Osteological Analysis
Dixon Lane and George Street
York
North Yorkshire

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NGR: SE 607 515

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York Osteoarchaeology Ltd was commissioned by the York Archaeological Trust for Excavation and Research Ltd to carry out the osteological analysis of four skeletons from St Stephen's church, York, North Yorkshire (SE 607 515). The skeletons were excavated during archaeological evaluations at the junction of Dixon Lane and George Street during the winter of 2005 to 2006. The four skeletons were a small sample of a larger cemetery, from which over 100 burials were excavated. Approximately half of the burials within the cemetery were thought to have been placed in wooden coffins and seven contained cobblestones placed around the head, elbows or feet. A small subset of the burials was believed to date to the pre-conquest era, while the majority were thought to have been associated with the churchyard of St Stephen's Church.

Osteological analysis revealed that the well-preserved group reported upon here included two mature adults, one of whom was male and the other female, as well as an adolescent and an older juvenile. The male was slightly above and the female below the average stature for early medieval Britain. The mature adult female and adolescent were probably of African or mixed ancestry based on their cranial morphology.

Both adults exhibited joint degeneration, which was more prevalent and severe in the female. Schmorl's nodes in the spine indicative of herniated discs were noted in the adults and adolescent, possibly suggesting a physically active lifestyle. Trauma was prevalent, including a crush fracture to the female adult's lower spine, an avulsion fracture to the male adult's palm and an ossified blood clot on the left lower leg of the adolescent. Notably, the adult male and older juvenile exhibited healed depression fractures to their skulls. These may have been incurred through violent encounters or simple accidents.

Inflammatory lesions were noted on the legs of two individuals and the internal skull surface of two skeletons. Evidence for chronic sinusitis, likely caused by poor dental health, was noted in both adults.

A few minor developmental anomalies were observed, but none appear to have been serious. *Cribra orbitalia* was observed in the orbits of both adults, which may be an indication of the general poor childhood health of the population. Grooves in the teeth of all four individuals also revealed that they were affected by periods of stress in childhood. The older adolescent had what may have been cysts on the left femur, however, it was not possible to confirm the diagnosis and further research would be beneficial, while the mature adult female had two benign tumours on her skull, as well as hormone-related changes to the internal cranium.

The frequency of dental plaque concretions, caries and abscesses observed in the dentitions from St Stephen's exceeded the average for the period, suggesting that oral hygiene had not been adequate.

Acknowledgements

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1.0 INTRODUCTION

In September 2015, York Osteoarchaeology Ltd was commissioned by the York Archaeological Trust for Excavation and Research Ltd to carry out the osteological analysis of four skeletons. The skeletons had been excavated between November 2005 and January 2006 during an archaeological excavation at the junction of Dixon Lane and George Street, York, North Yorkshire, (SE 607 515). An area of circa 20m by 25m was excavated, from which 118 articulated skeletons and a quantity of disarticulated human bone was recovered. Osteological analysis of the entire assemblage was originally carried out in 2007 and will be used for comparative analysis (Tucker 2007).

The site revealed evidence of activity dating from the Roman to the medieval period. Thirteen burials from the cemetery were believed to be pre-conquest in date, one of which - the grave of Skeleton 25 - was the only example on site with clench bolts in the grave fill (three clench bolts were found in association with five iron nails, which were arranged in a cross shape across the top of the skeleton). Two further burials in Sets 266–7 were backfilled with pure clay (redeposited natural) and Set 282 probably had a stone lining to the grave (though much of this grave was beyond the excavation area so it is impossible to be sure). Samples of two of the skeletons (consisting of three teeth per skeleton ; Contexts 1085 and 1094) were sent for radiocarbon dating analysis; calibration dates of AD 990–1160 and AD 900–1160 respectively were returned. While the two sigma calibration results cannot prove a pre-Conquest date for the two burials concerned, conventional radiocarbon dates may suggest a pre-Conquest date. A further 105 burials were recovered from what was believed to be the cemetery associated with St Stephen's Church; unfortunately, relatively little is known about St Stephen's Church from historical sources. The burials occurred in a band approximately 9m wide running roughly east-north-east to west-south-west across the area of excavation. The burials were heavily intercut, with only nineteen surviving intact. Almost all of burials were aligned east–west, but a couple were aligned south-west to north-east (Sets 326 and 332) and three were aligned south-east to north-west (Sets 320, 322 and 354).

1.1 AIMS AND OBJECTIVES

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

1.2 METHODOLOGY

The skeletons were 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 individuals. 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 sex dimorphism in occupation, lifestyle and diet, as well as the role of different age groups in society. A summary of the osteological and palaeopathological data for the articulated skeletons is given in Table 1, with a detailed catalogue of skeletons provided in Appendix A.

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 (Henderson 1987, Garland and Janaway 1989, Janaway 1996, Spriggs 1989). Preservation of human skeletal remains is assessed subjectively, depending upon the severity of bone surface erosion and post-mortem breaks, but disregarding completeness. Preservation is important, as it can have a large impact on the quantity and quality of information that it is possible to obtain from the skeletal remains.

Surface preservation, concerning the condition of the bone cortex, 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 and a clear surface morphology, 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. Surface preservation could be variable throughout an individual skeleton, so the condition of the majority of bones in the skeleton was taken as the preservation grade for the whole skeleton. The degree of fragmentation was recorded, using categories ranging from 'minimal' (little or no fragmentation of bones) to 'extreme' (extensive fragmentation with bones in multiple small fragments). Finally, the completeness of the skeletons was assessed and expressed as a percentage: the higher the percentage, the more complete the skeleton.

All four of the skeletons were in very good condition (Table 1). They exhibited minimal surface erosion, although Skeleton 23 was heavily fragmented.

Table 1 Summary of osteological and palaeopathological results

Sk No	Context	Position	Preservation	Completeness	Age	Age Group	Sex	Stature	Dental Pathology	Pathology
23	1085	Supine extended, left arm flexed at elbow, left hand on right forearm, right arm by right side, right hand in pelvis	1	75%	46+	MA	Male	173.6 +/- 4.32cm	AM tooth loss, calculus caries, DEH. Abscesses periodontal disease	DJC in mandibular fossae, left mandible, right lunate, left acetabulum, left proximal femur and a right proximal hand phalanx. OA in cervical and lumbar spine and right hip. Schmorl's nodes in thoracic and lumbar spine. *Cribra orbitalia.* Sinusitis. Periosteal reactions on endocranial parietals and left femur. Healed fracture to the right third

										metacarpal. Possible depression fracture to right frontal bone.
25	1094	Supine extended, arms extended, right hand over pelvis, left hand by side	1	90%	7-12	OJ	-	-	Calculus, caries, DEH, dental overcrowding	Healed depression fracture to left parietal. Endocranial periosteal reaction on parietals.
94	1373	Supine extended, left arm flexed, left hand in pelvis, right arm extended, and right hand by side	1	95%	15-17?	ADO	-	-	Calculus. DEH	Schmorl's nodes in thoracic and lumbar spine. Possible ossified haematoma and periosteal reaction on left fibula. Epiphyseal fragmentation of the left and right proximal articulations of the proximal foot phalanges for MT1. Possible cyst on distal shaft of right femur. Possible African ancestry.
104	1417	Supine extended, both arms extended hands by sides	1	95%	46+	MA	Female	152.8+/-3.28cm if African or 155.9+/-3.55cm if Caucasian	AM tooth loss, calculus, DEH, caries, abscesses, 1 broken tooth	DJC in cervical, thoracic and lumbar spine, mandibular fossae, mandible, manubrium, medial and lateral clavicles, glenoids, humeri, right distal humerus, proximal left radius, distal radii, right proximal ulna, lunates, scaphoids, right trapezium and triquetral, distal femora, right patella. Proximal and distal tibiae, metacarpals and hand phalanges, left distal metatarsals , and left and right foot phalanges. OA in acetabuli and proximal femora, right first metacarpal and articulating proximal phalanx, and a left intermediate hand phalanx. *Cribra Orbitalia.* Sinusitis. Periosteal reactions on posterior surfaces of left and right maxilla. HFI. Lumbarised T11. Crush fracture to L5. Possible fracture to the distal articulation of a left? intermediate hand phalanx. Asymmetry of sternum. Button osteomata on left parietal. Possible blunt force trauma on the right occipital. Possibly African ancestry.

Key: SP = Surface preservation: grades 0 (excellent), 1 (very good), 2 (good), 3 (moderate), 4 (poor), 5 (very poor), 5+ (extremely poor) after McKinley (2004a); C = Completeness; F = Fragmentation: min (minimal), sli (slight), mod (moderate), sev (severe), ext (extreme)

Non-adult age categories: f (foetus, <38weeks *in utero*), p (perinate, c. birth), n (neonate, 0-1m), i (infant, 1-12m), j (juvenile, 1-12y), ado (adolescent 13-17y)Adult age categories: ya (young adult, 18-25y), yma (young middle adult, 26-35y), oma (old middle adult, 36-45y), ma (mature adult, 46+y), a (adult, 18+y)

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.

