Osteological Analysis
Ebberston Manor
37 Main Street, Ebberston
North Yorkshire

Site Code: EBB05
NGR: SE 8990 8247

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Prepared for

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Summary

York Osteoarchaeology Ltd was commissioned by MAP Archaeological Consultancy Ltd to carry out the osteological analysis of one skeleton, found beneath a patio at Ebberston Manor, North Yorkshire (NGR SE 8990 8247). The skeleton was probably medieval in date, and was buried in a standard Christian fashion, with a west-east alignment, in a supine, extended position with the hands on the chest in an unfurnished grave. Several animal bones were present.

The individual was identified as a middle-aged (36-45 year old) woman, of average height for the medieval period. She suffered from osteoarthritis, particularly in her finger joints. Her spine and several of her limb joints displayed evidence of degenerative joint disease. These changes might be in part related to her age, but her daily activities and occupation could also be implicated. She had fractured several bones, including her right clavicle (collarbone), five ribs, and the body of one of her thoracic vertebrae, probably as the result of one (or more) falls. These breaks had healed well, but the poor alignment of the broken parts of the right clavicle had led to the development of osteoarthritis in her right shoulder.

Her dental health was generally poor, and she had calculus (mineralised plaque) on her teeth; two teeth affected by dental caries (tooth decay), and four teeth had been lost during life. Four of her molar teeth were either not present or had failed to erupt, and one of the molars had erupted sideways. Faint lines (dental enamel hypoplasia) were present on her lower canines, which might have been caused by an episode of childhood stress.

Acknowledgements

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1.0 INTRODUCTION

In December 2005 York Osteoarchaeology Ltd was commissioned by MAP Archaeological Consultancy Ltd to carry out the osteological analysis of one skeleton, found beneath a patio at Ebberston Manor. The skeletal remains had been excavated in 2005 following their discovery beneath the patio at 37 Main Street, Ebberston, North Yorkshire (NGR SE 8990 8247).

The skeleton was probably medieval in date, and was buried in a supine, extended position, with the head to the west and feet to the east, and the hands placed on the chest (see Table 1). The grave had been truncated by a recent feature, which had affected the lower half of the body. Several animal bones were found with the skeleton during analysis.

Table 1 Summary of archaeological information of the skeleton

Skeleton No	Position	Orientation	Date
1002	Supine, extended	West-east	Medieval?

1.1 AIMS AND OBJECTIVES

The aim of the skeletal analysis was to determine the age, sex and stature of the skeleton, as well as to record and diagnose any skeletal manifestations of disease and trauma.

1.2 METHODOLOGY

The skeleton was analysed in detail, assessing the preservation and completeness, calculating the minimum number of individuals present as well as determining the age, sex and stature of the individual (Appendix A). All pathological lesions were recorded and described.

2.0 OSTEOLOGICAL ANALYSIS

Osteological analysis is concerned with the determination of the identity of a skeleton, by estimating its age, sex and stature. Robusticity and non-metric traits can provide further information on the appearance and familial affinities of the individual studied. This information is essential in order to determine the prevalence of disease types and age-related changes. It is crucial for identifying gender dimorphism in occupation, lifestyle and diet, as well as the role of different age groups in society.

2.1 PRESERVATION

Skeletal preservation depends upon a number of factors, including the age and sex of the individual as well as the size, shape and robusticity of the bone. Burial environment, post-depositional disturbance and treatment following excavation can also have a considerable impact on bone condition. Preservation of human skeletal

remains is assessed subjectively, depending upon the severity of bone surface erosion and post-mortem breaks, but disregarding completeness.

Preservation was assessed using the seven-category grading system defined by McKinley (2004), ranging from 0 (excellent) to 5+ (extremely poor). Excellent preservation implied no bone surface erosion, a clear surface morphology, and very few or no breaks, whereas extremely poor preservation indicated heavy and penetrating erosion of the bone surface resulting in complete loss of surface morphology and modification of the bone profile, coupled with severe fragmentation.

The skeleton showed variable preservation (see Table 2). The upper half of the body was very well preserved (Grade 1), with only occasional small patches of slight surface erosion. In contrast, the lower half of the body was less well preserved (Grade 3), and most of the bone surface was affected by erosion which had masked some of the surface detail, although general morphology was maintained. The bones of the lower body were also more fragmented and less complete than those of the upper body.

