child bones.

Context No: 3083
S.F.No: 144
Year:2004
Sheet No: 3 Bone Nos: 4372-4551
Condition: collection of disarticulated bone from 3083(=4012).
Age: mix, included perinate, infant, child and adult bones.
Sex:
Stature:
Pathology: B#4394, a fragmented adult mandible with advanced attrition on remaining molars, pitting and infection in the alveolar bone, antemortem toothloss of LI1.
Comments: mixed disarticulated bone.

Context No: 4016
S.F.No: 194
Year: 2004
Sheet No: 3 Bone Nos: 4552-4721
Condition: good, concentration of infant bone. Possibly one complete infant of perinate age and isolated bones of at least one other.
Age: Included maxilla fragment and mandible with tooth buds, and loose tooth buds all estimated to age of under 4months so probably one individual.
Sex:
Stature:
Pathology:
Comments: SF194 was a concentration of infant remains most likely a single infant burial and the isolated remains of others. The primary burial aged perinate to neonate, under 4months based on the dental development.

Context No: 4002
S.F.No:125
Year:2004
Sheet No: 3 Bone Nos: 4722-4765
Condition: good, concentration of infant bones.
Age: perinate; more than 2 represented.
Sex:
Stature:

Pathology:
Comments: SF125 was a concentration of infant remains.

Context No: 4030
S.F.No: 188
Year: 2004
Sheet No: 3 Bone Nos: 4765-5271
Condition: very good; large collection of infant bones including very small phalanx and tooth buds. Atlas left neural arches x 5; Axis left neural arches x 4; pars basilaris x 5.
Age: perinate and late foetal bones.
Sex:
Stature:
Pathology:
Comments: collection of infant bones representing between three and six individual infants. The excavator commented that many of the remains appeared to be in close association and partly articulated amongst the concentration. The presence of smallest bones and skull fragments suggest primary burials were taking place below the stone under which SF188 was located.

Context No: 4012
S.F.No: 153
Year: 2004
Sheet No: 3 Bone Nos: 5272
Condition: damaged ends.
Age: adolescent >17yrs; line of fusion for greater visible.
Sex:
Stature:
Pathology:
Comments: adolescent Right femur.

Context No: 4016
S.F.No: 182
Year: 2004
Sheet No: 3 Bone Nos: 5273-5350
Condition: fragmented; collection of infant bones.
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF182 was a collection of infant, mostly perinate remains.

Context No: 4002
S.F.No: 130

Year: 2004
Sheet No: 3 Bone Nos: 5351-5375
Condition: poor, very fragmented.
Age: seems single individual; infant; dental development suggests an age around 9mnth to 1year old.
Sex:
Stature:
Pathology:
Comments: very fragmented remains of an infant.

Context No: 4012
S.F.No: 154
Year: 2004
Sheet No: 3 Bone Nos: 5376-5411
Condition: good, mix of infant bones.
Age: perinate remains, at least 2 individuals represented in this small collection.
Sex:
Stature:
Pathology:
Comments: SF154 was a small collection of mixed perinate remains.

Context No: 4016
S.F.No: 187
Year: 2004
Sheet No: 3 Bone Nos: 5412-5447
Condition: good; small collection of mixed bone.
Age: perinate mix.
Sex:
Stature:
Pathology:
Comments: SF187 was a small collection of mixed perinate remains.

Context No: 4016
S.F.No: 193
Year: 2004
Sheet No: 3 Bone Nos: 5448-5472
Condition: poor, fragmented mix of infant bones.
Age: ?perinate
Sex:
Stature:
Pathology:
Comments: small mix of infant, perinate bones.

Context No: 4002
S.F.No: 133
Year: 2004
Sheet No: 3 Bone Nos: 5473-5492
Condition: fair; small mix of infant bones – perinate and foetal.
Age: mix of perinate and foetal bones. B#5479 was a 28-30wk foetal humerus.
Sex:
Stature:
Pathology:
Comments: SF133 was a small concentration of perinate and foetal bones.

Context No: 4012
S.F.No: 152
Year: 2004
Sheet No: 3 Bone Nos: 5493-5514
Condition: fair; mix of bone; adult scapula fragments and perinate remains.
Age: adult and perinate mix.
Sex:
Stature:
Pathology:
Comments: SF152 was a small mix of adult fragments and perinate bones.

Context No: 4016
S.F.No: 195
Year: 2004
Sheet No: 3 Bone Nos: 5515 - 5544
Condition: fair; collection of mix bone.
Age: mainly perinate bones.
Sex:
Stature:
Pathology:
Comments: SF195 was a small collection of mainly perinate bones.

Context No: 4011
S.F.No: 131
Year: 2004
Sheet No: 3 Bone Nos: 5545 - 5621
Condition: good; mixed remains of just one individual.
Age: foetal; 32-34weeks
Sex:
Stature:
Pathology:

Comments: SF131 are the mixed remains of a single individual of 32-34weeks foetal age.

Context No: 4002
S.F.No: 128
Year: 2004
Sheet No: 3 Bone Nos: 5622-5627
Condition: fair, small mix of infant bones.
Age:
Sex:
Stature:
Pathology:
Comments: SF128 was a small mix of infant bones.

Context No: 4012
S.F.No: 149
Year: 2004
Sheet No: 3 Bone Nos: 5628-5632
Condition: poor, fragments of mixed infant bones.
Age: mixed, perinate
Sex:
Stature:
Pathology:
Comments: SF149 was a small mix of infant bones.

Context No: 4019
S.F.No: 196
Year: 2004
Sheet No: 3 Bone Nos: 5633
Condition: fragmented; Right parietal
Age: ?adolescent
Sex:
Stature:
Pathology:
Comments: right side parietal of possibly adolescent due to size and thickness.

Context No: 4019
S.F.No: 197
Year: 2004
Sheet No: 3 Bone Nos: 5634
Condition: fragment of maxilla, R side.
Age: child c.6years; M1 crown complete and possibly erupting.
Sex:
Stature:

Pathology:
Comments: fragment of right maxilla of child.

Context No: 4019
S.F.No: 198
Year: 2004
Sheet No: 3 Bone Nos: 5635-37
Condition: good
Age: adult
Sex:
Stature:
Pathology:
Comments: 3xproximal hand phalanges of an adult.

Context No: 4017
S.F.No:
Year: 2004
Sheet No: 3 Bone Nos: 5638-5809
Condition: good; large concentration of infant bones. Represents 2 individuals; pars lateralisx4 occurred in left and right matching pairs, also the humerusx4 in matching pairs (B#5772/5773 and B#5774/5775).
Age: two infants, one slightly younger than the other, one perinate and one late foetal 36-38weeks.
Sex:
Stature:
Pathology:
Comments: 4017 was a collection of infant remains representing parts of two individual infants; apparently were in partial articulation in the ground but unfortunately inadequately labelled to allow those parts to be identified in the lab.

Context No: 4039
S.F.No: 203
Year: 2004
Sheet No: 3 Bone Nos: 5810-5839
Condition: poor; small collection of mixed bone including child parietal.
Age: mix of infant and child bones.
Sex:
Stature:
Pathology:
Comments: SF203 was a mix of infant and child bones.

Context No: 4004
S.F.No: 228

Year: 2004

Sheet No: 3 Bone Nos: 5840-5869

Condition: fragmented; mix of infant and child bones; child bones represent one individual.

Age: child's age between 2-5years as suggested by vertebral fusion while dental development as shown by mandible B#5843 suggests age 3<6years as m2 roots are complete but M1 is unerupted.

Sex:

Stature:

Pathology:

Comments: SF228 was a mix of child and infant bones; the child bones represent a child of between 3 and 6 years.

Context No: 4039

S.F.No: 204

Year: 2004

Sheet No: 3 Bone Nos: 5870-5911

Condition: fair; concentration of child bones, mainly one individual but also some bones of younger individual.

Age: one older individual around 4.5 to 5.5years though ageing by dental development was hampered by eruption pattern and is based on the long bone measurements and spinal fusion. Younger individual was more likely under 3years and represented by just a few bones.

Sex:

Stature:

Pathology: dental development a little abnormal in the maxilla; m1's lost antemortem and rather than the PM erupting at the site, the C appear to be erupting which usually takes place at a later age c9years. The M1's are unerupted however and their root formation indicates an age of around 5years.

Comments: SF204 was a collection of child bones representing at least two children, one <3years and one around 5years.

Context No: 4016

S.F.No: -S of SF126 and SF167

Year: 2004

Sheet No: 3 Bone Nos: 5912-5952

Condition: good; collection of perinate remains.

Age: perinate, at least 2 individuals represented but not in full.

Sex:

Stature:

Pathology:

Comments: this was a small collection of perinate bones from South of SF126 and SF167.

Context No: 4016

S.F.No: 183

Year: 2004

Sheet No: 3 Bone Nos: 5953-6075
Condition: good; concentration of infant remains; at least two individuals represented in part; 2xRside pars lateralis, 2xRside pars petrosa, 2xRside ilium.
Age: mix of perinate remains.
Sex:
Stature:
Pathology:
Comments: SF183 was a mix of perinate remains.

Context No : 4016
S.F.No: 206
Year: 2004
Sheet No.: 3 Bone Nos: 6076-6119
Condition: fair; mix of infant remains.
Age: perinate mix
Sex:
Stature:
Pathology:
Comments: S.F.206 was a mix of infant remains.

Context No : 4016
S.F.No: 200
Year: 2004
Sheet No.: 3 Bone Nos: 6120-6235
Condition: fair; infant mix, long bones fragmented.
Age: perinate, at least two represented though most likely the burial of one with bones of a second collected by excavator.
Sex:
Stature:
Pathology:
Comments: SF200 was a concentration of perinate remains.

Context No :4012
S.F.No:
Year:2004
Sheet No.:3 Bone Nos: 6236-6270
Condition: fragmentary; mix of infant bones and adult/adolescent foot bones.
Age: perinate/foetal/adult/adolescent
Sex:
Stature:
Pathology:
Comments: 4012(possible ass with 3117?) was a mix of infant and adult/adolescent foot bones.

Context No :4016
S.F.No:181
Year:2004
Sheet No.:3 Bone Nos: 6271-6294
Condition:poor; mix of perinate bones.
Age:
Sex:
Stature:
Pathology:
Comments: SF181 was a mix of perinate bones.

Context No : 4003
S.F.No: 117
Year: 2004
Sheet No.: 3 Bone Nos: 6295-6332
Condition: fragmented; mix of perinate and infant remains including matching maxilla and mandible of infant.
Age: perinate and infant around 1-2yrs based on dental development; m2's erupting.
Sex:
Stature:
Pathology:
Comments: SF117 was a mix of remains of a perinate and an infant around 1-2yrs.

Context No : 4016
S.F.No: 237
Year: 2004
Sheet No.: 3 Bone Nos: 6333-6408
Condition: fragmented; mix of neonate and perinate bones.
Age:
Sex:
Stature:
Pathology:
Comments: SF237 was a mix of perinate and neonate bones.