The presence of two left distal adult humeri, an adolescent left distal humerus and a juvenile left distal humerus suggested a MNI of four individuals.

2.3 ASSESSMENT OF AGE

Age was determined using standard ageing techniques, as specified in Scheuer and Black (2000a; 2000b) and Cox (2000). For non-adults age was estimated using the stage of dental development (Moorrees *et al.* 1963a; 1963b), dental eruption (Ubelaker 1989), measurements of long bones and other appropriate elements, and the development and fusion of bones (Scheuer and Black 2000b). In adults, age was estimated from stages of bone development and degeneration in the pelvis (Brooks and Suchey 1990, Lovejoy *et al.* 1985) and ribs (modified version of methods developed by İşcan *et al.* 1984; 1985 and İşcan and Loth 1986 provided in Ubelaker 1989), supplemented through examination of patterns of dental wear (Brothwell 1981).

The individuals were divided into a number of age categories. Non-adults were subdivided into 'foetuses' (f: where the age estimate clearly fell below 38-40 *weeks in utero*), 'perinates' (p: where the age estimates converged around birth), 'neonates' (n: where the age estimate suggested 0-1 month), 'infant' (i; 1-12 months), juvenile (j; 1-12 years), and adolescent (ad; 13-17 years). Adults were divided into 'young adult' (ya; 18-25 years), young middle adult (yma; 26-35 years), old middle adult (oma; 36-45 years), and mature adult (46+ years). A category of 'adult' (a) was used to designate those individuals whose age could not be determined beyond the fact that they were eighteen or older.

For each skeleton as many criteria as possible (preservation allowing) were used to estimate age. However, it is important to note that several studies (for example Molleson and Cox 1993, Molleson 1995, Miles *et al.* 2008) have highlighted the difficulty of accurately determining the age-at-death of adults from their skeletal remains, with age-at-death frequently being underestimated for older individuals. The categories defined here should be taken as a general guide to the relative physiological age of the adult, rather than being an accurate portrayal of the real chronological age.

In the two adult skeletons, age was established using dental wear and the deterioration of the pelvis joints. It was noted during analysis that the dental age for each individual was consistently younger than the age suggested by the deterioration of the pelvis. The rate at which dental enamel wears away is multifactorial and can be affected by diet, the quality of the enamel, the use of teeth as tools and habitual grinding. As a result, the ages as indicated by the degenerative changes in the pelvis were taken to be a more accurate reflection of an individual's age. Analysis revealed that both adults had reached mature adulthood.

The development of the teeth and fusion of the joints was used to establish age in the two non-adults (see Table 1). While the ageing criteria corresponded in Skeleton 25 (aged between ten and eleven years), they differed in Skeleton 94. Metrical analysis of this individual indicated that it was between ten and fourteen years old, whereas the bone fusion suggested that the individual was between fifteen to seventeen years of age. The individual's dental development conflicted with both the skeletal development and metrical age estimates, suggesting that they were around eighteen to twenty years of age when they died. The disparity between the ageing criteria could have been the result of environmental and physiological stress, which dental development is least affected by, and therefore provides the most reliable reflection of an individual's chronological age. The individual's ancestry may also have affected the age estimates; Skeleton 94 exhibited a cranial morphology consistent with African or mixed ancestry. If the individual was African, or descended from African ancestors, it is possible that the aging criteria used would not have been accurate, having not been developed on an exclusively African population. It was decided that based on the range of ages, the individual was likely to be an adolescent rather than an older juvenile or a young adult.

The original analysis of the assemblage (Tucker 2008) revealed that twenty-five individuals (21%) from the cemetery were under the age of eighteen years at the time of death, none of whom was under the age of one year old. Six individuals were young adults (19–25 years), accounting for 5% of the total number of skeletons. Sixteen individuals were considered to be young middle adults (26–35 years) forming 14% of the population, while the largest number of individuals fell into the old middle adult category (36–45 years, 24% of the population). Twenty-one individuals survived into mature adulthood (46+, 18% of the total population), and a further 22 individuals could not be aged more accurately than to say they were adults (18+ years) when they died.

It should be noted that during the 2007 (Tucker) analysis Skeletons 23 and 104 were both recorded as old middle adults (36-45 years), which differs from the ages from the current re-analysis (see above).

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 involves examination of the shape of the skull and the pelvis and can only be carried out once sexual characteristics have developed, during late puberty and early adulthood. Evidence from the pelvis was favoured as its shape is directly linked to biological sex (the requirements of childbirth in females) whereas the shape of the skull can be influenced by factors such as age (Walker 1995). Measurements of certain bones were used to supplement the morphological assessment.

In both adults, cranial and pelvic traits along with metric analysis corresponded and revealed that Skeleton 23 was male, and Skeleton 104 was female.

The original analysis of the assemblage (Tucker 2007) suggested that the number of males and females was relatively equal, with a ratio of 1.14:1 respectively. It also suggested that the majority of males were dying in the young and old middle adult categories (26/42, or 62%), while the majority of females were dying in the old middle and mature adult categories (28/37, or 76%).

2.5 ANCESTRY

The term 'ancestry' is used to describe the genetic background of individuals. An attempt was made to determine the ancestry of each individual based on the visual appearance of traits in the cranial skeleton, as described by Byers (2010, 154-165). Unfortunately, the expression of the various traits used to define ancestral groups can be ambiguous and assessing them is subjective; consequently, it can be very difficult to determine ancestry (*ibid*, 152-154).

Analysis of the facial morphology of Skeletons 104, a mature adult female, and Skeleton 94, an adolescent, suggested that they may have had African or mixed ancestry. Due to the fragmentary nature of both crania, metrical analysis could not be performed, and the assessment of both individuals' ancestry was based on morphological characteristics alone.

The previous analysis of the skeletal remains (Tucker 2007) from St Stephen's also suggested that these were the only two individuals in the population thought to have been of African or mixed ancestry.

2.6 METRIC ANALYSIS

2.6.1 Stature

Stature depends on two main factors, heredity and environment; it 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, but preferably using the combined femur and tibia. 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). Where possible, bones from the legs were used in preference to those of the upper limb as these carry the lowest error margin (*ibid*).

The mature adult male (Skeleton 23) was slightly above the average male height (172cm; Roberts and Cox 2003) for the period, with a height of 173.6cm.

Different formulae have been developed for different ancestral groups (Trotter 1970). Consequently, the African formula was applied to Skeleton 104 (mature adult female). Based on measurements of the right femur and tibia, Skeleton 104 would have been approximately 152.8cm tall, with a standard error of

±3.28cm, if they were of African descent, or approximately 155.9cm ±3.55cm tall if they were of Caucasian decent. In both cases, the female would have been below the average stature for the period (Roberts and Cox 2003).

During the original analysis (Tucker 2007) stature was calculated for 37 males, 34 females, four individuals of indeterminate sex, and seven individuals of unknown sex. The average stature for males was 172cm with a range of 162–181cm, and for females was 160cm with a range of 153–172cm.

2.6.2 Platymeric and Platycnemic Indices

Leg measurements were obtained from the femora and tibiae of the adults and used to calculate the shape and robusticity of the femoral shaft (*platymeric* index) and the tibial shaft (*platycnemic* index; Bass 1987).

Both of the male femora and one of the females' fell into the *platymeric* range (broad and flattened from front to back), while the females' remaining femur was *eurymeric* (rounded).

The *platycnemic* index of the tibiae was calculated in order to establish the degree of tibial shaft flatness. Both of the adults had tibiae available to measure, and both the male and female tibial shafts were *eurycnemic* (broad).

2.6.3 Cranial Indices

Standard measurements of the crania and mandibles were taken where preservation allowed, however, the incomplete nature of both adult crania meant that a limited number of measurements could be taken.

The cranial index describes the shape of the cranium. The crania belonging to the mature adult male was *brachycranic* (round headed). The majority of crania analysed in 2007 (Tucker) had narrow cranial vaults (dolichocephalic).

The fronto-parietal index expresses the relationship between the minimum breadth of the frontal bone and the maximum cranial breadth. The mature adult male had a *eurymetopic* (broad shape) skull.

Further cranial indices pertaining to the facial skeleton revealed that the mature adult female had a *platyrrhinic* nose (broad/wide). The orbital index revealed that the females orbits were *chamaeconchic* (wide) and that she had a *mesuranic* palate (average shape).

2.7 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. The majority of non-metric traits were observed on the skull. These were anomalies that would not have affected the individual. Only the results for the three most common cranial and post cranial non-metric traits are presented below, a full catalogue may be found in the appendix.

Both adults and the older juvenile had parietal foramen (small hole in the top of the skull), all four individuals had *mastoid foramen extrasutural* (small hole in the skull behind the ear) and the male, adolescent and older juvenile all had bridging of their *supraorbital notch (small spicule of bone acrossthe roof or the orbit)*. These minor anomalies were probably genetic in origin.

