Osteological Analysis of the Human Remains from Kingston Down Anglo-Saxon Cemetery, Canterbury, Kent.

A Report for Canterbury Archaeological Trust

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Project OA1040

1. Introduction

The aim of this report is to present the data obtained from the osteological analysis of human skeletal remains recovered during an excavation at the site of Kingston Down Anglo-Saxon barrow field cemetery, near Canterbury, Kent (Grid reference: 620285 151902, project code BDSC-EX-13). The evaluation was carried out by Canterbury Archaeological Trust between the 12th August and 6th September 2013 on behalf of Natural England as an archaeological investigation along the line of a proposed installation of a rabbit-proof fence (See CAT interim report No 2013/132).

During the course of the archaeological investigations, sixteen graves were identified, twelve of which were excavated. Ten of these graves contained human remains that were subject to osteological analysis, the results of which are presented here. One further fragment of bone was recovered from context [208]. The cemetery is known to have been investigated previously by the antiquarian Reverend Faussett during the late 18th century and several of the graves had been disturbed by this work. Some of the graves were also noted to have been modified by extensive rabbit burrowing and fragments of human bone have been found scattered across the site.

The antiquarian excavations led to the discovery of 308 graves aligned on an approximately east-west axis, containing human skeletal remains accompanied by grave goods such as jewellery, spindle-whorls, swords, shields, ceramic and glass vessels (CAT interim report No 2013/132). An iron knife was also found during the current archaeological excavation in grave 7 (SK102).

Osteoarchaeological analysis was undertaken to assess the condition and completeness of the human skeletal remains recovered from the re-excavated graves as well as to determine the age, sex and stature of the individuals present. Any non-metric traits, skeletal and dental pathologies were also recorded. An overview of the overall findings for the group is presented here in addition to a summary catalogue of the human remains per context. Due to the small sample size and preservation of some of the skeletal remains, prevalence rates of pathologies within the group were not calculated; however, the individual pathologies noted were set into context by way of reference to average prevalence rates recorded for the Anglo-Saxon period as presented in Roberts and Cox (2003).

2. Methods and Process

The skeletal material was analysed according to the standards laid out in the guidelines recommended by the British Association of Biological Anthropologists and Osteologists in conjunction with the IFA (Guidelines to the Standards for Recording Human Remains, Brickley and McKinley (eds) 2004) as well as by English Heritage (Human Bones from Archaeological Sites: Guidelines for producing assessment documents and analytical reports, Centre for Archaeology Guidelines, 2002).

Recording of the material was carried out using the recognised descriptions contained in Standards for Data Collection from Human Skeletal Remains by Buikstra and Ubelaker (1994). Full recording forms are supplied separately to be archived with any other archaeological recording forms. All skeletal data has been recorded using an MS-Access database(s) which can be found on the CD-Rom provided.

The material was analysed macroscopically and where necessary with the aid of a magnifying glass for identification purposes. Where relevant, digital photographs have been used for illustration and a full digital image archive of all pathologies and any other features of interest has been provided on the CD-Rom enclosed with this report.

The material was analysed without prior knowledge of associated artefacts so that the assessment remained as objective as possible.

Comparison of the results was made with published osteological data from contemporary skeletal populations.

2.1 Reasons for the Analysis

Osteological analysis was carried out to ascertain:

- Inventory of the skeletal material
- Condition of bone present
- Completeness of the skeleton

- Age Assessment
- Sex Determination
- Non-metric Traits
- Stature and Morphometric Data
- Skeletal Pathology
- Dental Pathology

2.2 Skeletal Inventory

An inventory of the skeletal elements present is undertaken to assess the completeness of the skeletal remains and identify the number of individuals present. An inventory also provides information on the specific elements within the skeleton that are present and can be assessed for pathological changes. Each element is recorded as present or absent. The long bones are recorded according to the presence or absence of the proximal (upper), middle and distal (lower) sections as well as the proximal and distal joint surfaces. The completeness of the bones of the axial skeleton (with the exception of the spine) is recorded according to the categories of <25%, 25-50%, 50-75% and 75%>.

A summary inventory of the skeletal elements present for each individual is provided in the skeletal catalogue below (see Section 3). A full inventory can be found on the enclosed CD-Rom. No duplication of elements was observed within any one context and the inventory taken confirmed that each context contained the remains of a single individual.