Context No : 4016
S.F.No: 184
Year: 2004
Sheet No.: 3 Bone Nos: 6409-6421
Condition: good; small collection of peri/neonate mix bone.
Age: peri/neonate mix.
Sex:
Stature:

Pathology:
Comments: SF184 was a small collection of peri/neonate mixed bones.

Context No : 4003
S.F.No:
Year: 2004
Sheet No.: 3 Bone Nos: 6422
Condition: good
Age: older? adult
Sex:
Stature:
Pathology: osteophytic distal articulation.
Comments: B#6422 was a middle phalanx of the foot found in 4003 thought possibly part of 3117?

Context No : 4016
S.F.No: 192
Year: 2004
Sheet No.: 3 Bone Nos: 6423-53
Condition: fair; small collection foe/perinate mix.
Age: foetal/perinate mix.
Sex:
Stature:
Pathology:
Comments: SF192 was a small collection of mixed perinate and foetal bones.

Context No : 4016
S.F.No: 205
Year: 2004
Sheet No.: 3 Bone Nos: 6454-6457
Condition: poor, fragments.
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF205 was a small collection of infant bones.

Context No : 4016
S.F.No: 190
Year: 2004
Sheet No.: 3 Bone Nos: 6458-6470
Condition:fair; small collection perinate bones.

Age: perinate
Sex:
Stature:
Pathology:
Comments: SF190 was a small collection of perinate bones. See also S.F.191.

Context No : 4016
S.F.No: 190/191
Year: 2004
Sheet No.: 3 Bone Nos: 6471-74
Condition: good. Two small collections of remains.
Age: foetal/perinate mix. SF 190 had 1xfoetal femur and 1xfoetal tibia. SF191 had 1xfoetal femur and 1xfoetal mandible all aged around 16 to 18 foetal weeks.
Sex:
Stature:
Pathology:
Comments : SF190 and SF191 contained matching foetal bones of around 16 to 18 weeks.

Context No : 4016
S.F.No: 191
Year: 2004
Sheet No.: 3 Bone Nos: 6475-6503
Condition: fair
Age: peri/neonate mix
Sex:
Stature:
Pathology:
Comments: SF191 was a small collection of peri/neonate bones.

Context No : 4016
S.F.No: 189
Year: 2004
Sheet No.: 3 Bone Nos: 6504--27
Condition: fair, small collection mix infant bones.
Age: foe/peri mix.
Sex:
Stature:
Pathology:
Comments: SF189 was a small collection of mixed infant bones.

Context No : 4016
S.F.No: 207
Year: 2004

Sheet No.: 3 Bone Nos: 6528-40
Condition: fair
Age: perinate mix
Sex:
Stature:
Pathology:
Comments: SF207 was a small collection of perinate bones.

Context No : 4002
S.F.No: 116
Year: 2004
Sheet No.: 3 Bone Nos: 6541-48
Condition: poor, fragments.
Age: infant or early child?
Sex:
Stature:
Pathology:
Comments: SF116 was a small collection of fragmented bones from infant or early child.

Context No : 4057
S.F.No: 234
Year: 2004
Sheet No.: 3 Bone Nos: 6549-62
Condition: fair
Age: perinate mix
Sex:
Stature:
Pathology:
Comments: SF234 was a small collection of mixed perinate bones.

Context No : 4014
S.F.No:
Year: 2004
Sheet No.: 3 Bone Nos: 6563-6719
Condition: fragmented; mixed bone.
Age:
Sex:
Stature:
Pathology:
Comments: 4014 was a collection of mixed bones, mostly fragmented, or mixed ages.

Context No : 4002
S.F.No: 136

Year: 2004
Sheet No.: 3 Bone Nos: 6720-85
Condition: fair; mix of bones.
Age: perinate and early child mix.
Sex:
Stature:
Pathology:
Comments: SF136b was a small collection of mixed bones, included early child foot bones.

Context No : 4005
S.F.No: 121
Year: 2004
Sheet No.: 3 Bone Nos: 6786-6883
Condition: good; mix of late foetal and perinate bones.
Age: late foetal/ perinate mix.
Sex:
Stature:
Pathology: endocranial lesions on 2xR parietals.
Comments: SF121 was a concentration of mixed late foetal and perinate bones.

Context No :4002
S.F.No: 115
Year: 2004
Sheet No.: 3 Bone Nos: 6884
Condition: fragment
Age:
Sex:
Stature:
Pathology:
Comments: SF115 was a distal fragment of perinate humerus.

Context No : 4001
S.F.No: 119
Year: 2004
Sheet No.: 3 Bone Nos: 6885
Condition: fair; cracked.
Age: ?perinate
Sex:
Stature:
Pathology:
Comments: SF119 was a ?perinate frontal bone.

Context No : 4002

S.F.No: 134
Year: 2004
Sheet No.: 3 Bone Nos: 6886-92
Condition: fair, mix bone.
Age:
Sex:
Stature:
Pathology:
Comments: SF134 was a small mix of bone.

Context No : 4002
S.F.No: 123
Year: 2004
Sheet No.: 3 Bone Nos: 6893-6915
Condition: fair; mixed bone.
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF123 was a small collection of mixed perinate bones.

Context No : 4002
S.F.No: 126
Year: 2004
Sheet No.: 3 Bone Nos: 6916-7102
Condition: good; large concentration of infant bones.
Age: perinate
Sex:
Stature:
Pathology: some active endocranial lesions.
Comments: SF126 was a large collection of mixed perinate remains; included 4xoccipitals, 6xR pars petrosa. Represented at least 4 individuals.

Context No : 4002
S.F.No: 139
Year: 2004
Sheet No.: 3 Bone Nos: 7103-7146
Condition: fair
Age: perinate mix.
Sex:
Stature:
Pathology:

Comments: SF139 was a small mix of perinate bone, possibly originally single burial now mixed.

Context No : 4012
S.F.No: 148
Year: 2004
Sheet No.: 3 Bone Nos: 7147-7232
Condition: fair; perinate mix.
Age: perinates
Sex:
Stature:
Pathology:
Comments: SF148 was a collection of mixed perinate bones.

Context No : 4002
S.F.No: 118
Year: 2004
Sheet No.: 3 Bone Nos: 7233-47
Condition: fair; small collection perinate bones; probably single individual.
Age: perinate, c38wks.
Sex:
Stature:
Pathology:
Comments: SF118 was a small collection of perinate bones; probably partial burial.

Context No : 4016
S.F.No: 127
Year: 2004
Sheet No.: 3 Bone Nos: 7248-70
Condition: fair; small collection perinate bones.
Age: perinate mix.
Sex:
Stature:
Pathology:
Comments: SF127 was a small collection of perinate bones.

Context No : 4002
S.F.No: 122
Year: 2004
Sheet No.: 3 Bone Nos: 7271-7280
Condition: fragmented
Age: late foetal; 34-36weeks.

Sex:
Stature:
Pathology:
Comments: SF122 was a fragmented late foetal, 34-36weeks, skull.

Context No : 4002
S.F.No: 129
Year: 2004
Sheet No.: 3 Bone Nos: 7281-91
Condition: fragmented
Age:
Sex:
Stature:
Pathology:
Comments: SF129 was a small collection of mixed perinate bones.

Context No : 4016
S.F.No: 126/167
Year: 2004
Sheet No.: 3 Bone Nos: 7292-7336
Condition: fragmented
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF126/167 was a collection of mixed perinate bones.

Context No : 4002
S.F.No: 124
Year: 2004
Sheet No.: 3 Bone Nos: 7337-7411
Condition: fair; mixed bone.
Age: foetal and neonate mix.
Sex:
Stature:
Pathology:
Comments: SF124 was a mix of foetal and perinate bones including lower limb bones of 32-34week foetus.

Context No : 4012/4002/4016?
S.F.No: 135
Year: 2004
Sheet No.: 3 Bone Nos: 7412-55

Condition: fragmented
Age: mix; perinate/ adult
Sex:
Stature:
Pathology:
Comments: SF135 was a mix of bones from perinates and adult hand bones.

Context No : 4016
S.F.No: 174
Year: 2004
Sheet No.: 3 Bone Nos: 7456-7627
Condition: fair
Age: perinate mix
Sex:
Stature:
Pathology:
Comments: SF174 was a large collection of perinate remains incuding 4xsphenoid; 3xRmandibe/2xLmandible; 2xR1st ribs/2xL1st ribs.

Context No : 4016
S.F.No: 163
Year: 2004
Sheet No.: 3 Bone Nos: 7628-8323
Condition: fair; large collection of perinate remains.
Age: mostly perinate.
Sex:
Stature:
Pathology:
Comments: SF163 was a large collection of mostly perinate remains in 3 bags; long bone fragments from one bag matched fragments from another. Included pars basilarisx5.

Context No : 4016
S.F.No: 171
Year: 2004
Sheet No.: 3 Bone Nos: 8324-401
Condition: fair; mix of bone
Age: mix
Sex:
Stature:
Pathology:
Comments: mix of bones; included 4-6yrs R scapula and 4xR ribs and vertebrae. 30week radius B#8343. R femur/tibia with periostitis B#8400+8401.

Context No : 4016
S.F.No: 166
Year: 2004
Sheet No.: 3 Bone Nos: 8402-29
Condition: fragmented; mix
Age:perinate mix
Sex:
Stature:
Pathology:
Comments: SF166 was a small collection of mixed perinate bones.

Context No : 4016
S.F.No: 161
Year: 2004
Sheet No.: 3 Bone Nos: 8430-67
Condition: fair; adult/perinate mixed bone.
Age: perinate and adult mix.
Sex:
Stature:
Pathology:
Comments: SF161 was a mix of adult and perinate bones. Adult bones included axis, atlas fragments and fragments of other cervical vertebrae; also right hand bones.

Context No : 4016
S.F.No: 155
Year: 2004
Sheet No.: 3 Bone Nos: 8468-98
Condition: fair; mix perinate bones.
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF155 was a small collection of mixed perinate bones.

Context No : 4019
S.F.No: 172
Year: 2004
Sheet No.: 3 Bone Nos: 8499-555
Condition: fragmented, mixed perinate bones.
Age: perinates
Sex:
Stature:
Pathology:

Comments: SF172 was a small mix of perinate bones including 4xpars basilaris.

Context No : 4016
S.F.No: 173
Year: 2004
Sheet No.: 3 Bone Nos: 8556-617
Condition: fragmented mix.
Age: perinate mix
Sex:
Stature:
Pathology:
Comments: SF173 was a small mix of perinate bones including bones from a 38week and a 40week perinates.

Context No : 4012
S.F.No: 156
Year: 2004
Sheet No.: 3 Bone Nos: 8618-36
Condition: good; small collection.
Age: perinate and foetal (30-32week) mix.
Sex:
Stature:
Pathology:
Comments: SF156 was a small collection of mixed perinate and foetal bones. Included humerus, ulna and femur of 30-32weeks foetus.

Context No : 4016
S.F.No: 167
Year: 2004
Sheet No.: 3 Bone Nos: 8637-8710
Condition: fair, mix of bones.
Age: perinate and ?foetal.
Sex:
Stature:
Pathology:
Comments: SF167 was a mix of infant bones. Included pelvis and long bones from 36week foetus and perinate bones.