Al four individuals had *bipartite transverse foramen* (extra holes on the sides of the vertebrae in the neck) which occurred in the sixth cervical vertebrae. The mature adult female, adolescent and older juvenile had *hypotrochanteric fossae,* which are depressed areas at the back of the femur at the attachments of the *gluteus maximus* bottom muscle. *Third trochanters* (roughened area on the back of the femoral shaft) were seen in both adults and the older juvenile and are thought to reflect strain on the muscle. None of these traits would have caused any symptoms.

2.8 CONCLUSION

The preservation of the human remains from St Stephen's was very good, however, a number were fragmentary. Two of the individuals were non-adults; one was aged between ten and eleven years, while the other was more challenging to age accurately, with a potential age range of between eleven and twenty years, but likely an adolescent. Both the male and female survived into their mature adulthood. The stature of the mature adult male was slightly above the period average, but the mature adult female was considerably shorter than the national average. The mature adult female and the adolescent were possibly of African or mixed ancestry.

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. All bones were examined macroscopically for evidence of pathological changes. Fuller descriptions of the pathological lesions observed can be found in Appendix A.

3.1 CONGENITAL CONDITIONS

Heredity and environment can influence the embryological development of an individual, leading to the formation of a congenital defect or anomaly (Barnes 1994). The most severe defects are often lethal, and if the baby is not miscarried or stillborn, it will usually die shortly after birth. Such severe defects are rarely seen in archaeological populations, but the less severe expressions often are, and in many of these cases the individual affected will have been unaware of their condition. Moreover, the frequency with which these minor anomalies occur may provide information on the occurrence of the severe expressions of these defects in the population involved (*ibid*), and may provide information on maternal health (Sture 2001).

3.1.1 Variation in Number of Vertebral Segments and Transitional Vertebrae

The usual number of segments in the spine is 33, including seven cervical (neck) vertebrae, twelve thoracic vertebrae (bearing the ribs), five lumbar vertebrae (lower back), five fused segments in the sacrum (back of the pelvis), and four segments in the coccyx (tailbone). Occasionally the overall number of segments may vary. It is more common for an individual to have an additional vertebra than to have a reduction in the number of vertebrae (Barnes 1994, 78). Assessing the number of vertebrae in the spine of archaeological individuals can be difficult, due to the fact that skeletons may be incomplete, or because disarticulated bone can be present in the backfill of the grave and become intermixed with those of the articulated skeleton.

When additional vertebrae occur they often appear at the borders between the thoracic and lumbar spine, or between the lumbar vertebrae and sacrum. They may appear as a fully-fledged thoracic or lumbar vertebra, but frequently they will take on a mixture of the characteristics of the vertebrae on either side of the border, so appearing to be part-thoracic/ part-lumbar, or part-lumbar/ part-sacrum (Barnes 1994, 78). When this occurs they are described as 'transitional vertebrae.'

Skeleton 104 (mature adult female) had a transitional thoracic vertebra in her spine. The transition was observed at the lumbar-thoracic border, with her twelfth thoracic vertebrae displaying a curved right superior articulating facet, which corresponded with a curved right inferior articulating facet on her eleventh thoracic vertebra. The changes in the shape of the thoracic vertebrae resulted in a cranial shift in the thoracic-lumbar border.

Tucker (2007) suggested that twenty-four individuals (20% of the total population) from the original analysis had transitional vertebrae or variations in the number vertebrae.

3.1.2 Anomalies of the Sternum

The mature adult female (Skeleton 104) expressed another developmental anomaly. Her sternum was wider at the proximal end than at the distal part. The proximal end measured 40.4mm wide, while the distal end measured 31.2mm wide. According to Barnes (2012), this type of variation is one of the most common and is caused by the timing of the sternal bands joining together.

3.1.3 Epiphyseal Clefts

The adolescent (Skeleton 94) exhibited fragmentation of the proximal epiphyses of the left and right proximal phalanx for the first metatarsal (Plate 1). According to Scheuer and Black (2000), the basal epiphyseal surface of the proximal phalanx of the big toe is the most commonly affected, and that while the cause is unknown, it is thought that they only appear around the time of puberty and may not be related to multiple foci of ossification as previously thought.

Plate 1 Sk 94, epiphyseal cleft, right proximal foot phalanx

3.2 METABOLIC CONDITIONS

3.2.1 *Cribra Orbitalia*

Cribra orbitalia is a term used to describe fine pitting in the orbital roof, which develops during childhood and often recedes during adolescence or early adulthood. Until recently, iron deficiency anaemia was the accepted cause of these lesions (Stuart-Macadam 1992), but a strong case has been made by Walker *et al.* (2009) for different types of anaemia as the causative factor. These include megaloblastic anaemia in the New World, suggesting a diet deficient in Vitamin B_{12} (i.e. plant-based and lacking in animal products) and/or folic acid. Such dietary deficiency could have been exacerbated through poor sanitation leading to infection and infestation with gut parasites (*ibid*). In malarious areas of the Old World, haemolytic anaemia (e.g. sickle cell anaemia and thalassemia) may be important in the development of *cribra orbitalia* (*ibid*). However, for areas such as northern Europe they have proposed that *cribra orbitalia* may be more likely related to conditions such as scurvy (Vitamin C deficiency) or chronic infections (*ibid*). *Cribra orbitalia* is often used as an indicator of general stress (Lewis 2000; Roberts and Manchester 2005) and is often found associated with agricultural economies (Roberts and Cox 2003).

Both adults exhibited lesions in their orbital roofs indicative of *cribra orbitalia*. A crude prevalence rate of 7.6% of individuals from the early medieval period had *cribra orbitalia*, which was calculated using figures from Roberts and Cox (2003, Table 4.11, 187). *Cribra orbitalia* was recorded in eleven individuals (9.3% of the total number of individuals) during the original analysis (Tucker 2007), which would be higher than the national average for the period.

3.2.2 *Hyperostosis Frontalis Interna*

Hyperostosis Frontalis Interna (HFI) appears as irregular nodules of bone on the internal surface of the frontal bone (forehead), believed to be the result of changes in the hormones secreted by the pituitary gland. HFI is almost always seen in females over the age of thirty, and has been associated with pregnancy and *acromegaly* (a disorder involving overproduction of growth hormone during adulthood) (Aufderheide and Rodríguez-Martín

1998; Roberts and Manchester 1995).

Small, fibrous nodules of bone were seen on the endocranial surface of the frontal bone of the mature adult female (Plate 2), which were thought to have been caused by HFI.

Plate 2 Sk 104, HFI on endocranial surface of frontal bone

3.3 TRAUMA

The evidence for trauma in archaeological populations is restricted to that visible in the skeletal remains, unless soft tissue is preserved (Roberts and Manchester 2005, 85-86). Therefore, most of the soft-tissue injuries sustained by archaeological populations will be invisible, although occasionally soft tissue injuries can be inferred though ossification of the tissues at the site of damage, known as *myositis ossificans* (*ibid*). Much of the evidence for trauma in archaeological populations focuses on fractures to the bones (*ibid*, 84-85), although long standing well-healed fractures may be hard to detect (Jurmain 1999, 186).

Ante-mortem injuries occurred during life and show evidence for healing, whereas peri-mortem injuries occurred around the time of death and consequently no evidence for healing will be seen. Peri-mortem injuries did not necessarily occur at the instant of death. It takes time for evidence of healing to be visible in the bone following an injury, and also for bone to lose the physical characteristics it had in life following death. Therefore 'peri-mortem' really refers to a three-week window either side of death (Roberts and Manchester 2005, 114). Distinguishing between peri-mortem trauma and post-mortem damage can be difficult. Generally, post-mortem breaks will have a paler surface than the surrounding bone and broken edges will usually be perpendicular to the bone (*ibid*, 114-116; Lovell 1997, 145; Sauer 1998). Recent post-mortem breaks are usually easily distinguished, but breaks that occurred while the skeleton was in the burial environment and long before the skeleton was excavated may be much harder to identify as such.

3.3.1 Ante-Mortem Trauma

Both the adults and the older juvenile had small circular depressions on their cranial vaults, which may have been the result of healed depression fractures. Skeleton 25 (older juvenile, Plate 3) had a small spherical lesion on the left parietal (side of the skull), located immediately anterior to the parietal boss, which measured 11.1mm anterior-posteriorly and 8.9mm superior-inferiorly. The lesion had a pitted appearance at the base of the indentation and was rounded, indicative of healing. The mature adult male (Skeleton 23) also had a small indentation on the right frontal (front of the skull), located close to the coronal suture; the lesion measured 6.2mm anterior-posteriorly and 6.7mm medial-laterally, with a smooth but irregular appearance. The mature adult female also had a small spherical indentation located on the right side of her occipital bone (base of the skull). The lesion had smooth margins and a slightly irregular base and measured 8.4mm superior-inferiorly and 10.7mm medial-laterally. The evidence suggests that these three individuals may have incurred blunt force cranial trauma that was well healed at the time of death. The location of the lesions on the right side of the adults skulls may suggest that the trauma was slightly more likely to be accidental than due to interpersonal violence.

Plate 3 Sk 25, depression fracture, left parietal

A total of twelve individuals with cranial trauma are reported the original analysis (Tucker 2007), although the lesion on the base of the skull of Skeleton 104 (mature adult female) was not reported.