Table 2 Summary of osteological and palaeopathological results

Skeleton No	**Preservation**	**Completeness**	**Age**	**Sex**	**Stature (cm)**	**Pathology**
1002	Variable: upper body very good (Grade 1); lower body moderate (Grade 3)	60-70%	36-45 years	F	159.92	Osteoarthritis and DJD of spine Possible fractured thoracic vertebra Fractured ribs (x 5) Fractured right clavicle Osteoarthritis of right shoulder, both hands, left elbow DJD right hip, sterno-clavicular joints

The completeness of the skeleton was reasonably good at 60-70% complete. However, as with the preservation, the upper body was more complete than the lower body. For example, although almost all the hand bones had been recovered, none of the foot bones were present. The lower half of the body had obviously suffered as a result of a recent truncation of the grave, which had damaged the lowest vertebrae in the spine, the pelvis, and lower right leg, and also resulted in loss of both feet.

2.2 MINIMUM NUMBER OF INDIVIDUALS

A count of the 'minimum number of individuals' (MNI) recovered from a cemetery is carried out as standard procedure in osteological reports on inhumations in order to establish how many individuals are represented by the articulated and disarticulated human bones (without taking the archaeologically defined graves into account). The MNI is calculated by counting all long bone ends, as well as other larger skeletal elements recovered. The largest number of these is then taken as the MNI. The MNI is likely to be lower than the actual number of skeletons which would have been interred on the site, but represents the minimum number of individuals which can be scientifically proven to be present.

Only one of each bone, or bone part, was present, meaning that the minimum number of individuals was one.

2.3 ASSESSMENT OF AGE

Age was determined using standard ageing techniques, as specified in Scheuer and Black (2000a; 2000b) and Cox (2000). Age estimation relies on the presence of the pelvis and uses different stages of bone development and degeneration in order to calculate the age of an individual. Age is split into a number of categories, from foetus (up to 40 weeks in *utero*), neonate (around the time of birth), infant (newborn to one year), juvenile (1-12 years), adolescent (13-17 years), young adult (ya; 18-25 years), young middle adult (yma; 26-35 years), old middle adult (oma; 36-45 years), mature adult (ma; 46+) to adult (an individual whose age could not be determined more accurately than that they were eighteen or over).

Age estimation of the skeleton was based on as many criteria as possible. The amount of wear of the teeth, the degree of closure of the cranial sutures, and the condition of the auricular surface (the sacral joint of the pelvis) and sternal ends of the ribs, all suggested this individual was in the early/mid thirties to mid forties, and so they were considered to be an old middle adult (36-45 years).

2.4 SEX DETERMINATION

Sex determination was carried out using standard osteological techniques, such as those described by Mays and Cox (2000). Assessment of sex in both males and females relies on the preservation of the skull and the pelvis and can only be carried out once sexual characteristics have developed, during late puberty and early adulthood.

The skeleton was almost certainly female. Although the pelvis (the most reliable indicator of biological sex) was damaged and incomplete, what survived showed predominantly female traits with one (the sciatic notch) being indeterminate. The skull was extremely well preserved and very female in appearance, and the measurements taken of the post-cranial skeleton fell into the female range.

2.5 METRIC ANALYSIS

Stature depends on two main factors, heredity and environment. However, stature can also fluctuate between chronological periods. Stature can only be established in skeletons if at least one complete and fully fused long bone is present. The bone is measured on an osteometric board, and stature is then calculated using a regression formula developed upon individuals of known stature (Trotter 1970).

The stature of this skeleton was calculated as 159.92cm (± 4.24cm), based on measurement of the left radius (one of the bones in the forearm), which is only slightly taller than the mean stature of 158.60cm calculated for the medieval period by Caffell (1997). This female was also slightly taller than average for most other periods, with the exception of the Anglo-Saxon period (161.38cm; *ibid.*).

Leg measurements were obtained from the femora and tibiae and used to calculate robusticity indices. The *platymeria* index is a method of calculating the shape and robusticity of the femoral shaft. The left femur of Skeleton 1002 was *eurymeric* (of average dimensions); the right femur was too damaged to measure. The

platycnemia index of the tibiae was calculated in order to establish the degree of tibial shaft flatness. Both tibiae were *eurycnemic* (of average dimensions).