Context No : 4016
S.F.No: 176
Year: 2004
Sheet No.: 3 Bone Nos: 8711-773

Condition: fair, mixed bones.
Age: perinate
Sex:
Stature:
Pathology:
Comments:SF176 was a small collection of mostly perinate bones though included maxillary R PM1&2 of an adult.

Context No : 4016
S.F.No: 162
Year: 2004
Sheet No.: 3 Bone Nos: 8774-90
Condition: poor, fragments
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF162 was a small collection of mixed perinate bones.

Context No : 4016
S.F.No: 178
Year: 2004
Sheet No.: 3 Bone Nos: 8791-8802
Condition: good
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF178 was a small collection of upper body bones from perinate; shoulder and ribs probably one individual.

Context No : 4016
S.F.No: 156
Year: 2004
Sheet No.: 3 Bone Nos: 8803+04
Condition: fragments
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF156 contained fragments of perinate bones.

Context No : 4016
S.F.No: 160
Year: 2004
Sheet No.: 3 Bone Nos: 8805-08
Condition: fair
Age: adult/perinate mix
Sex:
Stature:
Pathology:
Comments: SF160 was a small collection of adult finger and perinate radius bones.

Context No : 4016
S.F.No: 177
Year: 2004
Sheet No.: 3 Bone Nos: 8809-26
Condition: fair.
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF177 was a small collection of perinate bones.

Context No : 4016
S.F.No: 165
Year: 2004
Sheet No.: 3 Bone Nos: 8827-54
Condition: fair
Age: peri/early child mix
Sex:
Stature:
Pathology:
Comments: SF165 was a small collection of mostly perinate bones with early child incisors and canine.

Context No : 4016
S.F.No: 157
Year: 2004
Sheet No.: 3 Bone Nos: 8855-8900
Condition: fair
Age: perinate
Sex:
Stature:
Pathology:

Comments: SF157 was a collection of perinate bones.

2006 Skeletal Examination Notes

Context No : 6072
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 8901-9062
Condition: good; some fragmentation but mostly present; no skull (see 6071 A/G).
Age: middle adult; c 35-50years, based on pelvic morphology and spinal degeneration.
Sex: ?Male/Male – based on pelvic morphology and shape of sacrum, measurements less definite.
Stature: 157-162cm
Pathology: this skeleton showed signs of previous periods of infection in the healed new woven bone on the shafts of the lower limb bones, the tibiae in particular. The right tibia had a large lesion on the surface of the medial malleolus 21.35mm long and 6.4mm deep, possibly a chondroblastoma or even benign cyst as there was little sign of active infection here. The spine showed boney proliferation along the posterior surfaces and ligament sites. The long bones also showed reactive bone at the joints. This may point to a spondylarthropathy such as psoriatic arthritis. The spine showed partial lumbarisation of the first segment of the sacrum.
There were also two fractured ribs on the right and one on the left with signs of reactive bone growth in the form of calluses and signs of healing. The shape of the lower arm bones and the muscle attachments on the arms suggest activity from the shoulder to hand with less bending of the elbow than other individuals in the collection.
Comments: 6072 was the burial of a middle adult male with possible psoriatic arthritis. This burial was located close to the large collection of remains 6071 from which cranium 6071A matches the atlas collected with this skeleton.

Context No : 6071 A
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 9063
Condition: very good.
Age: middle adult, based on dental attrition and suture closure.
Sex: Male
Stature:
Dentition: 6071 A&G: a
np x 6 5 / 3 x / / / 3 4 5 6 np np
/ x x x x 3 x x x x 3 x 5 x / /
a a

Pathology: this cranium showed massive AMTL; a massive abscess at RM2 with the alveolar bone completely resorbed. Periodontal disease was possible as the teeth were very low in the socket, however there was also advanced attrition. Remaining teeth show calculus.

This cranium has a complete metopic suture, wormian bones and pronounced bathrocephaly. There was a possible small healed blunt trauma to the left frontal bone. Post-mortem cracking and chipping of the skull was most likely caused by both burial in rubble and later moving of the skull.

Comments: This cranium matches the atlas collected with the spine of burial 6072 and also mandible 6071 G.

Context No: 6071 C

S.F.No:

Year: 2006

Sheet No.: 4 Bone Nos: 9064

Condition: very good.

Age: older child; dental development suggests 8-9years.

Sex:

Stature:

Dentition: maxilla only

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Pathology: pseudopathology – perimortem skull damage, from the pressure of stones placed over the burial. Shows cracking to the top left of cranium; also on the right side there is an indentation to the parietal and fractures leading up to the coronal suture and corresponding fractures in the frontal. All this seems to indicate that the skull was originally possibly buried upright but later moved either through taphonomic processes or to accommodate later burials.

Comments: 6071 C was a collection of remains of an older child; 6071 "mass burial" includes the remains of at least two children of similar ages.

Context No: 6071 G

S.F.No:

Year: 2006

Sheet No.: 4 Bone Nos: 9065 (loose teeth 9066-73)

Condition: fragmented mandible.

Age: adult.

Sex: ?Male

Stature:

Dentition: see 6071A above.

Pathology: massive AMTL; RM2 bone remodelled; bone remodelling at RM1; RC gross calculus and very high in bone; all Incisors lost; LCanine high in bone suggesting periodontal disease; LM1 area one gross abscess; RM2/M3 lost post-mortem.

Comments: this mandible matches the cranium 6071A which matches burial 6072.

Context No : 6071 F
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 9074
Condition: fragmented remains.
Age: older child ; dental development suggests c8years.
Sex:
Stature:
Dentition: mandible only:

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Pathology: at least 3 lines of hypoplasia on the unerupted canine but none on the fully erupted M1 suggests some breaks in development, possibly illness, between ages of 3-7years.
Comments: 6071F contained the fragmentary remains of an older child; similar in age to cranuim 6071C however, there are other mandible fragments of similar age in 6071 “mass burial”.

Context No : 6071 E
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 9075-97
Condition: fragmented, including R ribs, R scapula and R pelvis fragments and vertebrae.
Age: early child; c4-6years.
Sex:
Stature:
Pathology:
Comments: 6071E was a collection of early child bones.

Context No : 6071 I
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 9098-109
Condition: fragmented, included lower thoracic body, lumbars and sacral segment also a complete cervical and axis; and a matching L&R ilium.
Age: early child; vertebral fusion suggests c5-6years.
Sex:
Stature:
Pathology:
Comments: 6071I was a collection of early child bones.

Context No : 6071H
S.F.No:
Year: 2006

Sheet No.:4 Bone Nos: 9110-114
Condition: good
Age: child; c6years? Based on length of femur.
Sex:
Stature:
Pathology: patch of active periostis on the medial side of L femur B#9112.
Comments: 6071H was a collection of lower limb bones of a child.

Context No : 6071
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 9278-9436
Condition: fragmented; mix of bones.
Age: mix
Sex:
Stature:
Pathology:
Comments: B#9278-80 was the upper right arm of an adult which would appear to match individual 6076.
B#9281-86 was a collection of long bones from a child, seems all one individual, possible the child remains marked on plan104?
B#9287 was a fragmented mandible of child c6yrs.
B#9288-94 was a mix of upper right limb bones of c6yr old child.
In all it seems 6071 contained the remains of at least two children c6yrs and possible two others c8-10yrs.

Context No : 6055
S.F.No: 625
Year: 2006
Sheet No.: 4 Bone Nos: 9115 - 9190
Condition: good; mix of adolescent and adult bones.
Age: 1xadult mix 40yrs+; 1xadolescent c14-16yrs.
Sex: adult only – Female.
Stature: adult only Fem+Tib=153.4+/-3.57cm.

Dentition: Adult Mandible:

8 x 6 / / / / /	/ / / / / 6 7 /

Adolescent:

u 7 6 5 4 3 / 1	1 2 3 / 5 6 7 u
- 7 6 / 4 3 2 /	/ / / / 5 6 / -

Pathology: Adult : most teeth lost post-mortem; RM2 lost ante-mortem with socket sealing; attrition on remaining molars suggested age between 25-35yrs. Femur showed rodent gnawing on posterior shaft surface.

Adolescent : teeth slight attrition, no M3s but M2 root complete; slight lines of hypoplasia on the C/PM/M2 low in the crown and root, as M1 was not affected it suggests disruption through illness or malnutrition between 3-8yrs. Slight cribra in the orbits and endocranial bone proliferation on the occipital were possibly the result of infection or meningeal inflammation. The skull was also cracked by pressure most likely from the rubble deposits soon after burial.

Comments: 6055 SF625 was a collection of mixed adult and adolescent remains; notes suggest that the two individuals were grouped separately, with adult bones to the south with semi articulated arm bones. The adolescent remains were not in articulation. Associated with 6055 SF443.

Context No : 6055

S.F.No: 443

Year: 2006

Sheet No.: 4 Bone Nos: 9191-9277

Condition: fragmented; mix of adolescent, adult and other bones.

Age: adolescent remains c12-15years based on pelvis fusion.

Sex:

Stature:

Pathology:

Comments: SF443 was a collection of mostly adolescent bones including pelvis, tibiae, ulnae; and other remains. Associated with 6055 SF625.

Context No : 6076

S.F.No:

Year: 2006

Sheet No.: 4 Bone Nos: 9437-9494

Condition: fragmented, partial skeleton.

Age: middle to older adult, judging from lipping on articular area, spinal degeneration and auricular area fragment.

Sex: ?Male, based on partial measurements of lower limb bones.

Stature:

Pathology: There were signs of healed periostitis on the shafts of the tibia suggesting a previous period of infection or illness. There was also a non-lytic lesion on the plantar distal articular area of the R first metatarsal.

Comments: 6076 was the partial skeleton of an adult in the area of ‘mass burial’ 6071 and 6072. 6071 contained the upper limb bones of an adult which would seem visually to match 6076. The fragmented maxilla and mandible of an older child of 6 to 8 years were also found with 6076.

Context No : 6061
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 9495-9571
Condition: good; almost complete juvenile skeleton.
Age: child BUT dental development gives an age between 6-8 years while long bone measurements with 6061 suggested ages of 4/5years. Possibly lack of growth due to illness, but cannot be sure skull definitely belongs to this same individual.
Sex:
Stature:
Dentition:

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6 e d / / /	/ / / d e 6

Pathology: slight cribra orbitalia pitting in the orbits suggesting possible nutritional illness.
Comments: 6061 was the skeleton of a child with conflicting age results 4/5years from long bone measurements and 6-8years from dental development.

Context No : 6014
S.F.No: 447
Year: 2006
Sheet No.: 4 Bone Nos: 9572-98
Condition: fragmented; mix of mostly perinate bones.
Age: perinate mix
Sex:
Stature:
Pathology:
Comments: SF447 was a small mix of perinate bones.

Context No : 6055
S.F.No: 401
Year: 2006
Sheet No.: 4 Bone Nos: 9599
Condition: fragmented; cranial parts only, no facial bones.
Age: early child, based on non fusion of the occipital squama to pars lateralis.
Sex:
Stature:
Pathology:
Comments: SF401 was the fragmented cranium of an early child.