Skeleton 23 (mature adult male) had what appeared to be a healed fracture to the styloid process of his right third metacarpal (small nodule of bone on the proximal articulation). The styloid had taken on a slightly lobular appearance, with the fracture line well remodelled in appearance. Wedel and Galloway (2014) suggest that fractures to the base of the metacarpals are often a result of trauma to the carpo-metacarpal joint. It is possible that the fracture was an incomplete avulsion of the styloid process caused by strain on the *extensor carpi radialis brevis* tendon, which is involved in the abduction and flexion of the hand at the wrist joint. The original analysis (Tucker 2007) identified twenty individuals with avulsion fractures, three of which were to the area of attachment of *M. extensor carpi radialis brevis* on the third metacarpal.

The mature adult female also exhibited a cleft on the left intermediate hand phalanx for the second metacarpal. The cleft ran through the centre of the distal articulation on a superior-inferior alignment. The changes observed in the distal articulation may have been the result of a healed fracture or alternatively, may have been a developmental anomaly. A radiograph of the lesion did not reveal evidence for a fracture.

The mature adult female also had a crush fracture in her spine, affecting her fifth lumbar vertebral body. The left side of the fifth lumbar vertebra body measured 24.1mm in height while the right side of the body measured 21.6mm in height. Crush fractures are often seen in the thoraco-lumbar region of elderly individuals who have slipped and landed on their bottom (Dandy and Edwards 2003), but could also occur in younger patients who fall from a height and land on their heels (*ibid*). A crude prevalence rate of

1.1% of individuals from the early medieval period had fractured vertebrae, which was calculated using figures from Roberts and Cox (2003, Table 4.27, 206). The crush fracture was not identified during the original analysis (Tucker 2007) of the skeletons.

During the 2007 analysis (Tucker) of the 118 individuals analysed, 48 had evidence for one or more healed fractures (41% of the total population). However, re-analysis of the skeletal remains during the current study would suggest that a number of these may have been incorrectly diagnosed. For example, Skeleton 104 (mature adult female) was recorded as having had a fracture of the sternal end of one left rib, a fracture of the distal joint surface of the right radius, and a fracture of the distal joint of a left medial hand phalanx. The distal radius and the hand phalanx were both radiographed during the current study and revealed no evidence of fractures.

3.3.2 Ossified Haematoma

Haematomas can result from direct blunt force trauma or the tearing of muscle fibres, causing blood to collect and clot (Aufderheide and Rodríguez-Martín 1998, 27). If the damaged muscle is exercised too soon following the injury, the blood clot may ossify, producing a bony lump at the site of the haematoma.

Skeleton 94 (adolescent) had an irregular nodule of lamellar bone on the anterior-lateral mid shaft of the left fibula. The lesion measured 14.7mm superior-inferiorly and 3.7mm medial-laterally.

3.4 INFECTIOUS DISEASE

Bone tissue cannot respond quickly to an infectious disease, so evidence of any acute illness with a quick resolution (i.e. the patient recovers or dies within a short space of time) will not be seen in the skeleton (Roberts and Manchester 2005). However, bone can respond to the presence of a chronic infection through laying down new bone. Initially, this new bone is disorganised and termed ‘woven bone’, but with time, as healing takes place, this bone is remodelled and becomes transformed into more organised ‘lamellar bone’. The presence of woven bone therefore indicates an infection that was active at the time of death, and lamellar bone indicates an infection that had healed; the presence of both together can suggest a recurring, or long-standing infection (Roberts and Manchester 2005). Although the new bone deposition may have been associated with a specific disease in life, it is almost always impossible to diagnose this from the bones alone.

3.4.1 Maxillary Sinusitis

Maxillary sinusitis commonly occurs as a result of upper respiratory tract infections, pollution, smoke, dust, allergies, or a dental abscess that has penetrated the sinus cavity (Roberts and Manchester 2005).

Only the adults and the older juvenile had sinuses which could be examined, of which only the adults exhibited signs of bone formation within their maxillary antrum’s. It is possible that sinusitis was linked to dental caries or abscesses rather than solely to air quality in this population, as both of the adults exhibited poor dental health.

Thirteen individuals (11%) with observable sinuses in the original study were thought to have suffered from sinusitis (Tucker 2007).

3.4.2 Periosteal Reactions

New bone deposits on the surfaces of the bones can indicate inflammation of a sheath of tissue (the periosteum) which surrounds all bones (Ortner 2003, 206-207). Inflammation may be due to infection, but low-grade trauma and chronic ulceration can also lead to new bone formation (Roberts and Manchester 2005; Ortner 2003, 206-207). Periosteal reactions are commonly observed in archaeological populations, particularly on the tibiae, and their prevalence has been used as a general measure of stress in past populations (Ortner 2003, 209). Woven bone deposits are indicative of inflammation that was active at the time of death, while lamellar bone indicates that the inflammation was healing.

The mature adult male had deposits of striated lamellar bone on the posterior surface of his distal right femur, located within the popliteal space. The lesion measured 23.7mm superior-inferiorly by 12.3mm medial-laterally. The adolescent also revealed signs of a healed inflammation on the left fibula; the lamellar bone was located on the anterior-lateral margin of the distal mid shaft.

The posterior surfaces of the mature adult female's first to fifth cervical vertebral bodies and neural arches were encased in a finely woven bone which appeared to be active at the time of her death. The woman also had deposits of disorganised, porotic, lamellar bone on the posterior surfaces of her left and right maxillary antrums. On the right side a small spherical lesion penetrated the maxillary sinus. The inflammation did not appear to be active at the time of the individual's death, and may have been related to externally draining abscesses on the woman's posterior maxillary dentition.

3.4.3 Endocranial Bone Formation

New bone formation on the endocranial (internal) surface of the cranium is more commonly seen in infants and young children, and is believed to result following inflammation or haemorrhage of the meningeal blood vessels. The possible causes identified include chronic meningitis, trauma, anaemia, neoplastic disease (cancer), metabolic diseases (scurvy and rickets), venous drainage disorders and tuberculosis (Lewis 2007).

Endocranial bone formation was observed in one adult and the older juvenile from St Stephen's; the juvenile (Skeleton 25) had a whitish-grey staining on the internal surface of both parietals and the occipital. Hairline vascular impressions were evident on the right parietal in the centre of the lesion and towards its lateral margin. Skeleton 23, the mature adult male, had a patch of dense vascularised lamellar bone on the endocranial surface of his left and right parietals, located along the line of the sagittal suture.

3.5 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 septic 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

(Rogers 2000; Roberts and Manchester 2005).

3.5.1 Degenerative Joint Change

The term joint change encompasses a large number of conditions with different causes, which all affect the articular joints of the skeleton. Factors influencing joint changes 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.

Degenerative joint change (DJC) is the most commonly observed of all the joint diseases. DJC 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).

Both of the adults suffered from joint changes, which is unsurprising considering their age, however, the female was affected in a far greater number of joints than the male. Both individuals had degenerative changes in the temporo-mandibular joint (jaw), wrists and hip joints. The mature adult female also exhibited changes to the shoulders, elbows and knees, with numerous changes observed in her hands, fingers, feet and toes.

The intervertebral discs are the 'shock absorbers' of the spine, but these can degenerate as a result of gradual desiccation (age-related drying), which then causes transmission of the stress from the vertebral discs to the articular facets and ligaments (Hirsh 1983, 123). Spinal osteophytes form to compensate for the constant stress that is placed on the spine as a result of human posture (Roberts and Manchester 2005, 106). Increasing stress or activity can therefore lead to increased size and prevalence of osteophytes (*ibid*).

Both adults exhibited evidence for moderate joint changes in the spine. This was noted in all but two of the mature adult female's vertebral bodies (91.7%) and many of the articular facets. The male's spine was far less complete; none of his lumbar vertebral bodies survived, only two of his thoracic vertebral bodies were present, while four of his cervical vertebrae were preserved. In total, 66.6 % of his vertebral bodies were affected, all of which were in his cervical spine. The vertebral bodies largely showed evidence for joint degeneration in the form of porosity and osteophyte formation, whereas the facets were more likely to be affected by osteophyte formation alone.

3.5.2 Osteoarthritis

Osteoarthritis (OA) is a degenerative joint disease of synovial joints 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'. Previously other features were also associated with degeneration of the joint including osteophytes (bone formation) on the surface or around the margins, porosity on the surface, and the development of cysts (Rogers 2000; Roberts and

Manchester 2005), however; it is now believed that only eburnation alone should be used as a definitive indicator of osteoarthritis (Davina Crapps *pers comm.* 2015). OA is frequently associated with increasing age, but can be the result of mechanical stress and other factors, including lifestyle, food acquisition and preparation, social status, sex and general health and body weight (Larsen 1997; Roberts and Manchester 2005). OA was only recorded as present when eburnation was observed.

Both adults had eburnation present in their cervical (neck) vertebrae; in the male spine, the eburnation was observed in the vertebral bodies, while the vertebral facets, were affected in the female. Osteoarthritis was also observed in some of the female's extra spinal joints, including both of her hips, her right thumb, and the distal joint in one of her left fingers.