The cranium of Skeleton 1002 was in exceptional condition, being almost intact and with no surface erosion. However, a crucial piece of the frontal bone had broken off post-mortem (apparently the result of damage sustained relatively recently), and unfortunately this meant that measurements required to calculate several indices could not be taken. The orbital index is used to describe the shape of the eye socket, and the palatal and maxillo-alveolar indices are used to describe the shape of the palate (roof of the mouth). In this individual the left orbit was narrow, or *hypsiconchic* (the right side could not be measured), and the palate was long and narrow (*leptostaphyline* and *dolichuranic*).

2.6 NON-METRIC TRAITS

Non-metric traits are additional sutures, facets, bony processes, canals and foramina, which occur in a minority of skeletons and are believed to suggest hereditary affiliation between skeletons (Saunders 1989). The origins of non-metric traits have been extensively discussed in the osteological literature and it is now thought that while most non-metric traits have genetic origins, some can be produced by factors such as mechanical stress (Kennedy 1989) or environment (Trinkhaus 1978).

A total of thirty cranial (skull) and thirty post-cranial (bones of the body and limbs) non-metric traits were selected from the osteological literature (Buikstra and Ubelaker 1994, Finnegan 1978, Berry and Berry 1967) and recorded. Almost all cranial traits could be scored, and those present included an *ossicle in the right lambdoid suture* and an *ossicle at the right parietal notch* (additional bones in the sutures at the back and side of the head), *double right anterior condylar canal* (two holes instead of one at the base of the skull), a *parietal foramen* on the left side (an extra small hole towards the back of the head), an *extrasutural mastoid foramen* on the left side (a small hole in the ear bone), *absent zygomaticofacial foramina* on both sides (the lack of small holes that are normally present in the cheekbones), small *maxillary tori* on both sides (bony nodules next to the upper molar teeth on the inside of the mouth), and *extrasutural anterior and posterior left ethmoid foramina* (two small holes in the side of the orbit) on the right side.

Not many post-cranial traits could be scored in Skeleton 1002, largely due to the incomplete and damaged lower half of the skeleton. The only trait observed as present was an *accessory acromial facet* (an extra facet on part of the shoulder blade), which is probably related to the fractured clavicle (collarbone) discussed below.

2.7 CONCLUSION

The condition of the skeleton excavated at Ebberston Manor was affected by the recent truncation of her grave, with the upper half of the body being more complete, better preserved and less fragmented than the lower body. Osteological analysis established that the individual was a woman aged c.35-45 years old when she died. She was of average height for the late medieval period, being 159.92cm tall.

3.0 PATHOLOGICAL ANALYSIS

Pathological conditions (disease) can manifest themselves on the skeleton, especially when these are chronic conditions or the result of trauma to the bone. The bone elements to which muscles attach can also provide information on muscle trauma and excessive use of muscles.

3.1 DEGENERATIVE JOINT DISEASE

The term joint disease encompasses a large number of conditions with different causes, which all affect the articular joints of the skeleton. Factors influencing joint disease include physical activity, occupation, workload and advancing age, which manifest as degenerative joint disease and osteoarthritis. Alternatively, joint changes may have inflammatory causes in the *spondyloarthropathies*, such as sceptic or rheumatoid arthritis. Different joint diseases affect the articular joints in a different way, and it is the type of lesion, together with the distribution of skeletal manifestations, which determines the diagnosis.

3.1.1 DJD

The most common type of joint disease observed tends to be degenerative joint disease (DJD). DJD is characterised by both bone formation (osteophytes) and bone resorption (porosity) at and around the articular surfaces of the joints, which can cause great discomfort and disability (Rogers 2001).

This individual suffered from both spinal and extra-spinal DJD. The bodies of most of her cervical (neck) and lumbar (lower back) vertebrae, as well as the mid thoracic vertebrae, had new bone formation around the margins and porosity of the surfaces (Plate 1). DJD was also seen in a couple of the apophyseal joints between the cervical vertebrae.

Plate 1 DJD and osteoarthritis in cervical vertebrae

Degenerative changes (porosity and osteophytes) were seen in the right medial clavicle (where the collarbone meets the breastbone), and the left lateral clavicle (where the collarbone articulates with the shoulder blade). Her left hip joint was also affected by DJD, with deep cavities beneath the upper part of the joint surface of the acetabulum (hip socket). Unfortunately no other joints from the lower body could be observed as they had not survived.