Context No : 6055
S.F.No: 424
Year: 2006
Sheet No.: 4 Bone Nos: 6900-48

Condition: fair; mix of infant bones.
Age: perinate mix.
Sex:
Stature:
Pathology: some of the infant bones show signs of infection on the surfaces, active periostitis and infection.
Comments: SF424 was a mix of infant bones including perinate remains with active infection.

Context No : 6055
S.F.No: 440
Year: 2006
Sheet No.: 4 Bone Nos: 9649-9810.
Condition: good, collection of perinate bones; one main burial identifiable, notes say disarticulated baby burial.
Age: perinate/neonate, c40weeks determined from measurements.
Sex:
Stature:
Pathology:
Comments: SF440 was the disarticulated burial of a perinate.

Context No : 6055
S.F.No: 429
Year: 2006
Sheet No.: 4 Bone Nos: 9811-10189
Condition: very good, large concentration of perinate remains.
Age: 3 individuals of perinate age, one 36/38wks and two 40wks.
Sex:
Stature:
Pathology: skull fragments, parietals and frontals showed endocranial lesions.
Comments: SF429 was a concentration of perinate infants. Notes say some bones were in partial articulation and were bagged separately, this bag contained substantial parts of two perinate and bones of one other. Altogether, this collection contained the almost complete remains of three perinate infants including vomers and other such fragile bones which indicate these are primary burials.

Context No : 6014
S.F.No: 362
Year: 2006
Sheet No.: 4 Bone Nos: 10,190-212
Condition: fair, mix of infant bones.
Age: perinate, 40weeks.
Sex:

Stature:
Pathology: skull fragments show endocranial pathology.
Comments: SF362 was a small collection of perinate remains; there was little repetition of bones and all seem to be from the upper body suggesting this was a primary ‘baby in bag’ burial from which the lower bones have been displaced in the rubble?

Context No : 6014
S.F.No: 283
Year: 2006
Sheet No.: 4 Bone Nos: 10213-273
Condition: fragmented, collection of perinate bones.
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF283 was a collection of mixed perinate remains including skull fragments.

Context No : 6055
S.F.No: 417
Year: 2006
Sheet No.: 4 Bone Nos: 10274-319
Condition: fair, single infant.
Age: infant, c1.5-2years based on dental development and long bone measurements.
Sex:
Stature:
Pathology: porotic hyperostosis on the parietal at lambdoid suture, skull was fragmented and no frontals to assess full extent of pathology. Probably nutritional defiency.
Comments: SF 417 was the burial of an infant c1.5 to 2years of age with porotic hyperostosis.

Context No : 6029
S.F.No: 297
Year: 2006
Sheet No.: 4 Bone Nos: 10320-358
Condition: fair, collection of late foetal/perinate bones. Little repetition of elements.
Age: late foetal/perinate. Measurements suggest 36-38weeks, however the bones themselves, though in size are like perinate, are small, thinned and weak in appearance. Possible this was a malnourished perinate?
Sex:
Stature:
Pathology: endocranial lesions on the skull fragments, frontals in particular.

Comments: SF297 was a collection of late foetal/perinate bones indicating a single individual burial, the bones in appearance suggest a late foetal or perinate infant but small and weakened, possible malnourished?

Context No : 6055
S.F.No: 425
Year: 2006
Sheet No.: 4 Bone Nos: 10359-387
Condition: poor, fragmented bones, perinate collection.
Age: perinate, 38-40weeks.
Sex:
Stature:
Pathology:
Comments: SF 425 was a collection of perinate bones with little repition of elements, probably originally a burial now disturbed.

Context No : 6055
S.F.No: 407
Year: 2006
Sheet No.: 4 Bone Nos: 10388-465
Condition: fragmented; collection of early child bones, two individuals of similar age.
Age: early child; <5years and early child c3years.
Sex:
Stature:
Pathology:
Comments: SF407 was a collection of early child bones; matching right leg bones of a 3-4year old; maxilla of around 4years; vertebral elements of <5years old and long bones of another early child.

Context No : 6030
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 10,466-10,601
Condition: good, though lower limb bones fragmented, (see 6014 S.F.262 for skull).
Age: middle-older adult; +40-45yrs based on auricular surface and rib end appearance.
Sex: Male; base on all measurements and very narrow greater sciatic notch.
Stature: humerus only – 176.36+/-4.57cm.
Pathology: The spine showed alot of lipping and osteophyte spurring on the lumbar vertebrae. Schmorl's nodes were present on the lumbar vertebrae indicating disc deterioration. L5 also shows possible fracture at base of the right side superior facet, possibly a trauma but shows no healing or infection so was more likely spondylolysis.
A large probable calcified cyst found in the area of the ribs, a hydatid cyst from the organs in the abdomen measured 30x24mm indicated parasitic infection, most likely with the dog tapeworm *Echinococcus granulosus.'* (Waldron, 2009, 111). Infection with the parasite

indicates the close association of dogs and other animals with humans and might suggest poor levels of hygiene in domestic areas.
Comments: 6030 was a middle to older adult male with arthritis and a probable calcified hydatid cyst from the abdomen.

Context No : 6014
S.F.No: 262
Year: 2006
Sheet No.: 4 Bone Nos: 10,602-609
Condition: fragmented; mandible and maxilla fragments from 6030.
Age: older adult; based on the advance attrition and AMTL of molars.
Sex: Male
Stature:
Dentition:

x x x x / / / /	/ / / x x x x x
/ / x / / 3 / /	/ / / / / x x x

Pathology: showed massive AMTL and advanced attrition of remaining teeth down to root stubs which had fallen from the bone post-mortem.
Comments: SF262 was a very small collection which contained the fragmented mandible and maxilla of burial 6030.

Context No : 6030
S.F.No: 292
Year: 2006
Sheet No.: 4 Bone Nos: 10,610 - 750
Condition: fair; concentration of perinate remains.
Age: mix of perinate remains, all suggest 38-40weeks.
Sex:
Stature:
Pathology:
Comments: SF292/6030 was a mix of perinate remains, 3xpars basilaris and pairs of axis/atlas neural arches suggest 3 individuals but the long bones do not support this.

Context No : 6014
S.F.No: 292
Year: 2006
Sheet No.: 4 Bone Nos: 10,751- 768
Condition: fair; small collection of perinate bones.
Age: perinate mix.
Sex:
Stature:
Pathology:
Comments: SF292/6014 was a small collection of mixed perinate bones.

Context No : 6014
S.F.No: 251
Year: 2006
Sheet No.: 4 Bone Nos: 10774-909
Condition: good; concentration of bones proved to be an early child burial with almost all elements present.
Age: infant-early child; c2-3years based on the fusion of vertebrae and long bone length and dental development.
Sex:
Stature:
Pathology:
Comments: SF251 was the burial of an early child c2-3years.

Context No :6043
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 10,910-11,008
Condition: fair; smaller bones of hands and feet were missing and there was a high degree of fragmentation but all elements were represented.
Age: adolescent, older end of the scale c16-19yrs based on the full eruption of the third molars but incomplete fusion of the epiphyses.
Sex: given dental development is older with full eruption and completed third molar roots and the only partial fusion of the epiphyses could suggest male. However, were some indication possible periods of stress which may have affected growth.
Stature: no complete long bones plus epiphyses.

Dentition:

8 7 6 5 4 3 / /	/ 2 3 4 5 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

Pathology: pitting in the orbits suggested possible cribra orbitalia which possibly indicated nutritional influence like anaemia. Also, on the teeth, there appeared to be two periods of stress which affected the enamel leaving it longitudinally cracked and greyish in appearance; the first at 4-6years as the M1 and C are not affected and again 10-12years as it appears on the M3s. Could this have affected growth or epiphyseal fusion?
Comments: 6043 was an adolescent c16-19years.

Context No : 6065
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 11,008-085

Condition: fair; no skull, cervical or thoracic vertebrae or hand bones. All other elements present.

Age: young adult; 20-25years; based on fusing iliac crest and on the ribs tubercles were fused while heads still fusing.

Sex: ?Female, some measurements ambiguous due to damage and fragmentation, greater sciatic notch appears wide. No skull.

Stature: 152.9+/-3.72cm based on femur length.

Pathology:

Comments: 6065 was a young adult, probably female. The skull and upper vertebrae were missing, site notes say most likely due to disturbance by later burials in the immediate area. Also, a collection of perinate remains in this collection were associated with SF425 which was located over 6065.

Context No : 6055

S.F.No: 422

Year: 2006

Sheet No.: 4 Bone Nos: 11,086-108

Condition: fair; collection of bones of single perinate.

Age: perinate 38-40weeks based on lower limb measurements.

Sex:

Stature:

Pathology:

Comments: SF422 was a collection of bones from a perinate.

Context No :6055

S.F.No: 423

Year: 2006

Sheet No.: 4 Bone Nos: 11,109-125

Condition: fair; mix of perinate remains.

Age: perinate mix.

Sex:

Stature:

Pathology:

Comments: SF423 was a small mix of perinate bones.

Context No : 6055

S.F.No: 448

Year: 2006

Sheet No.: 4 Bone Nos: 11,126-251

Condition: fragmentary.

Age: mixed; included the skull and dentition of an infant c.18months with porotic hyperostosis which appears in healing stages on the skull fragments. Also included a large number of mixed perinate remains.

Sex:
Stature:
Pathology: early child skull fragments showed porotic hyperostosis though appears to be healing.
Comments: SF448 contained the mixed remains of an infant and perinates.

Context No : 6094
S.F.No: 639
Year: 2006
Sheet No.: 4 Bone Nos: 11,252-366
Condition: good; upper body all present, lower vertebrae, pelvis and upper femurs missing or damaged.
Age: infant; dental development suggests 18mnth to 1year; vertebral fusion suggests c2years, long bones suggest slightly younger but this possibly due to illness.
Sex:
Stature:
Pathology: active cribra orbitalia in both orbits; signs of healed porotic hyperostosis on the skull fragments; endocranial pathology follows the sulcii in the occipital; all probably metabolic or dietary related, perhaps given the age of the individual this could be due to the effects of weaning?
Comments: SF639 was the burial of an infant of c2years who showed signs of metabolic pathology.

Context No : 6015
S.F.No: 272
Year: 2006
Sheet No.: 4 Bone Nos: 11,367-422
Condition: fair; fragmented skull, upper body parts only.
Age: perinate
Sex:
Stature:
Pathology: endocranial pathology on the skull fragments; skull fragments are dense and thickened, probably due to pathology?
Comments: SF272 was the upper body parts of a perinate; probably 'baby-in-bag' burial.

Context No : 6014
S.F.No: 500
Year: 2006
Sheet No.: 4 Bone Nos: 11,423-454
Condition: fragmentary; mix of perinate remains.
Age: perinate mix.
Sex:
Stature:

Pathology:
Comments: SF500 was a small collection of mixed perinate remains.

Context No : 6015
S.F.No: 289
Year: 2006
Sheet No.: 4 Bone Nos: 11,455-503
Condition: fragmented perinate remains; complete adult foot bones.
Age: perinate mix; adult foot bones.
Sex:
Stature:
Pathology:
Comments: SF289 contained adult foot bones and mixed perinate remains.