3.5.3 Schmorl's Nodes

Schmorl's nodes affect the spine. They manifest as indentations in the upper and lower surfaces of the vertebral bodies caused by the pressure of herniated vertebral discs (Aufderheide and Rodríguez-Martín 1998). Discs may rupture due to trauma, but vertebrae weakened by infection, osteoporosis or neoplastic disease may be more vulnerable (Roberts and Manchester 2005, 140-141). Schmorl's nodes are often associated with degenerative changes to the vertebral bodies (Aufderheide and Rodríguez-Martín 1998; Hilton *et al.* 1976) and are most commonly seen in the lower thoracic vertebrae (Hilton *et al.* 1976). However, recently, a correlation was found between the shape and size of vertebrae and the development of Schmorl's nodes, suggesting there may be a congenital aspect to their development (Plomp *et al.* 2012).

Schmorl's nodes affected both adults and the adolescent from St Stephen's. Skeleton 23 (mature adult male) had Schmorl's nodes in his thoracic and lumbar spine, affecting two of seven of his thoracic vertebrae and one of one lumbar vertebrae. The mature adult female (Skeleton 104) also had Schmorl's nodes in her thoracic and lumbar spine, affecting one of twelve of her thoracic and four of her five lumbar vertebrae. The adolescent (Skeleton 94) also had Schmorl's nodes in the thoracic and lumbar spine, affecting five of nine thoracic and one of five lumbar vertebrae.

Schmorl's nodes were reported for the vertebrae of 62 individuals from the original study (Tucker 2007), 65% of the total number of adults and older adolescents. Of these, 32 were male (76% of the total number of males), and 27 were female (73% of the total number of females).

3.6 NEOPLASTIC CONDITIONS

The term 'neoplastic' literally translates as 'new growth', and it refers to the uncontrolled growth of any tissue, including bone (Roberts and Manchester 2005, 252). Benign lesions are contained within a local area and have discrete boundaries; they are usually slow-growing. In contrast, malignant neoplasms grow and spread at an uncontrolled rate, and frequently distribute themselves throughout the body (Roberts and Manchester 2005). Neoplastic conditions are infrequently reported among archaeological populations, but routine radiography (rarely carried out unless part of a research project) would be required to identify internal bone changes before they become visible macroscopically and it seems likely that the true prevalence is being under-diagnosed (*ibid*).

3.6.1 Ivory/ Button Osteomas

Plate 4 Sk 104, button osteoma left parietal

Ivory osteomata are small dense round nodules of lamellar bone that appear as smooth well-demarcated lumps on the external surface of the cranium (Roberts and Manchester 2005, 255). These are benign lesions, and cause no symptoms (*ibid*). Two ivory osteomata were observed on the cranium of the mature adult female (Plate 4), both of which were located on the left parietal, and measured 6mm and 8mm in diameter respectively. Both of the osteomata appeared extremely well integrated, and were difficult to discern from the surrounding outer table of the cranial vault.

According to Tucker (2007), evidence for neoplastic disease was seen in nine individuals from the original analysis, six of whom had benign tumours (button osteoma) on the external surface of the cranial vault (5% of the total number of individuals).

3.7 MISCELLANEOUS PATHOLOGY

Lytic lesions were observed on posterior surface of the distal shaft of the adolescent's right femur; the cause of the lesions remains unknown, but may have been the result of cysts. Cysts are fluid filled cavities surrounded by a lining composed of connective tissue (Ortner 2003, 504). Aufderheide and Rodríguez-Martín suggest that the humerus and femur are most commonly affected in children.

3.8 CONCLUSION

Evidence for joint degeneration was noted in both adults, but was more prolific and widespread in the female. Trauma to the spine suggests that these individuals carried out heavy physical work, probably from a young age, as these lesions were also noted in the adolescent. Trauma was prevalent in the individuals from St Stephen's; both adults and the adolescent had healed depression fractures on their crania, either from intentional violence or from accidental injuries. The mature adult female had a crush fractures in her lower spine, which may have resulted from a slip and landing on her bottom, or a fall from a height and landing on her heels. The mature adult male also had a well-healed avulsion fracture to the styloid process of his right third metacarpal (palm bone). The adolescent had an ossified blood clot on their left lower leg, which was caused by trauma.

The mature adult female and the adolescent had a small number of minor developmental anomalies, although none appear to have been serious, and would have not have caused the individuals any health problems. Both adults suffered from *cribra orbitalia*, which is likely an indication childhood stress. Signs of receding inflammation were observed in the legs the mature adult male and the adolescent. The adults also suffered from sinusitis (infection of the upper respiratory tract), which may have been related to their poor dental health. The mature adult male and the older juvenile had new bone formation on the internal surfaces of their crania indicative of an inflammation of the brain.

The mature adult female had two small benign tumours on her skull that are commonly observed in older adults. The adolescent had two small lesions on the posterior surface of their right femur, which may have been caused by cysts.

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 (Roberts and Manchester 2005).

All but the mature adult male (Skeleton 23), had a complete mandible and maxilla. The two adults had a total of 62 tooth positions, from which 49 teeth were recovered. Seven teeth had been lost post-mortem, four had been lost ante-mortem and the remaining three either were impacted or congenitally absent.

The adolescent (Skeleton 94) had 32 tooth positions present, 30 of which were in occlusion and two (the mandibular third molars) were erupting. The older juvenile (Skeleton 25) had 32 tooth positions, 23 of which were in occlusion, four were unerupted or congenitally absent, and five had been lost post-mortem.

4.1 DENTAL WEAR

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). Both non–adults had limited wear on their permeant teeth; unsurprisingly, the adults exhibited a greater degree of wear on their dentitions.

4.2 CALCULUS

If plaque is not removed from the teeth effectively (or on a regular basis) then it can mineralise and form concretions of calculus on the tooth crowns or roots (if these are exposed), along the line of the gums (Hillson 1996, 255-257). Mineralisation of plaque can also be common when the diet is high in protein (Roberts and Manchester 2005, 71). Calculus is commonly observed in archaeological populations of all periods, although poor preservation or damage caused during cleaning can result in the loss of these deposits from the teeth (*ibid*, 64).

The mature adult male had deposits of calculus on all of his teeth; the deposits were moderate to heavy on his anterior teeth, with flecks to moderate deposits on his posterior teeth. The mature adult female had slightly fewer teeth affected by calculus (27/30), with only flecks to moderate deposits accumulating on her teeth. The adolescent had slight to moderate deposits of calculus on 22 of 29 teeth with the more moderate deposits accumulating on the posterior teeth. Deposits of calculus affected fourteen of the older juvenile's teeth. Surprisingly, a greater number of teeth of the juvenile were affected with moderate deposits of calculus than those of the adolescent, and the teeth most heavily affected were the anterior ones. The calculus prevalence rate at this site was high, compared with the early medieval prevalence of 39.2% of teeth affected (Roberts and Cox 2003, 132). The high prevalence of calculus may be related to poor dental care, or a diet high in protein.

Of the 73 individuals with surviving dentition from the original analysis, Tucker (2007) has suggested that 70 (96%), or 88% of the total number of teeth had some degree of calculus. This suggests that the individuals included in the current study had considerably lower levels of calculus than indicated in Tucker's (*ibid*) report.

4.3 PERIODONTAL DISEASE

Calculus deposits in-between and around the necks of the teeth can aggravate the gums leading to inflammation of the soft tissues (gingivitis). In turn, gingivitis can progress to involve the bone itself, leading to resorption of the bone supporting the tooth, and the loss of the periodontal ligament that helps to anchor the tooth into the socket (Roberts and Manchester 2005, 73). It can be difficult to differentiate between periodontal disease and continuous eruption (whereby the teeth maintain occlusion despite heavy wear) in skeletal material, since both result in exposure of the tooth roots (*ibid*, 74).

Periodontal disease was moderate to considerable in the mature adult female and moderate in the mature adult male. The older juvenile showed signs of slight periodontal disease, which may have been linked to the high frequency of calculus deposits observed on the teeth. The adolescent did not show evidence for periodontal disease.

According to Tucker (2007), 63% of the individuals with observable dentitions from the original study had some degree of periodontal disease.

4.4 DENTAL CARIES

Dental caries (tooth decay) forms when bacteria in the plaque metabolise sugars in the diet and produce acid, which then causes the loss of minerals from the teeth and eventually leads to the formation of a cavity (Zero 1999). Simple sugars can be found naturally in fruits, vegetables, dried fruits and honey, as well as processed, refined sugar; since the latter three contain the most sucrose they are most cariogenic. Complex sugars are usually less cariogenic and are found in carbohydrates, such as cereals. However, processing carbohydrates, including grinding grains into fine powders or cooking them, will usually increase their cariogenicity (Moynihan 2003).