3.1.2 Osteoarthritis

Osteoarthritis is a degenerative joint disease characterised by the deterioration of the joint cartilage, leading to exposure of the underlying bony joint surface. The resulting bone to bone contact can produce polishing of the bone termed ‘eburnation’, which is the most apparent expression of osteoarthritis. Osteoarthritis can be the result of mechanical stress and other factors, including lifestyle, food acquisition and preparation, social status, sex and general health (Larsen 1997, 179).

As well as DJD, this woman had also suffered from osteoarthritis in her spine, her right shoulder, left elbow, and both her hands. Eburnation (indicating direct contact between the bones in a joint) and osteophytes were seen in the joints between the mid cervical (neck) vertebrae, the mid thoracic vertebrae (right side only), and the mid lumbar (lower back) vertebrae; the joints between the lowest lumbar vertebra and the sacrum were also affected.

The right shoulder was damaged post-mortem and the right humeral head (the 'ball' part of the shoulder joint) no longer survived. Some eburnation was seen on the inferior surface of the acromion (beneath the shoulder blade), and also on the greater tubercle of the humerus (a part of the bone next to the normal joint surface) together with marginal osteophytes. These parts are not normally involved in joint changes, but the presence of bone polishing shows that they had come into contact with each other, almost certainly following the fracture of the clavicle (collarbone) discussed in the trauma section below. A small patch of eburnation (bone polishing) was observed on the left radial head (part of the elbow joint).

Severe osteoarthritic changes were seen in both hands. These changes were symmetrical in appearance and distribution, and the hands were virtually mirror images of each other. All joints in the thumb (including the saddle-joint at the base) had osteophytes around the margins and were eburnated, sometimes with grooves worn into the bone, creating marked changes in the normal contours of the joint surface (Plate 2). Extremely large osteophytes were present on the dorsal surface of the second and third metacarpal heads (the knuckles), and both joints showed eburnation (Plate 3), yet the fourth and fifth metacarpals were unaffected. All the distal, and most of the proximal, inter-phalangeal joints (the joints in the fingers) showed new bone around the margins coupled with eburnation, and one intermediate phalanx showed possible erosive lesions of the head.

Plate 2 Osteoarthritis in thumbs

Plate 3 Osteoarthritis in third metacarpals

The degeneration and osteoarthritis of the joint surfaces could be age-related, but considering this individual was probably 35-45 years old when she died it is likely that some kind of physical activity was also involved. Her spine has both DJD and osteoarthritis, particularly in the neck and lower back, showing stress of these areas; some of the changes in the thoracic vertebrae might be related to a possible fracture (see below). The severe osteoarthritis seen in both hands would be more likely to occur in an older individual, and presumably resulted from the work she habitually carried out as an adult. The changes that had occurred would have restricted mobility to some extent, and as well as deforming the hands were no doubt painful. The osteoarthritis of the left elbow and degeneration of the left hip were probably also the result of physical activity. The osteoarthritis of the right shoulder was almost certainly the result of a fractured clavicle, which brought bones into contact that are normally kept well apart. Overall these changes probably reflect a lifetime of manual work which placed stress on her spine, hip, shoulders and elbow, and also her hands.

3.1.3 Schmorl's Nodes

A different condition which affects the spine is Schmorl's nodes. Schmorl's nodes are indentations in the upper and lower surfaces of the vertebral bodies, most commonly in the lower thoracic vertebrae (Hilton *et al.* 1976).

Schmorl's nodes can result from damage to the intervertebral discs, which then impinge onto the vertebral body surface (Rogers 2001), and may cause necrosis (death) of the surrounding tissue. Rupture of the discs only occurs if sufficient axial compressive forces are causing pressure on the central part of the discs; frequent lifting or carrying of heavy loads can cause this. Schmorl's nodes were observed in the upper and lower surfaces of the body of the third lumbar vertebra, in the mid lower back.

3.2 TRAUMA

The patterns of trauma, or injuries sustained, may be related to living conditions, different types of activity and occupation, and acts of aggression (Roberts and Manchester 1995). Fractures are often the result of an accident, and are frequently reported for archaeological populations.