Context No : 6055
S.F.No: 396
Year: 2006
Sheet No.: 4 Bone Nos: 11,504-602
Condition: fair; mixed incomplete remains of perinate and infant.
Age: perinate 38-40wks, infant of 1.5-2years based on long bone lengths.
Sex:
Stature:
Pathology:
Comments: SF396 contained the incomplete remains of an infant, 1.5-2yrs and a perinate. Also contained a humerus fragment of 28-30week foetus.

Context No : 6015
S.F.No: 250
Year: 2006
Sheet No.: 4 Bone Nos: 11,603-610
Condition: very good
Age: adult
Sex:
Stature:
Pathology:
Comments: SF250 was a collection of right foot bones of an adult.

Context No : 6014
S.F.No: 450
Year: 2006
Sheet No.: 4 Bone Nos: 11,611-613
Condition: fragmented.

Age:mix
Sex:
Stature:
Pathology:
Comments: SF.450 contained an adult humerus shaft, a rib fragment and a perinate pars petrosa.

Context No : 6014
S.F.No: 363
Year: 2006
Sheet No.: 4 Bone Nos: 11,614-645
Condition: fragmented, mix.
Age: perinate mix and adult phalanges.
Sex:
Stature:
Pathology:
Comments: SF363 was a small collection of mixed remains.

Context No : 6055
S.F.No: 442
Year: 2006
Sheet No.: 4 Bone Nos: 11,646-654
Condition: fair
Age: child
Sex:
Stature:
Pathology:
Comments: SF442 was a small collection of child bones; left rib fragments, left clavicle and sternum manubrium.

Context No : 6034
S.F.No: 316
Year: 2006
Sheet No.: 4 Bone Nos: 11,655-678
Condition: fair; mixed remains.
Age: perinate mix and adolescent foot bones.
Sex:
Stature:
Pathology:
Comments: SF316 was a collection of mixed perinate remains and adolescent foot bones.

Context No : 6013
S.F.No: 427
Year: 2006
Sheet No.: 4 Bone Nos: 11,679-693
Condition: poor, fragmented and eroded bones.
Age: perinate mix.
Sex:
Stature:
Pathology:
Comments: SF427 was a small collection of mixed perinate remains which included a matching pair of L&R scapulae.

Context No : 6055
S.F.No: 428
Year: 2006
Sheet No.: 4 Bone Nos: 11,694-716
Condition: fragmented.
Age: perinate mix.
Sex:
Stature:
Pathology:
Comments: SF428 was a small collection of perinate remains, mostly skull parts.

Context No : 6014
S.F.No: 335
Year: 2006
Sheet No.:4 Bone Nos: 11,717-727
Condition: fragmented
Age: perinate mix
Sex:
Stature:
Pathology:
Comments: SF335 was a small collection of mixed perinate remains.

Context No : 6055
S.F.No: 439
Year: 2006
Sheet No.: 4 Bone Nos: 11,728-743
Condition: fair
Age: perinate mix
Sex:
Stature:
Pathology:

Comments: SF439 was a small mix of perinate remains, mostly vertebral parts.

Context No : 6055
S.F.No: 389
Year: 2006
Sheet No.: 4 Bone Nos: 11,744-750
Condition: fair
Age:mix
Sex:
Stature:
Pathology:
Comments: SF389 was a small collection of mixed bones.

Context No : 6015
S.F.No: 340
Year: 2006
Sheet No.: 4 Bone Nos: 11751-756
Condition: good
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF340 was a small collection of perinate bones.

Context No : 6014
S.F.No: 284
Year: 2006
Sheet No.: 4 Bone Nos: 11,757
Condition: fragments
Age: adult
Sex:
Stature:
Pathology:
Comments: SF284 was a collection of bone fragments, possibly pelvis fragments collected near burial 6096.

Context No : 6015
S.F.No: 319
Year: 2006
Sheet No.: 4 Bone Nos: 11,758-764
Condition: fair
Age: perinate
Sex:

Stature:
Pathology:
Comments: SF319 was a small collection of perinate bones.

Context No : 6015
S.F.No: 294
Year: 2006
Sheet No.: 4 Bone Nos: 11765-769
Condition: good
Age:
Sex:
Stature:
Pathology:
Comments: SF294 was a small collection of mixed bone which included a c26weeks humerus.

Context No : 6055
S.F.No: 434
Year: 2006
Sheet No.: 4 Bone Nos: 11,770-771
Condition: fragments
Age:perinate
Sex:
Stature:
Pathology:
Comments: SF.434 were frontal and mandible fragments, probably perinate.

Context No : 6055
S.F.No: 433
Year: 2006
Sheet No.: 4 Bone Nos: 11,773
Condition: fragment
Age:perinate
Sex:
Stature:
Pathology:
Comments: SF433 was an occipital fragment, probably perinate.

Context No : 6045
S.F.No: 1296
Year: 2006
Sheet No.: 4 Bone Nos: 11,774

Condition: fragments
Age:
Sex:
Stature:
Pathology:
Comments: SF1296 skull fragments, possibly foetal?.
Context No : 6055
S.F.No: 436
Year: 2006
Sheet No.: 4 Bone Nos: 11,775
Condition: fragment
Age: early child, <6years based on what appears non-erupted M1.
Sex:
Stature:
Pathology:
Comments: SF436 was a fragment of child maxilla with m1,m2 insitu but no M1 suggesting age under 6years, teeth showed attrition suggesting older end of the age phase.

Context No : 6023
S.F.No: 265
Year: 2006
Sheet No.: 4 Bone Nos: 11776
Condition: fragment.
Age: early child, based on non-erupted M1.
Sex:
Stature:
Pathology:
Comments: SF.265 was a fragment of early child maxilla with m1,m2 insitu but no sign M1 suggesting age at under 6years.

Context No : 6096
S.F.No: 284
Year: 2006
Sheet No.: 4 Bone Nos: 11,777-830(ADULT); 11,831-849(CHILD)
Condition: fair; fragmented; no skulls; all long bones were broken, site notes say this probably due to a wall constructed over these burials.
Age: Adult: probably middle or older adult. Child: early child suggested by the lengths of long bone fragments.
Sex: Adult was estimated probable Male.
Stature:
Pathology: The adult remains showed considerable eburnation and lipping on the right knee with probable ostechondritis dissecans as the cause and could be seen on the left femur also. There were a number of cuts/strikes with sharp implements to the long bones of the adult in

6096 which may be perimortem but most likely occurred after burial when the remains were skeletonised- but not during excavation. As the notes say that a wall was built over this burial, it could be these marks occurred during construction of the later building?

Comments: 6096 SF284 consisted of the remains of an adult male and a child; site notes say a wall was built over the remains in this area and that 6014 284 and SF627 were also associated with these remains. A large amount of animal bone, sheep ribs in particular, were collected with these remains.

Context No : 6014

S.F.No: 284

Year: 2006

Sheet No.: 4 Bone Nos: 11,850-893(CHILD); 11894-12,007(PERI MIX)

Condition: poor-fair; no skull of the child in the collection.

Age: Child: estimated early child from available long bone lengths. Remainder contained mixed remains of more than one perinate.

Sex:

Stature:

Pathology:

Comments: 6014 SF284 contained the incomplete remains of a child and a collection of mixed perinate remains. Site notes say this collection was associated with 6096 and indeed some of the fragments found in this collection were found to match fragments from 6096.

Context No : 6014

S.F.No: 627

Year: 2006

Sheet No.: 4 Bone Nos: 12,008-392

Condition: fragmented; mix.

Age: adult fragments, perinate mixed remains and early child mix.

Sex: sex of adult scapula was Male, possibly from burial 6096 SF284?

Stature:

Pathology:

Comments: SF627 was a large collection of mixed bone including a large amount of mixed perinate remains; adult bones most likely from 6096 as the cervical vertebra fragments match those in that collection in their pathologies; and a collection of child remains, which also were probably associated with the child bones in SF284.

Context No : 6045

S.F.No:

Year: 2006

Sheet No.: 4 Bone Nos: 12,393-631

Condition: fair; large collection of mixed remains.

Age: mixed remains, included foetal mandibles L&R, 24wks-28wks (B#12,393&394), also foetal long bones and axis/atlas; also contained large number of adult and adolescent hand/foot bones.

Sex:
Stature:
Pathology:
Comments: 6045 contained a collection of mixed remains including foetal bones 24-28wks and adult and adolescent hand/foot bones.

Context No : 6015
S.F.No: 282
Year: 2006
Sheet No.: 4 Bone Nos: 12,632-659
Condition: fragemented; collection of peri/neonate remains.
Age: B#12,632-635 were skull parts collected together or an early neonate. Remainder of the bones all probably belong to same individual, measurements span late perinate-neonate ranges.
Sex:
Stature:
Pathology:
Comments:SF282 was a collection of perinate-neonate remains, most likely one individual.

Context No : 6055
S.F.No: 408
Year: 2006
Sheet No.: 4 Bone Nos: 12,660-669
Condition: fragmentary; frontal bone, atlas/axis, vertebrae and rib fragments.
Age: adult, axis/atlas suggest 35yrs due to lipping or articular areas.
Sex: ?M from visual assessment of the frontal.
Stature:
Pathology:
Comments: SF408 was a collection of adult remains including frontal bone, axis/atlas and other vertebrae of an adult, most likely from same individual burial. What was SF408's location? Close to any burials?

Context No : 6055
S.F.No: 438
Year: 2006
Sheet No.: 4 Bone Nos: 12,670-676
Condition: fragments, vertebra fragments and loose teeth.
Age: adult
Sex:
Stature:
Pathology:
Comments: SF438 was a small collection of fragmented adult vertebrae and loose teeth.

Context No : 6071
S.F.No:
Year:
Sheet No.: 4 Bone Nos: 12,677-682
Condition: fair; mixed bones.
Age: perinate
Sex:
Stature:
Pathology:
Comments: 6071 – this collection was found around burial 6072; contains small collection of perinate bones.

Context No : 6014
S.F.No: 449
Year: 2006
Sheet No.: 4 Bone Nos: 12,683-686
Condition: fragments
Age: child
Sex:
Stature:
Pathology:
Comments: SF449, associated with SF251; small collection of child bones including an axis dens of early child, possibly from the child burial SF251?

Context No : 6055
S.F.No: 444
Year: 2006
Sheet No.: 4 Bone Nos: 12,687-698
Condition: fair, small collection perinate bones.
Age: perinate, one adult hamate.
Sex:
Stature:
Pathology:
Comments: SF444 was a small collection of perinate bones and an adult hamate.

Context No : 6014
S.F.No: 485
Year: 2006
Sheet No.: 4 Bone Nos: 12,699-709
Condition: fragmented; small collection mixed bones.
Age: perinate and infant mix.
Sex:
Stature:

Pathology:
Comments: SF485 was a small collection of mixed perinate and infant bones.

Context No : 6014
S.F.No: 501
Year: 2006
Sheet No.: 4 Bone Nos: 12,710-716
Condition: fair, small collection perinate skull fragments, ilium, mandible.
Age: perinate.
Sex:
Stature:
Pathology:
Comments: SF501 was a small collection of perinate bones.