Both mature adults and the older juvenile were affected by caries. The female (Skeleton 104) had five carious lesions on four of her teeth. The male (Skeleton 23) had a small carious lesion on the distal surface of his right maxillary third molar. Two of the older juvenile's teeth were affected by caries, with lesions evident on the buccal surface of their left mandibular first and second molars. Overall, 6.25% of teeth were affected by carious lesions in the individuals from St Stephen's, which was slightly higher than the overall early medieval prevalence rate of 4.2% (Roberts and Cox 2003, 191). The cause of the cariogenic decay was not obvious, but may have been linked to a diet rich in sugar.

Tucker (2007) reported forty-eight individuals (66% of the population with observable dentitions) or 11.1% of teeth with evidence for dental caries.

4.5 ABSCESSES AND PERIAPICAL LESIONS

Dental abscesses occur when bacteria enter the pulp cavity of a tooth causing inflammation and a build-up of pus at the apex of the root. Eventually, a hole forms in the surrounding bone allowing the pus to drain out and relieve the pressure. They can form as a result of dental caries, heavy wear of the teeth, damage to the teeth (e.g. fractures), or periodontal disease (Roberts and Manchester 2005).

Only the adults were affected by dental abscesses. The mature adult female (Skeleton 104) had four abscesses, which were largely located at the back of the mouth (Plate 5). The mature adult male (Skeleton 23) had an abscess at the root of his right maxillary first molar. Overall, a prevalence rate of 8.3% is obtained for the adults, which is nearly three times higher than the overall early medieval prevalence rate of 2.8% (Roberts and Cox 2003, 192).

Plate 5 Sk 104, abscesses at the root of the left 1st molar

4.6 DENTAL ENAMEL HYPOPLASIA

Dental enamel hypoplasia (DEH) is the presence of lines, grooves or pits on the surface of the tooth crown, and occurs as a result of defective formation of tooth enamel during growth (Hillson 1996). Essentially, they represent a period when the crown formation is halted, and they are caused by periods of severe stress, such as episodes of malnutrition or disease, during the first seven years of childhood. Involvement of the deciduous (milk) teeth can indicate pre-natal stress (Lewis 2007). Trauma can also cause DEH formation, usually in single teeth.

All four individuals were affected with DEH and it was most prevalent in the non-adults. Skeleton 25 (older juvenile) had twelve teeth and the adolescent nine with DEH. The mature adult male was the least affected, with only one tooth displaying evidence of DEH, while the mature adult female (Skeleton 104) had six teeth with DEH. The evidence suggests that individuals that exhibited the highest prevalence of the lesions were less likely to live into adulthood. The true prevalence rate of DEH at St Stephen's was 25%, which was considerably higher than the overall early medieval prevalence rate of 7.4% (Roberts and Cox 2003, 188).

Tucker (2007) suggests that 56% of the population with surviving teeth had enamel hypoplasia, indicating that it was prevalent in the population.

4.7 Dental Fractures

The mature adult female (Skeleton 104, Plate 6) had fractured her right mandibular first molar. The presence of a dental fracture in this individual is consistent with the fact that dental trauma tends to accumulate with age (Glendor *et al.* 2007. 225). The type of force applied to the teeth results in differences in the pattern of teeth fractured. The anterior (front) teeth are usually fractured if they are hit directly (e.g. banging the teeth against an object in a fall, or following a direct blow to the face), whereas the molars and premolars are more likely to be injured when the lower jaw is forced against the upper jaw (e.g. following a fall onto, or a blow delivered to, the underside of the chin; Glendor *et al.* 2007, 235). Crown fractures of the molars and premolars have also been reported due to violent tooth clenching seen in drug addicts (*ibid* 233). Damage to the teeth without damage to the surrounding tissues is more common with high velocity impacts, and sharp objects are more likely to cause crown fractures with minimal tooth displacement, whereas blunt objects are more likely to cause root fractures and displacement of teeth (*ibid* 235-236). The fracture of the woman's first molar suggests than an indirect force was applied to her posterior teeth. The polished nature of the surface of the exposed root would suggest that the fracture occurred sometime prior to the woman's death.

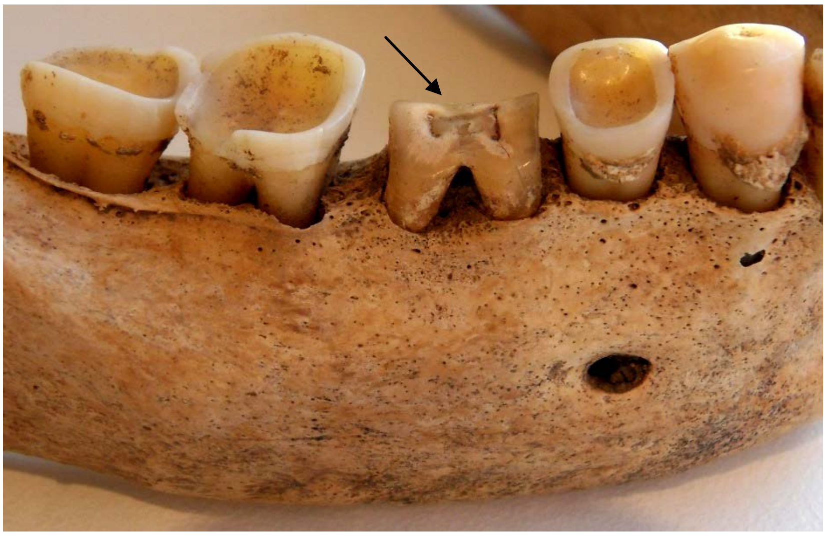

Plate 6 Sk 104, right mandible broken 1st molar

4.8 DENTAL ANOMALIES

The older juvenile's left mandibular second premolar appeared to have rotated by 90 degrees, so that the buccal surface was orientated mesially. The dentition of the mature adult male (Skeleton 23) had a large space between their maxillary central incisors. These are minor developmental anomalies, which are not uncommon.

Teeth can be absent from the erupted dentition due to a genuine failure of the tooth to develop (congenital absence), or because the tooth develops but fails to erupt (impaction). Full impaction means the tooth remains completely within the jaw, but teeth that erupt at an angle can be considered partially impacted. In well preserved archaeological skeletal remains, it is usually impossible to identify without a radiograph whether a tooth has not erupted because it is impacted or because it is congenitally absent. Occasionally, it is possible to observe that a tooth is impacted if post-mortem damage exposes the impacted tooth. Since systematic radiographs were not taken of the jaws from St Stephens's, teeth that were absent from the erupted dentition were recorded as 'not present/ unerupted' unless there was definite evidence for impaction. The mature adult male (Skeleton 23) had an unerupted/congenitally absent third molar in his right maxilla, while the mature adult female (Skeleton 104) had an unerupted/congenitally absent left maxillary third molar. The adolescent had both of their maxillary third molars in occlusion, while neither of their mandibular third molars were present. Overall the prevalence of unerupted/congenitally absent teeth was 4.3% (excluding the older juvenile's dentition), which is almost double the crude prevalence rate for impacted third molars during the early medieval period of 2.4% (Roberts and Cox 2003, 214).

4.9 DENTAL CONCLUSIONS

Analysis revealed that the majority of teeth were affected by deposits of calculus, which were slight to heavy. Notably, the older juvenile suffered from greater deposits of calculus than the adolescent, suggesting that the oral hygiene had not been adequate. Both adults and the older juvenile exhibited evidence of periodontal disease, which may have been caused by deposits of calculus at the gum-line. The prevalence rate of caries in the St Stephens population was higher than expected for the period, which may suggest that the diet included fruits, honey and carbohydrates. The frequency of abscesses was considerably higher than the mean for the period, but no obvious cause was evident. All four individuals were affected by periods of severe stress in their childhood, which had manifest as grooves in the surface of the teeth and were more prevalent in the non-adults, suggesting childhood stress may have contributed to early mortality.

5.0 DISCUSSION AND SUMMARY

The osteological analysis of the skeletal assemblage from St Stephen's has provided a glimpse into the lives of the people buried there. The small group of skeletal remains included two mature adults, one older juvenile and an adolescent. One of the mature adults was male and the other was female. The mature adult male was slightly taller than average for the period, while the female was shorter than the mean stature for the period. Morphological cranial characteristics of the female and adolescent suggested that might have been of African or mixed ancestry.

Evidence for joint degeneration was noted in both adults, but was more severe and prevalent in the female. Schmorl's nodes in the spine indicative of herniated discs suggests that these individuals may have carried out heavy physical work, probably from a young age, as these lesions were also noted in the adolescent.

Trauma was prevalent in the individuals from St Stephen's. Most notable were healed blunt force depression fractures in the skulls of both adults and the adolescent, which may have interpersonal violence accidental causes. The female also had a crush fracture in her spine and the mature adult male had a well-healed avulsion fracture to his palm. The adolescent had an ossified blood clot on his left lower leg.

The mature adult female and adolescent showed evidence for a small number of minor developmental anomalies, which would have had no effect on their quality of life. Both adults had *cribra orbitalia* lesions, which may be an indication of poor childhood health. Grooves in the teeth of all four individuals also indicated that they were affected by periods of stress during their childhood. The shorter than normal height of the adolescent supports this suggestion, implying retarded growth due to childhood stress. This may also have contributed to the premature death of the juvenile and adolescent.