2.3 Condition of the Bone Present

The condition of the bone was assessed macroscopically according to the categories and descriptions provided by the Guidelines to the Standards for Recording Human Remains (Brickley and McKinley, eds, 2004). Since most skeletons exhibit more than one grade of state of preservation, these categories are simplified into 4 main groups of preservation: Good (grades 0-

2), Fair (grades 2-4), Poor (grades 4-5+) and Varied (more than 4 grades of condition). The condition of human bone can be influenced by both extrinsic (i.e. taphonomic conditions) and intrinsic (i.e. robustness) factors (Henderson 1987).

The remains from four contexts were assessed as being in fair condition, with five being in poor and one context being in fair-poor condition (see Figure 1). The outer surface of the cortices of many of the bones were eroded, some heavily so, and skeletal elements high in the more vulnerable cancellous (spongy) bone content were generally under-represented. The bones were light and notably fragile. This was particularly true of the epiphyses of long bones, some having been penetrated by root growth. The condition of the bones was such that it was likely that diseases affecting the outer cortex of the bone only, such as periostitis, would be under-recorded. Nonetheless, the bone present was sufficiently well preserved to allow the observation of some major gross pathologies. Though the majority of the teeth present were intact, it was noted that the enamel surfaces of most of the dentition were eroded to some extent. This may have led to an under-recording of dental enamel hypoplasia. Occlusal surfaces were sufficiently preserved, however, to observe dental attrition for age assessment.

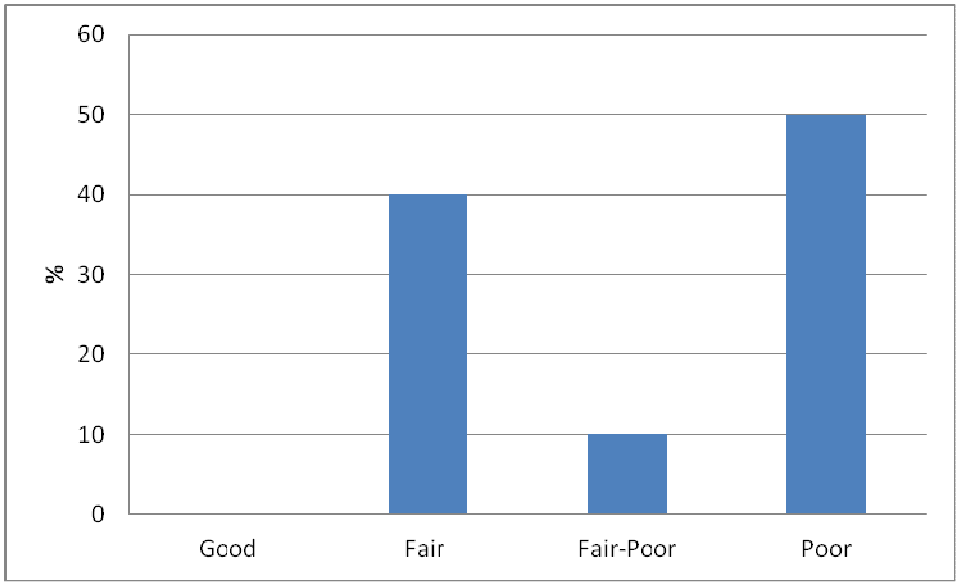

Figure1: *Comparative Rates of Preservation*

2.4 Completeness of Skeletons

This is a guide to the overall completeness of the individual's skeletal remains and is calculated according to the percentage of the bones present in relation the total number of bones in a

complete human skeleton. Completeness of remains is gauged through an assessment of the amount of material representing different areas of the body. A complete skeleton comprises of:

Skull = 20%

Torso = 40%

Arms = 20%

Legs = 20%

Each area of the skeleton was assessed and then placed into the following four categories of completeness: <25%, 25-50%, 50-75% and 75%> (Buikstra and Ubelaker 1994).

Recording the completeness of the individual can allow an insight to be gained into how much post-depositional activity has occurred as well as to assess how much information can potentially be gained from the remains.

Only two of the contexts contained skeletal remains that were at least 75% complete, although four contexts were found to contain remains that were 50-75% complete (See Figure 2). A further four contexts contained remains that were less than 25% complete. These latter contexts were likely to produce a limited amount of osteological data.