Context No : 6014
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 12,717-726
Condition: fragmented, mixed bone.
Age: mix
Sex:
Stature:
Pathology:
Comments: this was a small collection of mixed bones from context 6014.

Context No : 6074
S.F.No: 494
Year: 2006
Sheet No.: 4 Bone Nos: 12,727
Condition: fragment
Age: adult
Sex:
Stature:
Pathology:
Comments: SF494 was a fragment of adult zygomatic.

Context No : 6014
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 12,728-729
Condition: fair; mandible and rib fragments.
Age: perinate mandible; adult rib fragments.
Sex:

Stature:
Pathology:
Comments: these bones were collected near burial 6030, a perinate mandible and adult rib fragments.

Context No : 6014
S.F.No: 486
Year: 2006
Sheet No.: 4 Bone Nos: 12,730-743
Condition: fair, mixed child bones and teeth.
Age: early child, teeth.
Sex:
Stature:
Pathology:
Comments: SF486 was a small collection of early child hand and foot bones and loose teeth.

Context No : 6014
S.F.No: 274
Year: 2006
Sheet No.: 4 Bone Nos: 12,744-821
Condition: fragmented; concentration of mixed adult and perinate bones.
Age: adult probably older adult from lipping of articular areas, and perinate bones.
Sex: Female clavicle.
Stature:
Pathology:
Comments: SF274 was a concentration of bone that contained adult hand, foot, vertebrae fragments; and mixed perinate remains.

Context No : 6014
S.F.No: 361
Year: 2006
Sheet No.: 4 Bone Nos: 12,822-897
Condition: fair; mix of perinate and neonate bones.
Age: perinate and neonate.
Sex:
Stature:
Pathology:
Comments: SF361 was a collection of mixed perinate and neonate bones; including 2xR 1st ribs, 2xL 1st ribs, 2xR femur.

Context No : 6014
S.F.No: 271
Year: 2006

Sheet No.: 4 Bone Nos: 12,898-911
Condition: fair; mixed remains.
Age: perinate mix.
Sex:
Stature:
Pathology:
Comments: SF271 was a small collection of mixed perinate bones.

Context No : 6014
S.F.No: 253
Year: 2006
Sheet No.: 4 Bone Nos: 12,912-921
Condition: fair; small mix perinate bones.
Age: perinate
Sex:
Stature:
Pathology:
Comments: SF253 was a small collection of perinate bones including a matching pair of L&R humerus.

Context No : 6012
S.F.No: 246
Year: 2006
Sheet No.: 4 Bone Nos: 12,922-927
Condition: fragments, mix.
Age: mix
Sex:
Stature:
Pathology:
Comments: SF246 was a small mix of fragmented bones.

Context No : 6013
S.F.No: 266
Year: 2006
Sheet No.: 4 Bone Nos: 12,928
Condition: fragment of adult mandible.
Age: younger adult? M3 erupted though missing post-mortem, M1/M2 show slight attrition.
Sex:
Stature:
Pathology:
Comments: SF266 was a fragment from the left side of a younger adult mandible with M3 erupted but missing post-mortem and slight attrition on M1/M2.

Context No : 6014
S.F.No: 248
Year: 2006
Sheet No.: 4 Bone Nos: 12,929-936
Condition: fair; loose teeth and fragments.
Age: adult teeth based on appearance.
Sex:
Stature:
Pathology:
Comments: SF248 was a small collection of fragments and loose adult PM's.

Context No : U/S
S.F.No: 359
Year: 2006
Sheet No.: 4 Bone Nos: 12,937
Condition: occipital fragments.
Age: ?adult
Sex:
Stature:
Pathology:
Comments: SF359 were fragments of probably adult occipital.

Context No : 6014
S.F.No: 252
Year: 2006
Sheet No.: 4 Bone Nos: 12,938-942
Condition: fragments
Age:adult L side temporal; perinate long bone fragments.
Sex: ?F mastoid.
Stature:
Pathology:
Comments: SF252 was a small collection of mixed remains including possibly Female temporal fragment.

Context No : 6000
S.F.No: 240
Year: 2006
Sheet No.: 4 Bone Nos: 19,943-961
Condition: fair; mix of perinate bones.
Age: perinate mix.
Sex:
Stature:
Pathology:

Comments: SF240 was a small collection of mixed infant remains including a matching 38weeks L&R tibiae and a foetal pars petrosa fragment.

Context No : 6012
S.F.No: 249
Year: 2006
Sheet No.: 4 Bone Nos: 12,962-978
Condition: fragmented mix.
Age: perinate mix and child femur fragment.
Sex:
Stature:
Pathology:
Comments: SF249 was a small collection of mixed perinate bone fragments and a child distal femur fragment.

Context No : 6012
S.F.No: 242
Year: 2006
Sheet No.: 4 Bone Nos: 12,979-13,072
Condition: fragmented, mixed remains.
Age: early child, infant and perinate.
Sex:
Stature:
Pathology:
Comments: SF242 was a collection of mixed remains including upper limb bones of an adult, (B#12979); skull of an infant (B#12,980&981), mixed dentition of an infant and early child (B#12,982&983), and mixed perinate remains.

Context No : 6032
S.F.No:
Year: 2006
Sheet No.: 4 Bone Nos: 13,073-181
Condition: good; almost complete skeleton.
Age: young adult, based on dental attrition, pubic symphysis and skull suture closure.
Sex: Female, based on all visual traits and measurements.
Stature: Fem&Tib= 159.1+/-3.55cm.

Dentition:

	b b
8 7 6 5 4 3 2 /	/ / 3 4 5 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

Pathology: the distal femurs and proximal tibiae all show varus torsion resulting in 'knock-knees' but no signs of other trauma or infection on the legs. Slight cribra orbitalia; a small button osteoma and a slight amount of calculus on the buccal/labial sides of the teeth.

Comments: 6032 was the skeleton of a young adult female in very good condition; showing 'knock-knees' of both legs. The left humerus and scapula collected with this skeleton do not appear to match the rest of the remains and may be from another individual as site notes do mention that the left humerus came from a location in the rubble higher than the rest of the remains.

<u>2007-2009 Skeleton Examination Notes</u>

Context No : 7015
S.F.No:
Year: 2007
Sheet No.: 5 Bone Nos: 13,182-310
Condition: very good; all elements represented though some fragmentation including of skull and long bones.
Age: Middle adult; c40-45years; determined by pelvis assessment and dental attrititon, and rib and appearance.
Sex: Male; determined by measurement and visual assessment.
Stature: only humerus complete suggests 161.9+/-4.57cm.

Dentition:

	x x x x x x / 1	1 2 / x x x x x
	8 7 x 5 / 3 2 x	1 2 3 4 x x 7 x
	c	c

Pathology: slight but active cribra orbitalia identified on skull fragments; a 'sunburst' boney growth on the palate may be an osteoblastic sarcoma but also may be the result of infection through massive AMTL. Dental attrition of the anterior teeth down to the root and massive AMTL in the maxilla leaving only the anterior teeth; slight to moderate calculus on the labial surfaces of the teeth and interproximal caries on both M2's of the mandible.

A robust male, with large muscle attachments on the anterior humerus, distal radius and ulna suggesting lifting or pulling with the lower arm either upwards or downwards with the palms supinated. Also the sternum and 1st ribs show calcification of the intercostals cartilage. The thorax would most likely have been broad in appearance. There was also slight spinal osteoarthritis and eburnation on the facets between the lumbar vertebrae.

Comments: 7015 was the skeleton of a robust middle adult male with pathologies suggesting active and heavy physical activities during life.

Context No : 7039
S.F.No:
Year: 2007
Sheet No.: 5 Bone Nos: 13,311-361
Condition: very good but partial skeleton; only Left arm, scapula, and ribs.

Age: Middle adult; based on the rib end appearance and spinal degeneration.

Sex: Male; based on measurements.

Stature: 161.9+/-4.57cm based on the humerus length.

Pathology: arthritis in the hand, metacarpal and carpals show eburnation and lipping of articular areas.

Spinal degeneration, osteoarthritic spurring and lipping of varying degrees on the lumbar bodies, also Schmorl's nodes identified on lumbars, eburnation on some articular facets between vertebrae.

One left rib had a fracture which given the robusticity of the ribs must have been caused by strong force. The fracture is healing well with little sign of infection but has realigned poorly.

Comments: 7039 was the partial skeleton of a mid/older age male with a fractured rib and arthritis found in the area where the walls of Structure C and Structure F overlap and it was most likely the construction of these buildings which caused the removal of parts of this skeleton.

Context No : 7037

S.F.No:

Year: 2007

Sheet No.: 5 Bone Nos: 13,362 - 463

Condition: fragmented; partial child remains with some other bones.

Age: child; dental development suggests age 6-8yrs, scapula/clavicle measurements suggestc7years. The complete upper limb bones in this collection most likely from another individual of older age, c10years,

Sex:

Stature:

Dentition: mandible only:

e d c b /	/ / c d e

Pathology:

Comments: 7037 was the partial skeleton of a late child aged between 6 and 8years with the upper limb bones of a second older child around 10years.

Context No : 9010

S.F.No:

Year: 2009

Sheet No.: 5 Bone Nos: 13,464-532

Condition: poor; all elements represented but very fragmentary.

Age: middle adult?; rib end appearance and maxillary dental attrition would suggest middle adult age over 35years. However, mandibular dental attrition suggest a younger adult age range which raises question of whether there was some occupational affect on attrition or if the mandible/maxilla each belong to the same individual?

Sex: Female?; based on available measurements and smallish size of the mastoid process. Also site notes point out that the greater sciatic notch appeared wide when in situ.

Stature:

/ 7 6 5 4 3 - -	1 / 3 4 / 6 / /

Dentition: / / 6 5 / / / / | / / 3 4 5 6 7 /

Pathology: slight spinal degeneration on vertebral fragments.
Comments: 9010 was the poorly preserved skeleton of a probable female most likely of middle adult age.

Context No : 9003
S.F.No:
Year: 2009
Sheet No.: 5 Bone Nos: 13,533-611
Condition: fair; all elements represented but fragmented.
Age: adolescent; dental development suggests an age of 10-15years as the roots of M2 are incomplete. No epiphyseal fusion though evidence of beginning of fusion of the pelvis parts and distal end humerus suggests an age of c12-15years.
Sex: some measurements are large considering the young age suggesting that this may be a male.
Stature:
Dentition:

u 7 6 / 4 3 / -	- 2 3 / / 6 7 -
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 u
	a

Pathology: one small abscess was identified on the labial CEJ of the left side first incisor.
The tibiae show twisting or orientation of the proximal ends in a varus orientation which suggests ‘knock-knees’ similar to burial 6032. No other signs of malnutrition or bending.
Comments: 9003 was the skeleton of an adolescent, possibly a male, with ‘knock-knees’.