This individual had sustained several fractures to her bones. Her right clavicle (collarbone) had an oblique fracture of the mid-shaft (the centre of the bone), and the bone had healed in poor alignment (Plate 4). The broken fragments had healed in an overlapping position, with the lateral (shoulder) end of the bone positioned in front of the proximal (body) end, and with the lateral end displaced inferiorally (downwards). As a result, the right clavicle was at least 1cm shorter than the left clavicle (impossible to measure accurately due to post-mortem damage), and the downward displacement of the lateral end brought part of the scapula (with which it articulates) into contact with the top of the humerus resulting in eburnation (bone polishing). Aside from the poor alignment, the fracture was well-healed with no sign of infection. This, coupled with the joint changes in the shoulder, suggests the injury was sustained some time before death. It is the type of injury sustained through falling on an outstretched hand, or onto the point of the shoulder (Roberts and Manchester 1995).

Plate 4 Fracture of right collar bone below healthy left bone

This woman had also fractured five ribs on the right side, probably ribs 3-7 in the upper part of the rib-cage. They were all transverse fractures of the rib shaft, and well-healed with only a slight deviation in orientation to show their presence. It is likely they were all sustained at the same time, a while before death, and possibly caused by a fall, or a blow to the ribs (Roberts and Manchester 1995). Finally, she had a possible fracture of the body of the eighth thoracic vertebra (in the middle of the spine), and it is possible that some of the joint changes seen in the thoracic vertebrae are related to this fracture. Again, this fracture was probably sustained some time before death.

Whether these fractures all occurred at the same time, and were the result of the same accident, is unknown. However, they were all sustained some time before death as they had healed well, and caused associated joint changes.

3.3 MISCELLANEOUS

There was a large, deep, hollow with smooth rounded edges immediately adjacent to the posterior border of the left auricular surface (the joint between the pelvis and sacrum). This could be a developmental anomaly, or

perhaps be associated with other joint changes. The left fibula shaft appears bent, especially at the distal end, but the tibia is straight; the right side is lost post-mortem.

3.4 CONCLUSION

The skeleton of this woman showed numerous joint changes (osteoarthritis and degenerative joint disease) in the spine, shoulders, left elbow, left hip, and both hands. To some extent these could be associated with her age, yet the severity of the changes, particularly those of the hands and spine would be more common in an older individual. This implies that she led an active life with a physical occupation that placed stress on her spine, and also caused her to develop severe osteoarthritis in both hands, particularly in her thumbs and first two fingers. The changes in her hands would have been apparent during life, as her hands would have been deformed, the range of movement of her joints would have been limited to some extent, and they were probably painful. As well as extensive joint changes, she had also sustained numerous broken bones, including her right collarbone, five right ribs in the upper part of her ribcage, and the body of one of her thoracic vertebrae, probably the result of one or more falls. Although all had healed long before death, the collarbone was poorly aligned and shorter than that on the left side. Because the shoulder end of the bone had been displaced downwards, and healed in that position, it had caused part of the shoulder blade to come into contact with the top of the humerus resulting in osteoarthritis of the shoulder joint. It is possible that her shoulders were mal-aligned, which might have caused the arthritis in her neck.

4.0 DENTAL HEALTH

Analysis of the teeth from archaeological populations provides vital clues about health, diet and oral hygiene, as well as information about environmental and congenital conditions. All tooth positions were available for observation. Fifteen permanent teeth were present: nine were lost post-mortem, four were lost ante-mortem (before death), and four teeth were not present or were unerupted.

Table 3 Summary of dental pathology

Skeleton No	Number of teeth present	Calculus	Caries	Abscesses	DEH	Infractions	Wear	Periodontitis
1002	15	15	2	0	2	-	Moderate to heavy	Considerable

Four of the permanent teeth from Skeleton 1002 had been lost ante-mortem (12.5% of the tooth positions). The causes of ante-mortem tooth loss (the loss of teeth during life) include dental caries (tooth decay), heavy wear of the teeth exposing the pulp, and periodontal disease. Once the tooth has been lost, the empty socket is filled in with bone.

Dental wear tends to be more common and severe in archaeological populations than in modern teeth. Severity of the dental wear was assessed using a chart developed by Smith (1984): each tooth was scored using a grading system ranging from 1 (no wear) to 8 (severe attrition of the whole tooth crown). The wear of the surviving

teeth in Skeleton 1002 was moderate to heavy, with the right teeth showing slightly heavier wear than those on the left.