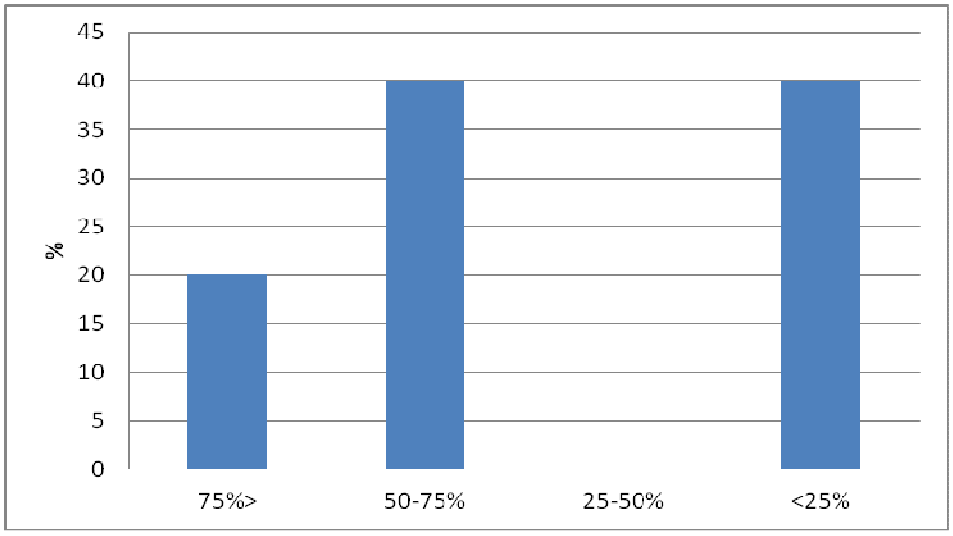

Figure 2: *Completeness of Skeletal Remains*

2.5 Age Assessment

Establishing the age and sex of individuals from an archaeological assemblage not only provides an insight into the demographic profile of the population but can also be used to inform us of patterns in pathological distributions in a skeletal assemblage.

The age of sub-adults is assessed using both dental development (Smith 1991) and eruption (Ubelaker 1989) as well as long bone lengths (Schaefer *et al*. 2009) and epiphyseal fusion (Scheuer & Black 2004). These methods can usually provide a reasonably accurate age estimation due to a relatively narrow range of variation in normal sub-adult development. Thus, sub-adults can be placed into the following age categories: Foetal (<36 weeks), Neonate (0-1 month), Young Infant (1-6 months), Older Infant (6-12 months), Child (1-5 years), Juvenile (6-12 years) and Adolescent (13-17 years).

Assessment of adult age at death, unfortunately, results in much less specific age estimates due to a much greater individual variation in the features exhibited by the examined elements at particular ages (Cox 2000). Age estimation of adults was assessed from analysis of the auricular surface (Lovejoy et al 1985) and the pubic symphysis (Brookes and Suchey, 1990). Each of these methods examines the deterioration of these surfaces and categorises them accordingly. This deterioration is due in part to due to the health status of the individual but can also be influenced by life-style and so the variation produced by these factors results in much wider age categories: Very Young Adult (18-24), Young Adult (25-34), Middle Adult (35-49) and Old Adult (50+) (Buikstra and Ubelaker, 1984). Grading of dental attrition was also used as a supplementary age assessment technique using the Miles method (1963) where dentition sets were complete enough to allow fair observation.

Six of the individuals present were assessed as being of adult age and two individuals were sub-adult. The remains from two contexts were highly incomplete and fragmentary; it was therefore not possible to observe age at death, though in both cases the remains were thought to be of at least adolescent age and may well have been adult.

For five of the adult individuals it was possible to assign a further age category (see Figure 3). One very young adult was present (SK 131) in addition to two middle aged adults (SK120 and

SK123) and two old age adults (SK102 and SK126). The two sub-adults were classified as young infant (SK188) and adolescent (SK140).