The adolescent suffered from what may have been cysts in their right femur, although the lesions could not be positively diagnosed and would benefit from further research.

Dental disease in this small group was poor, with a high prevalence of calculus, cavities and dental abscesses, which exceeded the average for the period. Periodontitis was prevalent and the female adult had incurred a molar fracture.

References

Aufderheide, A. C. and Rodríguez-Martín, C. 1998. *The Cambridge Encyclopedia of Human Paleopathology* (Cambridge)

Barnes, E. 2012. Atlas of Developmental Field Anomalies of the Human Skeleton: A Paleopathology Perspective (Colorado)

Barnes, E. 1994. *Developmental Defects of the Axial Skeleton in Paleopathology* (Niwot, Colorado)

Bass, W. M. 1987. *Human Osteology: A Laboratory and Field Manual* (Columbia)

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

Brooks, S. T. and Suchey, J. M. 1990. 'Skeletal age determination based on the os pubis: a comparison of the Acsádi-Nemeskéri and Suchey-Brooks methods' *Human Evolution* 5: 227-238

Brothwell, D. R. 1981. *Digging Up Bones* (New York)

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

Byers, S. N. 2010 *Introduction to Forensic Anthropology (International Edition)*, 3rd edition, (Boston)

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

Dandy, D. J. and Edwards, D. J. 2003. *Essential Orthopaedics and Trauma* (Edinburgh)

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

Garland, A. N. and Janaway, R. C. 1989. 'The taphonomy of inhumation burials', in C. A. Roberts, F. Lee and J. Bintliff (eds) *Burial Archaeology: Current Research, Methods and Developments. British Archaeological Reports British Series* 211 (Oxford): 15-37

Glendor, U., Marcenes, W. and Andreasen, J. O. 2007. 'Classification, epidemiology and etiology', in J. O. Andreasen, F. M. Andreasen and L. Andersson (eds) *Textbook and Color Atlas of Traumatic Injuries to the Teeth (4th edition)* (Oxford): 217-254

Henderson, J. 1987. 'Factors determining the state of preservation of human remains', in A. Boddington, A. N. Garland and R. C. Janaway (eds) *Death, Decay and Reconstruction: Approaches to Archaeology and Forensic Science* (Manchester): 43-54

Hillson, S. 1996. *Dental Anthropology* (Cambridge)

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

Hirsh, L. 1983. 'Cervical degenerative arthritis - possible cause of neck and arm pain', *Postgraduate Medicine* 74 (1): 123-130

İşcan, M. Y. and Loth, S. R. 1986. 'Determination of age from the sternal rib in white females: a test of the phase method' *Journal of Forensic Sciences* 31: 990-999

İşcan, M. Y., Loth, S. R. and Wright, R. K. 1984. 'Age estimation from the rib by phase analysis: white males' *Journal of Forensic Sciences* 29: 1094-1104

İşcan, M. Y., Loth, S. R. and Wright, R. K. 1985. 'Age estimation from the rib by phase analysis: white females' *Journal of Forensic Sciences* 30: 853-863

Janaway, R. C. 1996. 'The decay of buried human remains and their associated materials', in J. Hunter, C. A. Roberts and A. Martin (eds) *Studies in Crime: An Introduction to Forensic Archaeology* (London): 58-85

Jurmain, R. 1999. *Stories from the Skeleton* (London and New York)

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

Lewis, M. E. 2007. *The Bioarchaeology of Children: Perspectives from Biological and Forensic Anthropology* (Cambridge)

Lewis, M. E. 2000. 'Non-adult palaeopathology: current status and future potential', in M. Cox and S. Mays (eds) *Human Osteology in Archaeology and Forensic Science* (London): 39-57

Lovejoy, C. O., Meindl, R. S., Pryzbeck, T. R. and Mensforth, R. P. 1985. 'Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of adult skeletal age at death' *American Journal of Physical Anthropology* 68: 15-28

Lovell, N. C. 1997. 'Trauma analysis in paleopathology', *Yearbook of Physical Anthropology* 40: 139-170

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

McKinley, J. I. 2004. 'Compiling a skeletal inventory: disarticulated and co-mingled remains', in M. Brickley and J. I. McKinley (eds) *Guidelines to the Standards for Recording Human Remains. IFA Paper No. 7* (Southampton and Reading): 14-17

Miles, A., Powers, N., Wroe-Brown, R. and Walker, D. 2008. *St Marylebone Church and Burial Ground in the 18th to 19th Centuries: Excavations at St Marylebone School, 1992 and 2004-6* (London)

Molleson, T. 1995. 'Rates of ageing in the eighteenth century', in S. R. Saunders and A. Herring (eds) *Grave Reflections: Portraying the Past Through Cemetery Studies* (Toronto): 199-222

Molleson, T. and Cox, M. 1993. *The Spitalfields Project. Vol 2. The Anthropology: The Middling Sort*, CBA Research Report 86 (York)

Moorrees, C. F. A., Fanning, E. A. and Hunt, E. E. 1963a 'Formation and resorption of three deciduous teeth in children' *American Journal of Physical Anthropology* 21: 205-213

Moorrees, C. F. A., Fanning, E. A. and Hunt, E. E. 1963b 'Age variation of formation stages for ten permanent teeth' *Journal of Dental Research* 42: 1490-1502

Moynihan, P. 2003. 'Diet and dental caries', in J. J. Murray, J. H. Nunn and J. G. Steele (eds) *The Prevention of Oral Disease* (Oxford): 9-34

Ortner, D. J. 2003. *Identification of Pathological Conditions in Human Skeletal Remains* (Amsterdam)

Plomp, K. A., Roberts, C. A. and Viđarsdóttir, U. S. 2012. 'Vertebral morphology influences the development of Schmorl's nodes in the lower thoracic vertebrae', *American Journal of Physical Anthropology* 149: 572-582

Roberts, C. A. and Cox, M. 2003. *Health and Disease in Britain* (Stroud)

Roberts, C. A. and Manchester, K. 2005. *The Archaeology of Disease (third edition)* (Stroud)

Rogers, J. 2000. 'The palaeopathology of joint disease', in M. Cox and S. Mays (eds) *Human Osteology in Archaeology and Forensic Science* (London): 163-182

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

Sauer, N. J. 1998. 'The timing of injuries and manner of death: distinguishing among antemortem, perimortem and postmortem trauma', in K. Reichs (ed) *Forensic Osteology: Advances in the Identification of Human Remains* (Springfield): 321-332

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

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

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

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

Spriggs, J. A. 1989. 'On and off-site conservation of bone', in C. A. Roberts, F. Lee and J. Bintliff (eds) *Burial Archaeology: Current Research, Methods and Developments. British Archaeological Reports British Series* 211 (Oxford): 39-45

Stuart-Macadam, P. 1992. 'Anemia in past populations', in P. Stuart-Macadam and S. Kent (eds) *Diet, Demography and Disease: Changing Perspectives of Anemia* (New York): 151-170

Sture, J. F. 2001. *Biocultural Perspectives on Birth Defects in Medieval Urban and Rural English Populations*, Unpublished PhD Thesis (Durham)

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

Tucker, K. 2007. 'Then [sic] Human Bone', in J.M. McComish (eds) *Roman, Anglian and Anglo-Scandinavian activity and a medieval cemetery on land at the junction of Dixon Lane and George Street, York*. York Archaeological Trust web publication report No. AYW9

Ubelaker, D. H. 1989. *Human Skeletal Remains; Excavation, Analysis, Interpretation* (Washington)

Walker, P. L. 1995. 'Problems of preservation and sexism in sexing: some lessons from historical collections for palaeodemographers', in S. R. Saunders and A. Herring (eds) *Grave Reflections: Portraying the Past Through Cemetery Studies* (Toronto): 31-47

Walker, P. L., Bathurst, P. R., Richman, R., Gjerdrum, T. and Andrushko, V. A. 2009. 'The causes of porotic hyperostosis and cribra orbitalia: a reappraisal of the iron-deficiency-anemia hypothesis' *American Journal of Physical Anthropology* 139: 109-125

Wedel, V. L and Galloway, A. 2013. *Broken Bones: Anthropological analysis of blunt force trauma* (Illinois)

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

APPENDIX A: OSTEOLOGICAL AND PALAEOPATHOLOGICAL CATALOGUE

Skeleton Number	**23 (1085)**
Preservation	Very good
Completeness	75%
Age	46+, mature adult
Sex	Male
Stature	173.6 +/- 4.32 cm
Non-Metric Traits	*Ossicle in lambdoid* (left), *parietal foramen* (left), *mastoid foramen extrasutural* (bilateral), *sutural mastoid foramen*(left), *posterior condylar canal open* (right), *palatine torus, maxillary torus* (*left*), *mandibular torus* (bilateral), *bridging of supraorbital notch* (right), *accessory supraorbital foramen* (bilateral), *posterior atlas bridging* (partial, right), *transverse foramen bipartite* (right), *septal aperture* (left), *Allen's fossa* (left), *third trochanter* (bilateral)
Pathology	DJC in mandibular fossae, left mandible, right lunate, left acetabulum, left proximal femur and a right proximal hand phalanx. OA in cervical and lumbar spine and right hip. Schmorl's nodes in thoracic and lumbar spine. *Cribra orbitalia.* Sinusitis. Endocranial new bone on left and right parietals. Striated lamellar bone on left femur. Healed fracture to the right third metacarpal. Possible depression fracture to the right frontal bone.
Dental Health	28 tooth positions present, 19/28 teeth present, 7/28 lost post mortem, 3/28 teeth lost ante mortem, 1/28 teeth not present, 19/19 teeth affected by calculus flecks to heavy calculus, 2 caries, 1/19 teeth with DEH. Externally draining abscesses on the right maxilla at the root apex of M1. Moderate periodontal disease on left mandible and maxilla. Large space between the maxillary central incisors.