Context No : 9023
S.F.No:
Year: 2009
Sheet No.: 5 Bone Nos: 13,612-676
Condition: good; though vertebrae poorly represented.
Age: infant; majority of measurements suggest c3months while dental development may suggest slightly older; estimate at 3-6months.
Sex:
Stature:
Pathology: slight endocranial indication of perhaps inflammatory infection on the occipital; margins of the exterior parietals and occipital show possible early stage porotic hyperostosis.
Comments: 9023 was the almost complete skeleton of an infant aged between 3to 6 months.

Context No : 9016
S.F.No:
Year: 2009

Sheet No.: Disartic Bone Nos: Disartic # sequence 5539-724

Condition: fair, some mixing of the remains and fragmented long bones.

Age: infant/early child; dental development suggests 2.5-3years; long bone measurements suggest 1-2years. Long bone measurements suggest age at around 1-2years and deciduous dental development suggests age under 3years as m2 and canine roots were incomplete.

Two additional skulls found in the grave include fragments of a perinate skull, and fragments of a 3-6month infant including the mandible with no erupted teeth.

Sex:

Stature:

Dentition: Skull/Mandible 1:

e d / - -	- - - d e
e d c / /	a b / / /

Pathology: m2's show hypoplasia pits indicating disruption in growth at around 6months; perhaps illness as a neonate.

Comments: 9016 was recorded as part of the disarticulated collection and contained the remains of an infant/early child and the fragmented skulls of a perinate and second infant..

Context No : 9013

S.F.No:

Year: 2009

Sheet No.: Disartic Bone Nos: Disartic # sequence 4938-5071

Condition: fair, but long bones fragmented.

Age: adolescent; dentals suggest age between 14-16years as roots complete on M2's. Teeth collected with the remains suggest age between 14-16years, however all teeth collected were loose and no mandible or maxilla were retrieved. Epiphyseal closure beginning, proximal ulna and distal humerus recently fused suggests age 12-15years female/14-18years male. Given the older dental age and early rate of epiphyseal closure suggests could be male.

Sex: ?male

Stature:

Pathology: partial sacralisation of the 5^{th} lumbar vertebra.

Comments: 9013 was an adolescent burial originally recorded as part of the disarticulated collection.

Context No : 9007

S.F.No:

Year: 2009

Sheet No.: Disartic Bone Nos: disartic # sequence 3988-4086

Condition: good; some fragmentation and mixing of remains.

Age: perinate, based on long bone measurements.

Sex:

Stature:

Pathology:

Comments: 9007 was the skeleton of a perinate infant buried with a sheep SF1487.

Context No : 7015
S.F.No: 880
Year: 2007
Sheet No.: 5 Bone Nos: 13,677-79
Condition: fragments
Age: perinate fragments.
Sex:
Stature:
Pathology:
Comments: SF880 was a small collection of perinate parietal L&R fragmentd and occipital fragment. Found around burial (7015).

Context No : 7015
S.F.No: 868
Year: 2007
Sheet No.: 5 Bone Nos: 13,680
Condition: fragments
Age: ?perinate fragments
Sex:
Stature:
Pathology:
Comments: SF868 consisted of fragments of infant frontal fragments collected from around burial (7015).

Context No : 7015
S.F.No: 866
Year: 2007
Sheet No.: 5 Bone Nos: 13,681
Condition: fair
Age: infant
Sex:
Stature:
Pathology:
Comments: SF866 was an infant left side femur collected from around burial (7015).

Context No : 7015
S.F.No:
Year: 2007
Sheet No.: 5 Bone Nos: 13, 682-696
Condition: poor
Age: infant mix
Sex:

Stature:
Pathology:
Comments: mixed remains from around burial (7015).

Context No : 7024
S.F.No: 779
Year: 2007
Sheet No.: 5 Bone Nos: 13,697-717
Condition: fair; mixed infant remains.
Age: mixed perinate.
Sex:
Stature:
Pathology:
Comments: SF779 was a small collection of mixed perinate remains, at least 2 individuals.

Context No : 7094
S.F.No: 1064
Year: 2007
Sheet No.: 5 Bone Nos: 13,718-773
Condition: good; almost complete infant.
Age: infant
Sex:
Stature:
Pathology: Many of the bones have a light, brittle appearance suggesting possible pathology.
Comments: S.F.1064 was the remains of what appears to be a single infant. The Right Femur was sent for RCD.

Context No : 7024
S.F.No: 736
Year: 2007
Sheet No.: 5 Bone Nos: 13,774-790
Condition: fair; mixed remains.
Age: infant mix
Sex:
Stature:
Pathology:
Comments: SF736 was a small collection of mixed infant remains.

Context No : 7024
S.F.No: 728
Year: 2007
Sheet No.: 5 Bone Nos: 13,791-819
Condition: fair; mixed remains.

Age: infant mix.
Sex:
Stature:
Pathology:
Comments: SF728 was a small collection of infant remains.

Context No : 7024
S.F.No: 703
Year: 2007
Sheet No.: 5 Bone Nos: 13,820
Condition: fragments
Age: infant/perinate
Sex:
Stature:
Pathology:
Comments: SF703 consisted of infant skull fragments.

Context No : 7024
S.F.No: 701
Year: 2007
Sheet No.: 5 Bone Nos: 13,821-832
Condition: fragmented.
Age: ?late foetal 36-38weeks
Sex:
Stature:
Pathology:
Comments: SF701 was a small collection of infant remains including matching L&R scapula fragments and axis. No repetition ans uniform coloration suggests this represents single late foetal infant.

Context No : 7041
S.F.No: 876
Year: 2007
Sheet No.: 5 Bone Nos: 13,833
Condition: fragments
Age: infant
Sex:
Stature:
Pathology:
Comments: SF876 was a small collection of infant skull fragments.

Context No : 7041
S.F.No: 884

Year: 2007
Sheet No.: 5 Bone Nos: 13,834
Condition: complete bone.
Age: ealy child; Maresh measurement suggests c4.5years.
Sex:
Stature:
Pathology:
Comments: SF884 was the left side radius bone of an early child.

Context No : 7041
S.F.No: 851
Year: 2007
Sheet No.: 5 Bone Nos: 13,835
Condition: complete bone
Age: adult
Sex:
Stature:
Pathology:
Comments: SF851 was an adult atlas bone.

Context No : 7041
S.F.No: 870
Year: 2007
Sheet No.: 5 Bone Nos: 13,836
Condition: fragmented
Age: child
Sex:
Stature:
Pathology:
Comments: SF870 was a fragmented child rib.

Context No : 7041
S.F.No: 883
Year: 2007
Sheet No.: 5 Bone Nos: 13,837-841
Condition: fair
Age: perinate mix
Sex:
Stature:
Pathology:
Comments: SF883 was a small collection of perinate remains.

Context No : 7041
S.F.No: 858
Year: 2007
Sheet No.: 5 Bone Nos: 13,842-849
Condition: fair
Age:mix
Sex:
Stature:
Pathology:
Comments: SF858 was a small collection of mixed remains.

Context No : 7041
S.F.No: 871
Year: 2007
Sheet No.: 5 Bone Nos: 13,850-854
Condition: fair
Age: infant mix
Sex:
Stature:
Pathology:
Comments: SF871 was a small collection of infant remains including a right side humerus and radius.

Context No : 7041
S.F.No: 864
Year: 2007
Sheet No.: 5 Bone Nos: 13,855-858
Condition: good.
Age: mix; adult
Sex:
Stature:
Pathology:
Comments: SF864 was a small collection of mixed bones including adult hand/foot phalanges.

Context No : 7093
S.F.No: 1083
Year: 2007
Sheet No.: 5 Bone Nos: 13,859
Condition: fragment
Age: perinate?
Sex:
Stature:

Pathology:
Comments: SF1083 was a peri/neonate frontal fragment.

Context No : 7000
S.F.No: 640
Year: 2007
Sheet No.: 5 Bone Nos: 13,860
Condition: fragment.
Age: child
Sex:
Stature:
Pathology:
Comments: SF640 was a fragment of child occipital.

Context No : 7085
S.F.No: 1051
Year: 2007
Sheet No.: 5 Bone Nos: 13,861-873
Condition: fragmented
Age: child; c5-6yrs based on dental development.
Sex:
Stature:
Pathology: lines of hypoplasia on the Canine and PreMolar tooth buds suggest disturbances in health/growth from c4years onwards.
Comments: SF1051 consisted child skull fragments and loose teeth.

Context No : 7004
S.F.No: 658
Year: 2007
Sheet No.: 5 Bone Nos: 13,874-891
Condition: fair
Age: infant mix
Sex:
Stature:
Pathology:
Comments: SF658 was a small collection of mixed infant remains.

Context No : 7051
S.F.No: 911
Year: 2007
Sheet No.: 5 Bone Nos: 13,892
Condition: fragments

Age:infant
Sex:
Stature:
Pathology:
Comments: SF911 was infant skull fragments.

Context No : 7051
S.F.No: 908
Year: 2007
Sheet No.: 5 Bone Nos: 13,893-952
Condition: fair
Age: infant mix
Sex:
Stature:
Pathology:
Comments: SF908 was a collection of infant remains including 3xR 1st ribs and 2xL 1st ribs.

Context No : 7051
S.F.No: 916
Year: 2007
Sheet No.: 5 Bone Nos: 13,953-960
Condition: fair
Age: infant mix
Sex:
Stature:
Pathology:
Comments: SF916 was a small collection of mixed infant bones.

Context No : 7051
S.F.No: 913
Year: 2007
Sheet No.: 5 Bone Nos: 13,961-976
Condition: fair
Age: infant mix
Sex:
Stature:
Pathology:
Comments: SF913 was a small collection of mixed perinate bones.

Context No : 7051
S.F.No: 909
Year: 2007
Sheet No.: 5 Bone Nos: 13,977-989

Condition: fragmented; vertebrae and scapula fragments.
Age: ?middle-older adult
Sex: ?M; based on the glenoid cavity and clavicle measurements.
Stature:
Pathology: vertebrae fragments show left side degeneration possibly due to extra occupation stress on that side?or injury?
Comments: SF909 was a collection of adult scapula, clavicle and vertebrae fragments. Spinal degeneration and appearance suggests middle or older adult.

Context No : 7024
S.F.No: 919
Year: 2007
Sheet No.: 5 Bone Nos: 13,990-14,074
Condition: fair
Age: infant mix – 34-36weeks foetal.
Sex:
Stature:
Pathology:
Comments: SF919 was a concentration of infant remains. This collection included remains of a 34-36weeks foetus; L&R ulna/radius, L&R femur, L tibia, scapula and ilium.

Context No : 7067
S.F.No:
Year: 2007
Sheet No.: 5 Bone Nos: 14,075-105
Condition: fair
Age: mixed
Sex:
Stature:
Pathology: neonate bones B#14,075-092 show pathology suggestive of nutritive illness like scurvy or rickets. Scurvy causes disruption in formation of periosteum and new bone growth is as a cause of bleeding under the periosteum etc.
Comments: 7067 was a collection of bones including pathological neonate remains and adult fibula/hand/foot bones.

Context No : 7017
S.F.No: 1036
Year: 2007
Sheet No.: 5 Bone Nos: 14,106-133
Condition: good; mix
Age: mixed
Sex:
Stature:

Pathology:
Comments: SF1036 was a small collection of mixed bones including adult foot bones.