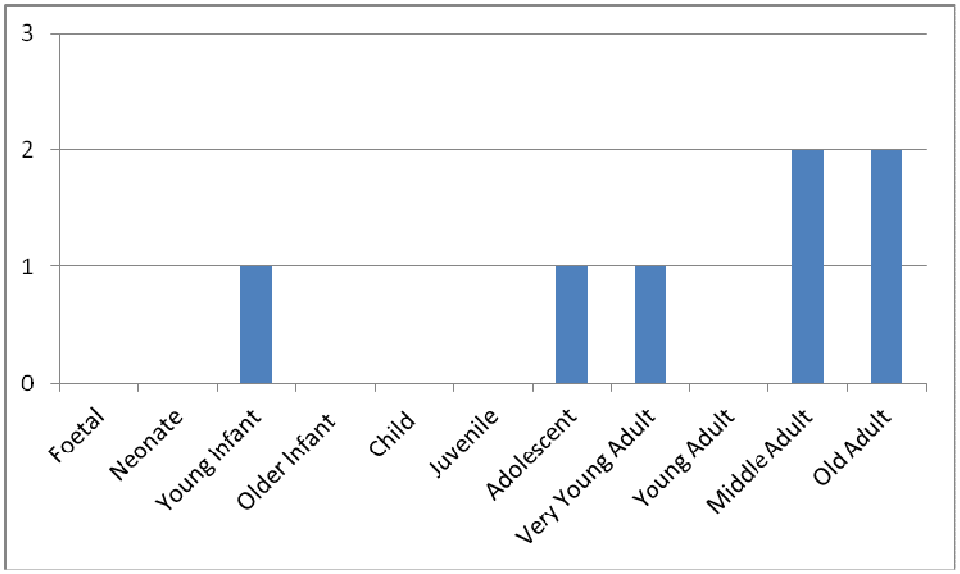

Figure 3: *Age Profile of the Population*

2.6 Sex Determination

Sex is assessed using the criteria laid out by Buikstra and Ubelaker (1984) in the analysis of morphological features of the skull and pelvis. In addition, metric data is also used where possible, taking measurements of sexually dimorphic elements such as the femoral and humeral head (Bass 1995). Categories ascribed to individuals on the basis of this data were 'Male', Possible Male', 'Indeterminate', 'Possible Female', 'Female' and 'Unobservable'. Sex may be ascribed on the basis of metrics alone where no sexually dimorphic traits are observable. Where sex was not observable be either metric or morphological observations, it was recorded as 'Unobservable'. No sexing of sub-adult material is attempted due to the lack of reliable criteria available.

Two of the individuals present were assessed as being male (SK102 and SK123), while two were female (SK126 and SK131) and one further individual (SK120) was assessed as possible female. No sex could be assessed for the remaining five individuals, though two of these were sub-adult, for which there are currently no osteological techniques for determining sex. The remaining three individuals were significantly depleted in skeletal content and therefore sex could not be assessed.

2.7 Non-Metric Traits

Non-metric traits are morphological features that occur both in bone and dentition. These features have no specific functional purpose and occur in some individuals and not in others. The origins of non-metric traits have now been shown to be highly complex, each having its own aetiology and each being influenced to differing extents by genetics, the environment and by physical activity. A review of the current literature suggests that the undetermined specific origins of these traits and the fact that there is more genetic variation within populations than between them can prevent useful conclusions regarding their presence or absence in skeletal remains from being drawn (Tyrell 2000).

The presence of any non-metric traits is noted in the skeletal catalogue below (see Section 3).

2.8 Stature and Morphometric Analysis

Stature of adult individuals can be reconstructed from measurements of long bones of the skeleton. Since the long bones of sub-adults have not yet fully developed it is not possible to provide an estimate of stature for immature remains. Stature is the result of many factors including genetics and environmental influences (Floud *et al*. 1990), such as malnutrition and poor health. Height can be used as an indicator of health status and there is a wide range of literature on the relationships between height, health and social status. Estimated stature was calculated by taking the measurements of the individual long bones and using the formula provided by Trotter (1970). Variation in estimated stature can be up to 3cm.

Metric analysis of the long bones, cranium and mandible may also be undertaken on adult remains to provide comparative information on morphological variability.

Stature was estimated from the complete long bones of four individuals. The stature of two males was estimated as 1.68m (SK102) and 1.78m (SK123), with an average of 1.73m. The stature of two females was assessed as 1.53m (SK126) and 1.61m (SK131), with an average of 1.57m. Overall, the average stature was 1.65m. These estimates fit well with those recorded for the Anglo-Saxon period; between 1.70m and 1.82m for males and 1.52m and 1.70m for females, with averages of 1.72m and 1.61m respectively (Roberts and Cox 2003).

A summary of the morphometric data is provided in the skeletal catalogue below for each individual. Full recording can be found on the CD-Rom provided.

2.9 Skeletal Pathology

Palaeopathology is the study of diseases of past peoples and can be used to infer the health status of groups of individuals within a population as well as indicate the overall success of the adaptation of a population to its surrounding environment. Pathologies are categorised according to their aetiologies; e.g. congenital, metabolic, infectious, traumatic, neoplastic etc. (Roberts and Manchester 1997). Any pathological modifications to the bone are described. The size and location of any lesion is also noted. Distribution of lesions about the skeleton should be noted to allow diagnosis. A differential diagnosis for any pathological lesions should also be provided.