	Right Dentition								Left Dentition							
Present	NP	AM	PM	P	P	P	P	P	PM	P	P	P	P	AM	P	P
Calculus	-	-	-	Fm	Fb	Fb	Mb	Mb Smd	Hb Sm	Mb Sm	Sb	Fb	Mb	-	Smb Fl	Smb Fl
DEH	-	-	-	-	-	-	G	-	-	-	-	-	-	-	-	-
Caries	-	-	-	Sd	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	5	5	4	3	3	3	2	3	4	4	-	6	7
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**	**5**	**6**	**7**	**8**
Present	PM	PM	P	P	P	PM	PM	P	P	-	-	PM	PM	AM	P	P
Calculus	-	-	Mbd Fm	Fmd	Fml	-	-	Mlbm Sd	Mml Fb	-	-	-	-	-	Sld	Mlmd
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Sb
Wear	-	-	5	5	4	-	-	3	3	-	-	-	-	-	6	5

Skeleton Number	**25 (1094)**
Preservation	Very good
Completeness	90%
Age	7-12, older juvenile
Sex	-
Stature	-
Non-Metric Traits	*Ossicle in lambdoid* (right), *parietal foramen* (right), *mastoid foramen extrasutural* (left), *bridging of supraorbital notch* (right), *accessory supraorbital foramen* (left), *anterior ethmoid foramen extrasutural* (left), *transverse foramen bipartite* (right), *Allen's fossa* (bilateral), *hypo trochanteric fossa* (bilateral), *third trochanter* (bilateral), *absent anterior calcaneal facet* (right)
Pathology	Healed depression fracture to the left parietal. Endocranial new bone formation on left and right parietals.

Dental Health	32/32 tooth positions present, 23 teeth present, 4/32 lost post mortem, 4/32 not present, 14/23 teeth affected by calculus, 2 caries on 2/23 teeth, DEH affects 12/23 teeth, dental overcrowding															
	Right Dentition								Left Dentition							
Present	NP	PM	P	P	P	PM	P	PM	P	P	P	P	P	P	PM	NP
Calculus	-	-	Sbdm	Fbm	Mb	-	Mb	-	-	Fd	Fb	Fbm	-	Sbm Fl	-	-
DEH	-	-	G	-	G	-	-	-	G	G	G	G	G	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	2	1	1	-	2	-	2	2	1	1	1	2	-	-
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**	**5**	**6**	**7**	**8**
Present	NP	P	P	P	P	P	P	P	P	P	P	PM	P	P	P	UE
Calculus	-	-	Fm	-	-	-	Mbl	Mbl	Mbl	Mbl	-	-	-	Fm	-	-
DEH	-	-	-	-	G	G	-	-	-	-	G	-	G	-	G	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	Sb	Sb	-
Wear	-	1	2	1	1	1	2	2	2	2	1	-	1	2	1	-

Skeleton Number	**94 (1373)**
Preservation	Very good
Completeness	95%
Age	13-17, adolescent
Sex	-
Stature	-
Non-Metric Traits	*Mastoid foramen extrasutural* (bilateral), *posterior condylar canal open* (left), *open foramen spinosum* (right), *bridging of supraorbital notch* (left), *transverse foramen bipartite* (right), *circumflex sulcus* (right), *Allen's fossa* (bilateral), *hypo trochanteric fossa* (bilateral), *lateral tibial squatting facet* (bilateral), *double anterior calcaneal facet* (bilateral), *os trigonum* (bilateral).
Pathology	Schmorl's nodes in thoracic and lumbar spine. Possible ossified haematoma and new bone formation on left fibula. Epiphyseal fragmentation of left and right proximal articulations of the proximal foot phalanges for MT1. Cyst on distal shaft of right femur. Possible African ancestry.
Dental Health	32 tooth positions present, 29/32 teeth present, 1/32 sampled, 2/32 teeth not present, 22/23 teeth affected by calculus, flecks to moderate deposits. DEH affects 9/29 teeth.

	Right Dentition								Left Dentition							
Present	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Calculus	-	-	Fb	-	Sb Ml	Sb Ml	Fb	-	-	Fb Fm	Fm	Fm	Mm	Mm	-	-
DEH	-	-	-	-	-	G	G	-	-	G	G	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	0	1	2	1	1	2	2	2	2	2	1	1	1	2	1	0
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**	**5**	**6**	**7**	**8**
Present	NP	P	P	P	P	P	P	P	P	P	P	PM	P	P	P	NP
Calculus	-	Sb Ml	Fl	Sl	Sl	Smd	Sbl	Sbl	Sbl	Sbl	Fb Sl	-	Sl	Ml	Fl	-
DEH	-	G	-	G	-	G	-	-	-	-	G	-	G	-	G	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Wear	-	2	3	2	2	2	2	2	2	2	2	-	2	3	2	-

Skeleton Number	**104 (1417)**
Preservation	Excellent
Completeness	95%
Age	46+, mature adult
Sex	Female
Stature	152.8$^{+/-}$3.28cm if African 155.9$^{+/-}$3.55cm if Caucasian
Non-Metric Traits	*Parietal foramen* (right), *ossicle at pterion* (bilateral), *mastoid foramen extrasutural* (bilateral), *sutural mastoid foramen* (bilateral), *posterior condylar canal open* (left), *accessory lesser palatine foramen* (bilateral), *palatine torus, maxillary torus* (bilateral), *accessory supraorbital foramen* (right), *transverse foramen bipartite* (left), *accessory acromial facet (bilateral), circumflex sulcus (right), septal aperture (left) hypo trochanteric fossa* (bilateral), *exostosis in trochanteric fossa* (bilateral), *third trochanter* (bilateral), *vastus notch* (left), *lateral tibial squatting facet* (bilateral)
Pathology	DJC in cervical, thoracic and lumbar spine, left and right mandibular fossae, left and right mandible, left and right manubrium, both sides of the medial and lateral clavicles, both glenoids, left and right proximal humerus, right distal humerus, proximal left radius, both distal radii, right proximal ulna, left and right lunates, left and right scaphoid, right trapezium and triquetral, both distal femora, the right patella. both proximal and distal tibiae, left and right metacarpals, hand phalanges, left distal metatarsals and left and right foot phalanges. Possible OA in left and right acetabuli and both proximal femora, right first metacarpal and articulating proximal phalanx and a left intermediate hand phalanx. *Cribra Orbitalia.* Sinusitis. Woven bone formation on posterior surfaces of left and right maxilla. HFI. LumbarisedT11. Crush fracture to L5. Possible fracture to the distal articulation of a left? intermediate hand phalanx. Asymmetry of sternum. Two button osteomas on the left parietal. Depression fracture on the right occipital.
Dental Health	32/32 tooth positions present, 30/32 teeth present, 1/30 teeth broken, 1/32 lost ante mortem, 1/32 teeth not present, 27/30 teeth affected by calculus, flecks to moderate deposits. DEH affects 6/30 teeth, 5 caries on 4/30 teeth.2 left mandibular externally draining abscesses 1 right maxillary externally draining abscess and 1 left maxillary externally draining abscess.

	Right Dentition								Left Dentition							
Present	P	P	P	P	P	P	P	P	P	P	P	P	P	P	AM	NP
Calculus	Slb	Mm	Md Sl	Sb	Fb Sl	Sld	Sb Fl	Sbm	-	Fm	Fb	-	-	Mb	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	Ld	-	-	-	-	-	-	-	-	-	Mm	-	-	-	-
Wear	5	5	7	6	5	4	4	4	4	4	5	7	7	7	-	-
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**	**5**	**6**	**7**	**8**
Present	P	P	B	P	P	P	P	P	P	P	P	P	P	P	P	P
Calculus	Sbl	Fb Sl	Fmb	Sbl	Mbl	Sl Mb	Sbl	Sbl	Sbl	Sbl	Fb Sd	Fb Sd	Sl Fd	Sl Sb	Sl Sb	Sl
DEH	-	-	-	-	-	G	G	G	G	G	G	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Mb Md	Lb
Wear	7	7	8	7	3	3	4	5	5	5	4	4	6	7	6	6

KEY:
Present - Tooth presence; am - ante-mortem tooth loss; pm - post-mortem tooth loss; p - tooth present; - - 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