Calculus (mineralised plaque) is commonly observed in archaeological populations whose dental hygiene was not as rigorous as it is today: if it is not regularly and effectively removed then plaque mineralises and forms concretions on the tooth crowns, along the line of the gums. Calculus was observed on all surviving teeth, being heavy on the anterior (front) teeth (incisors and canines), and becoming moderate, and then slight towards the rear of the mouth (Plate 5).

Plate 5 Calculus and ante-mortem tooth loss in mandible

Dental caries (tooth decay) occurs when bacteria in the mouth metabolise sugars and carbohydrates, producing acid which causes loss of minerals from the structure of the tooth, eventually causing the development of a cavity (Zero 1999). Naturally occurring sugars are found in fruits, vegetables, and honey, but caries becomes more common when the diet is high in refined sugars, and so it tends to increase in frequency through time as imported refined sugars gradually become more prominent in the diet. Three carious lesions (cavities) were seen in two of the teeth (both lower second molars). Both teeth had cavities at the junction between the crown and the root, but one also had a small cavity in the occlusal (biting) surface.

Dental enamel hypoplasia (DEH) was observed in the lower canines, with a faint line present on both teeth; the incisors could not be observed as their surfaces were obscured by heavy calculus. DEH is the manifestation of lines, grooves or pits on the crown surface of the teeth, which represent the cessation of crown formation. The defects are caused by periods of severe stress during the first to seventh year of childhood, including malnutrition or disease.

Four of the teeth had not erupted, or were not present. In the mandible these were the third molars, the teeth that most commonly fail to develop or fail to erupt, but in the maxilla it appeared that it was the second molars that were absent/unerupted with the third molars being present; a radiograph would help to elucidate the situation. The upper right third (or possibly second) molar was erupting sideways (laterally and posteriorally), and most of the crown was not in contact with the opposing tooth.

5.0 MORTUARY PRACTICE

This individual had been buried in a supine, extended position, with her hands placed on her chest, right hand beneath left. She was lying in a west-east alignment, with her head to the west and feet to the east, and no grave-goods were recovered. This is the typical Christian burial practice seen in medieval and post-medieval cemeteries (Daniell 1997). Although a reasonably large number of animal bones were present in the grave that were probably residual, there were no fragments of human bone from other individuals.

6.0 DISCUSSION AND SUMMARY

The skeleton from Ebberston Manor was reasonably well preserved, although there was a noticeable difference between the condition of the upper body (largely complete, well preserved, mostly intact) and that of the lower body (less complete, only moderately preserved, and more fragmented), which can be attributed to the later disturbance of the grave. The grave was that of an old middle adult female, probably around 35-45 years old at the time of her death and of average height for the medieval period. She had been buried in the standard Christian manner, supine with her head to the west, legs extended, and hands placed on her chest, in an unfurnished grave. Although no bones from another individual were present, numerous animal bones were recovered.

She had experienced extensive joint disease, including both osteoarthritis and degenerative joint changes in the spine and in her limbs, probably related to physical activity but in part possibly related to her age. Particularly affected by severe osteoarthritis were her hands, which had been affected symmetrically by extensive new bone formation and polished areas of the joint surfaces where the bones had come into contact with one another. She would have had a restricted range of movement in her fingers and thumbs, which would have been visibly deformed, and they would have been painful. These changes probably resulted from an occupation, or daily activities, which involved use of the hands. The joint changes in her spine were most severe in her neck and lower back, suggesting that these areas of her spine were particularly stressed as a result of physical activity. Other evidence of stress to her skeleton was seen in her shoulders, elbow and hip, all attesting to a life of physical labour.

She had suffered from at least one fall which led to broken bones (collarbone, five ribs, and a vertebra), and although they were well-healed, the poor alignment of the collarbone meant it was shortened and had damaged the normal relationship of the bones and muscles of the shoulder, probably affecting the range of movement of this joint and leading to osteoarthritis. Her shoulders might have been mal-aligned, which might have caused the arthritis in her neck. It is possible that her occupation or daily activities placed her at greater risk of accidental falls. These fractures had all been sustained some time before death, as they had healed well and caused associated joint changes.