Context No : 7006
S.F.No: 676
Year: 2007
Sheet No.: 5 Bone Nos: 14,134-140
Condition: fair-good, mix
Age: adult
Sex:
Stature:
Pathology:
Comments: SF676 was a small collection of mixed adult bones including an axis and atlas. Notes say possibly part of a burial excavated in 2006 but no numbers provided.

Context No : 7017
S.F.No: 1037
Year: 2007
Sheet No.: 5 Bone Nos: 14,141
Condition: fragment
Age: adult
Sex:
Stature:
Pathology:
Comments: adult Rside femur fragment with black scorching to the proximal edges.

Context No : u/s
S.F.No: 900
Year: 2007
Sheet No.: 5 Bone Nos: 14,142-143
Condition: fragments
Age:
Sex:
Stature:
Pathology:
Comments: SF900 consisted of mixed skull fragments.

Context No : 7064
S.F.No: 1042
Year: 2007
Sheet No.: 5 Bone Nos: 14,144-156
Condition: fair

Age: infant/early child
Sex:
Stature:
Pathology:
Comments: SF1042 was a small collection of mixed infant and early child bones.

Context No :7024
S.F.No: 722
Year: 2007
Sheet No.: 5 Bone Nos: 14,157-164
Condition: good; mix
Age: perinat/infant mix
Sex:
Stature:
Pathology:
Comments: SF722 was a small collection of mixed infant remains.

Context No : 7024
S.F.No: 696
Year: 2007
Sheet No.: 5 Bone Nos: 14,165-167
Condition: fragments
Age: infant
Sex:
Stature:
Pathology:
Comments: SF696 consisted of infant skull fragments.

Context No : 7051
S.F.No: 917
Year: 2007
Sheet No.: 5 Bone Nos: 14,168-183
Condition: fragments
Age: infant
Sex:
Stature:
Pathology:
Comments: SF917 was a fragmented infant skull with loose tooth buds suggesting age at <6months.

Context No : 7051
S.F.No: 918
Year: 2007

Sheet No.: 5 Bone Nos: 14,184-214
Condition: fair
Age: mix
Sex:
Stature:
Pathology:
Comments: SF918 was a collection of mixed remains including an early child maxilla fragment.

Context No :7051
S.F.No: 902
Year: 2007
Sheet No.: 5 Bone Nos: 14,215-262
Condition: good
Age: mixed; perinate
Sex:
Stature:
Pathology:
Comments: SF902 was a collection of mostly perinate mixed bones including R&L radius; 2xL ulna, 2xLfemur, 3xRfemur, 2xLhumerus, 1xRhumerus, 2xoccipital squama.

Context No : 7024
S.F.No: 766
Year: 2007
Sheet No.: 5 Bone Nos: 14,263-266
Condition: good
Age: perinate mix
Sex:
Stature:
Pathology:
Comments: SF766 was a collection of perinate spine parts.

Context No :7041
S.F.No: 872
Year: 2007
Sheet No.: 5 Bone Nos: 14,267-269
Condition: fragments
Age: adult
Sex:
Stature:
Pathology:
Comments: SF872 consisted of an adult axis and sterna fragment.

Context No : 7041
S.F.No: 869
Year: 2007
Sheet No.: 5 Bone Nos: 14,270+271
Condition: good, mix
Age: child
Sex:
Stature:
Pathology:
Comments: SF869 was a child vertebra and maxillary canine.

Context No : 7041
S.F.No: 863
Year: 2007
Sheet No.: 5 Bone Nos: 14,272-277
Condition: poor
Age: infant
Sex:
Stature:
Pathology:
Comments: SF863 was a small collection of infant ribs.

Context No : 7041
S.F.No: 874
Year: 2007
Sheet No.: 5 Bone Nos: 14,278
Condition: complete bone
Age: infant
Sex:
Stature:
Pathology:
Comments: SF874 was an infant Lfemur.

Context No : 7051
S.F.No: 907
Year: 2007
Sheet No.: 5 Bone Nos: 14,279-286
Condition: fair, mix
Age: mixed infant
Sex:
Stature:
Pathology:
Comments: SF907 was a small collection of mixed infant bones.

Context No : 7085
S.F.No: 1050
Year: 2007
Sheet No.: 5 Bone Nos: 14,287
Condition: good
Age: early child
Sex:
Stature:
Pathology:
Comments: SF1050 was an early child mandible with all teeth lost post-mortem. Lside M1 unerupted.

Context No : 7058
S.F.No: 910
Year: 2007
Sheet No.: 5 Bone Nos: 14,288-418
Condition: good though mixed collection of infant/early child remains.
Age: mixed; mostly early child. B#14,380+381 matching maxilla/mandible of around 4years. B#14,417+418 matching L&R side maxilla of around 3 to 4years..
Sex:
Stature:
Dentition: Maxilla/Mandible B#14,380&381:

- d c / /	/ b / d e
e d c b /	a b c d /

Matching L/R maxilla B#14,417&418:

e d c b /	a / c d e

Pathology: some possible occupational tooth wear on mandible/maxilla B14,380+381.
Comments: SF910 was a collection of infant and early child bones which included skull fragments and maxilla/mandibles. At least 3 individuals of infant-early child age were represented in this collection.

Context No : 8104
S.F.No: 1187
Year: 2008
Sheet No.: 5 Bone Nos: 14,419
Condition: fragment
Age: ?child
Sex:
Stature:
Pathology:
Comments: SF1187 was a possible child skull fragment.

Context No : 8104
S.F.No: 1188
Year: 2008
Sheet No.: 5 Bone Nos: 14,420-427
Condition: fragmented.
Age: ?neonate based on pars lateralis measurement.
Sex:
Stature:
Pathology: fragments show endocranial pathology; frontal fragments show ‘hair-on-end’ pathology.
Comments: SF1188 was a fragmented infant, probable neonate, skull with endocranial pathology on frontal fragments.

Context No : 8104
S.F.No: 1196
Year: 2008
Sheet No.: 5 Bone Nos: 14,428-430
Condition: fair; mixed
Age: infant
Sex:
Stature:
Pathology:
Comments: SF1196 was a small mix of infant bones.

Context No : 9005
S.F.No: 1490
Year: 2009
Sheet No.: 5 Bone Nos: 14,431-503
Condition: good; no repetition of elements.
Age: perinate; 38-40weeks
Sex:
Stature:
Pathology:
Comments: SF1490 was a collection of perinate bones. Notes say this a probable ‘baby-in-a-bag’ burial as the skull fragments and upper body bones were found lying directly over the leg bones.

Context No : 9001
S.F.No: 1400
Year: 2009
Sheet No.: 5 Bone Nos: 14,504-525

Condition: fragmented; dark coloration suggesting close to surface/in topsoil.
Age: perinate mix.
Sex:
Stature:
Pathology:
Comments: SF1400 was a collection of mixed perinate bones.

Context No : 9044
S.F.No: 1666
Year: 2009
Sheet No.: 5 Bone Nos: 14,526-548
Condition: fair, mixed bones.
Age: infant mix.
Sex:
Stature:
Pathology:
Comments: SF1666 was a small mix of infant remains including ribs and skull parts.

Context No : 9002
S.F.No: 1472
Year: 2009
Sheet No.: 5 Bone Nos: 14,549+550
Condition: fragmented
Age: adult/child mix
Sex:
Stature:
Pathology: attrition on the M1&M2 remaining suggest young adult but no M3 evident-congenitally absent or unerupted?
Comments: SF1472 consisted of a fragmented young adult mandible and a child's ulna.

Context No :8104
S.F.No: 1390
Year: 2008
Sheet No.: 5 Bone Nos: 14,551-555
Condition: fragmented
Age: mix
Sex:
Stature:
Pathology:
Comments: SF1390 was a small collection of mixed bones.

Context No : 9005
S.F.No: 1486
Year: 2009
Sheet No.: 5 Bone Nos: 14,556-573
Condition: fair; mixed bones
Age: mixed; includes adolescent foot bones.
Sex:
Stature:
Pathology:
Comments: SF1486 was a small collection of mixed bones including adolescent foot bones.

Context No : U/S
S.F.No: 1538
Year: 2009
Sheet No.: 5 Bone Nos: 14,574-609
Condition: fragmented, mixed
Age: infant mix
Sex:
Stature:
Pathology:
Comments: SF1538 was a collection of mixed infant remains including some with white and green staining from exposure.

Context No : 9005
S.F.No: 1500
Year: 2009
Sheet No.: 5 Bone Nos: 14610-627
Condition: fragmented mix of adult spine, pelvis, sacrum.
Age: adult (Older adult based on Lovejoy/spinal degeneration).
Sex: ?M based on narrow greater sciatic notch.
Stature:
Pathology: L4 shows spondylolysis of the left side superior and inferior articular facets and right side inferior facets missing; the corresponding piece of the neural arch/spinous process not present. The L5 shows osteophytic spurring on the anterior surface, possible this due the effects of non-union of the L3?
Comments: SF1500 was a collection of adult, possible male, lumbar vertevrae, right pelvis and sacrum. Site notes say this collection came from immediately s/sw of burial (9010) but examination of my records show (9010) collection included sacrum.

Context No : 9005
S.F.No: 1498
Year: 2009
Sheet No.: 5 Bone Nos: 14,628-681

Condition: good
Age: foetal and infant mix
Sex:
Stature:
Pathology:
Comments: SF1498 was a concentration of infant remains which contained bones of a 32week foetus and mixed infant skull fragments.

Context No : 9005
S.F.No: 1509
Year: 2009
Sheet No.: 5 Bone Nos: 14,682-721
Condition: fragmented; mix
Age: perinate mix
Sex:
Stature:
Pathology:
Comments: SF1509 was a collection of mixed perinate remains with infant spinal fragments.

Context No : 9005
S.F.No: 1502
Year: 2009
Sheet No.: 5 Bone Nos: 14,722-828
Condition: fair; perinate mix.
Age: mix of perinate remains.
Sex:
Stature:
Pathology:
Comments: SF1502 was a collection of mixed perinate remains. Appears to contain incomplete remains of two perinates, one slightly older than the other but both within the 40week measurements range.

Context No : 9005
S.F.No: 1512
Year: 2009
Sheet No.: 5 Bone Nos: 14,829-832
Condition: good; mix
Age: mix
Sex:
Stature:
Pathology:
Comments: SF1512 was a small collection of mixed bones.

Context No : 9005
S.F.No: 1508
Year: 2009
Sheet No.: 5 Bone Nos: 14,833-868
Condition: fair, single infant.
Age: perinate infant
Sex:
Stature:
Pathology:
Comments: SF1508 was a collection of perinate remains representing a single infant.

Context No : 9005
S.F.No: 1503
Year: 2009
Sheet No.: 5 Bone Nos: 14,869-900
Condition: fragmented; mix.
Age: mix
Sex:
Stature:
Pathology: fragments of some infant/early child bones show a very brittle appearance and may be pathological.
Comments: SF1503 was a collection of mixed remains including a number of loose teeth of apparently similar age 1-2years.