Her dental health was relatively poor. She had heavy deposits of mineralised plaque on her front teeth, with less severe deposits on her premolars and molars, suggesting she did not practice effective or regular oral hygiene. This is commonly observed in archaeological populations. She had tooth decay in two of her teeth, suggesting a diet containing some form of sugar (probably from fruits, vegetables or honey) or processed carbohydrates; it could also be a reflection of the poor oral hygiene already noted. She had lost four of her teeth during life, possibly as a result of tooth decay, or heavy wear of the teeth. Four of her teeth had either failed to develop, or failed to erupt into the mouth; unusually two of these teeth appear to have been the second molars. One of her molar teeth was erupting sideways, with only a small part of the crown in occlusion with the opposite tooth, and it would probably have caught on and irritated the inside surface of her cheek. Faint lines (dental enamel hypoplasia), thought to indicate such periods of halted growth during childhood, were observed on two of her canine teeth.

Overall, it appears that this woman had led a physically demanding life, possibly suffering from diseases and poor nutrition in childhood, and in adulthood undertaking tasks that had placed stress on her spine, several of

her limb joints, and particularly her hands; these joint changes would no doubt have caused her pain. She had suffered at least one fall which resulted in broken bones, and although she had survived these injuries and they had healed, they had provoked further degeneration and osteoarthritis of associated joints, and the range of movement of her right shoulder was probably restricted as a result of the fractured collarbone. In addition, the condition of her teeth attests to poor oral hygiene and a diet containing some degree of sugar (perhaps in fruit, vegetables or honey) or refined/processed carbohydrates.

7.0 FUTURE RECOMMENDATIONS

It is recommended that the skeleton excavated at Ebberston Manor undergoes radiocarbon dating. This would provide accuracy in assigning it to a specific period and therefore aid in interpretation of the site. It would also permit comparative analysis with contemporary burials from North Yorkshire and the surrounding area. This skeleton would prove invaluable as part of a teaching and research collection.

References

Berry, A.C. and Berry, R.J. 1967. 'Epigenetic variation in the human cranium', *Journal of Anatomy* 101 (2): 361-379

Buikstra, J.E. and Ubelaker D.H. (eds) 1994. *Standards for Data Collection from Human Skeletal Remains* (Fayetteville)

Caffell, A. 1997. *A Comparison of Stature between British Skeletal Populations*, Bradford University, Unpublished Undergraduate Dissertation

Cox, M. 2000. 'Ageing adults from the skeleton', in M. Cox and S. Mays (eds), *Human Osteology in Archaeology and Forensic Science* (London): 61-82

Finnegan, M. 1978. 'Non-metric variation of the infracranial skeleton', *Journal of Anatomy* 125: 23-37

Hilton, R.C., Ball, J. and Benn R.T. 1976. 'Vertebral end-plate lesions (Schmorl's nodes) in the dorsolumbar spine', *Ann Rheum. Dis.* 35: 127-132

Kennedy, K.A.R. 1989. 'Skeletal markers of occupational stress', in M.Y. Işcan. and K.A.R. Kennedy (eds), *Reconstruction of Life from the Skeleton* (New York):129-160

Larsen, C.S. 1997. *Bioarchaeology: Interpreting Behavior from the Human Skeleton* (Cambridge)

McKinley, J.L. 2004. 'Compiling a Skeletal Inventory: Disarticulated and Co-Mingled Remains', in M. Brickley and J.L. McKinley (eds) *Guidelines to the Standards for Recording Human Remains. IFA Paper No. 7* (Southampton and Reading): 14-17

Mays, S. and Cox, M. 2000. 'Sex determination in skeletal remains', in M. Cox and S. Mays (eds), *Human Osteology in Archaeology and Forensic Science* (London): 117-130

Roberts, C.A. and Manchester, K. 1995. *The Archaeology of Disease* (Stroud)

Rogers, J. 2001. 'The palaeopathology of joint disease', in M. Cox and S. Mays (eds), *Human Osteology in Archaeology and Forensic Science* (London): 163-182

Saunders, S.R. 1989. 'Non-metric variation', in M.Y. Işcan and K.A.R. Kennedy (eds) *Reconstruction of Life from the Skeleton* (New York): 95-108

Scheuer, L. and Black, S. 2000a. *Developmental Juvenile Osteology* (San Diego)

Scheuer, L. and Black, S. 2000b. 'Development and ageing of the juvenile skeleton', in M. Cox and S. Mays (eds), *Human Osteology in Archaeology and Forensic Science* (London): 9-22

Smith, B.H. 1984. 'Patterns of molar wear in hunter-gatherers and agriculturalists', *American Journal of Physical Anthropology* 63: 39-56

Trinkhaus, E. 1978. 'Bilateral asymmetry of human skeletal non-metric traits', *American Journal of Physical Anthropology* 49: 315-318

Trotter, M. 1970. 'Estimation of Stature from Intact Long Limb Bones', in T.D. Stewart (ed) *Personal Identification in Mass Disasters* (Washington DC): 71-83.

Zero, D.T. 1999. 'Dental Caries Process', *Dental Clinics of North America* 43: 635-664

APPENDIX A: OSTEOLOGICAL AND PALAEOPATHOLOGICAL CATALOGUE

Skeleton Number	**1002**
Preservation	Upper body Very Good (Grade 1); lower body Moderate (Grade 3)
Completeness	60-70%, skull complete and nearly intact, long bones (bar proximal and distal right femur, both tibiae, both fibulae; distal left femur), pectoral girdle, some of pelvic girdle (right side mostly lost postmortem), all ribs, most vertebrae (C1 and L5 lost postmortem, and body of L4 truncated), hands (nearly complete), but feet lost postmortem.
Age	36-45 years
Sex	Female
Stature	159.92 ± 4.24cm
Non-Metric Traits	Ossicles in lambdoid suture (right), ossicle in parietal notch (right), double anterior condylar canal (right), parietal foramen (left), mastoid foramen extrasutural (left), absent zygomaticofacial foramina (bilateral), anterior and posterior ethmoid foramina extrasutural (left), accessory acromial facet (right)
Pathology	Degenerative joint disease in spine: bodies (most cervical, mid thoracic, most lumbar), cervical apophyseal facets (C2, 3 & 5); also clavicles, and left acetabulum. Osteoarthritis in apophyseal joints between C1/2, C3/4, C4/5; T3/4, T4/5, T5/6 (right side only); L3/4, L5/S1; also in left elbow (radial head), right shoulder (acromion, greater tubercle of humerus), both hands (right lunate (left lost pm), joint between trapezium & MC1 (bilateral), all joints in thumbs (bilateral), MCP joints of 2nd and 3rd digits (bilateral), proximal IP joints of 5th digit on left side, 3rd & 4th digits on right side, all distal IP joints (bilateral); distal IP joint of 2nd digit on left side shows possible erosive lesion). Oblique fracture of right clavicle midshaft, shortened, lateral end displaced inferiorally and anteriorally, well-healed, associated OA of right shoulder; transverse fractures of 5 ribs (probably 3-7), well healed; fracture of anterior body of T8, healed, possibly associated joint changes in thoracic spine? Left fibula bent at distal end Large, deep hollow immediately adjacent to posterior border of superior demiface of left auricular surface of ilium. Smooth, rounded edges. Developmental?
Dental Health	4 teeth lost antemortem; heavy calculus on anterior lower teeth, moderate to slight on posterior teeth; 3 carious lesions in two molars; enamel hypoplasia on two canines; 4 teeth not-erupted not-present; RM2/3 erupting laterally and posteriorally

	Right Dentition								Left Dentition							
Present	P?	NP/ U?	AM	PM	AM	PM	PM	PM	PM	PM	PM	AM	PM	P	NP/ U?	PM
Calculus	S ldb	-	-	-	-	-	-	-	-	-	-	-	-	M ldb	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	2	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**e**	**6**	**7**	**8**
Present	NP /U	P	P	P	P	P	P	P	P	P	P	P	P	AM	P	NP/ U
Calculus	-	S mld b	M mldb	M mld b	M mld b	H mld b	H mld b	H mld b	H mld b	H mld b	H mld b	M mld b	M mld b	-	S mldb	-
DEH	-	-	-	-	-	L	-	-	-	-	L	-	-	-	-	-
Caries	-	So Sd	-	-	-	-	-	-	-	-	-	-	-	-	Md	-
Wear	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-

KEY:

Present - Tooth presence; am - ante-mortem tooth loss; pm - post-mortem tooth loss; p - tooth present; p (u) – tooth present but unerupted
- - jaw not present

Caries - Calculus; F - flecks of calculus; S - slight calculus; M - moderate calculus; H - heavy calculus; a - all surfaces; b - buccal surface; d - distal surface; m - mesial surface; l - lingual surface; o - occlusal surface

DEH - dental enamel *hypoplasia*; l - lines; g - grooves; p - pits

Caries - caries; s - small lesions; m - moderate lesions; l - large lesions

Wear - dental wear; numbers from 1-8 - slight to severe wear