Details of pathological conditions observed in the Kingston Down assemblage are noted in the skeletal catalogue below (see Section 3). Overall, 5 incidences of trauma were noted consisting of 5 fractures, including a well healed Colles fracture and co-occurring fracture to the ulnar styloid process (SK126), a rare example of an unhealed ante-mortem subtrochanteric femoral fracture (SK126), a clavicle fracture (SK123) and an intra-articular fracture to a proximal 1st hand phalanx (thumb) (SK123). Extra-spinal degenerative joint disease (DJD) was rarely observed, though one case of severe DJD in the spine was noted (SK102). One metabolic condition, cribra orbitalia, was noted in one individual (SK120) while a suspected case of osteoporosis was also recorded (SK126). One case of cervical block vertebra, a developmental condition, was also recorded (SK126).

2.10 Dental Pathology

Dental diseases include conditions that not only directly affect the teeth but also the soft tissue surrounding them, sometimes observable in changes to the underlying alveolar bone (Hillson 1986). Each condition can give an indication of different aspects of lifestyle and health of the individual. For example, caries is associated with diets high in sucrose content. The presence of calculus can inform us about dental hygiene whilst enamel hypoplastic defects testify to developmental stresses that an individual has undergone in childhood (Goodman and Armelagos 1985, Hutchinson and Larsen 1988, Dobney and Goodman 1991). The analysis of dental disease,

therefore, not only informs us of specific oral conditions but provides complimentary data regarding overall health status and cultural practices.

Calculus was recorded as present in five individuals, though was generally only mild or moderate, the latter occurring in an older individual (SK102). It was often seen in co-occurrence with mild periodontal disease. Enamel hypoplasia was only observed in one individual (SK131), though the erosion the dental enamel surfaces noted may have led to its under-recording in the group as a whole. Caries and dental abscesses were present in two individuals (SK102, SK126) and were also infrequent. Both conditions were recorded in the same individuals, both old adults, reflecting the inter-related aetiology and the increased risk of these dental diseases with age. This is also true of ante-mortem tooth loss (SK102, SK123), though this was more frequent in the group taking the number of individual teeth affected into account.

3. Catalogue of Human Remains

The results of the osteoarchaeological analysis are presented below in numerical order according to each individual context. Due to the small sample size, disease prevalence rates have not been calculated but prevalence rates reported in the literature for other, contemporary sites is referred to. A full inventory and recording of the human skeletal remains can be found on the MS Access database.

SK102 [Grave 7]

Inventory: Complete Cranium (both orbits observable); Mandible; T7-L6 Vertebrae; 6 left ribs; Incomplete humerii, radii and ulnae; Complete femora and fairly complete tibiae and fibulae; Incomplete right ilium; Fairly complete left ilium, ischium and pubis; Incomplete sacrum; Incomplete left scapula and clavicle; Complete patellae; 5th right metatarsal; 2nd left metatarsal; Tali; Left Calcaneus; Left Cuboid; 3 hand phalanges and 1 foot phalanx.

Completeness: 50-75%

Condition: Fair (Grades 2, 3 and 4)

Dental Inventory and Pathology:

102	*Observable Dentition*	*Observable Tooth Sockets*	*Ante-mortem Loss*	*Caries*	*Calculus*	*Periodontal Disease*	*Enamel Hypoplasia*	*Abscess*
n	10	31	10	3	4	8	0	1

Impacted 3rd right mandibular molar (see Plate 1).

Age Assessment: Age: 50+. Auricular surface stage 7 (only partly observable)

Sex Determination: Male. Pelvic and cranial morphology, male; Metric data, male

Stature: 1.68m (Tibia)

Platymeric Index: 75.1 (Platymeric)

Platycnemic Index: 77.1 (Eurycnemic)

Non-Metric Traits: Ossicle at the right asterion

Skeletal Pathology: Six lumbar vertebrae present. Severe degenerative joint disease (osteoarthritis) was noted in the vertebrae including large osteophytes in the lower thoracic and lumbar spine, resulting in the ankylosis (fusion) of L2 and L3 (see Plate 2). The osteophytes were present on the right hand side in the lower thoracic and upper lumbar vertebrae (T10-L3) and on the left hand side in the lower lumbar region (L3-L6); the right hand side of the lower lumbar vertebral bodies, however, was not observable due to post-mortem damage. Although the osteophytes were similar to those found in DISH (Diffuse Idiopathic Skeletal Hyperostosis) they did not extend superiorly beyond the level of T10. Eburnation was present in two zygapophyseal joints and several other joints were affected by micro- and macroporosity with some expansion of the joint surfaces. Micro- and macroporosity was also observed on the majority of the vertebral body surfaces. Degenerative changes were also observed in the costal facet on T12, consisting of macroporosity and osteophytes.

Additional Observations: Green staining to the proximal aspect of the right radius. Iron knife found in grave.

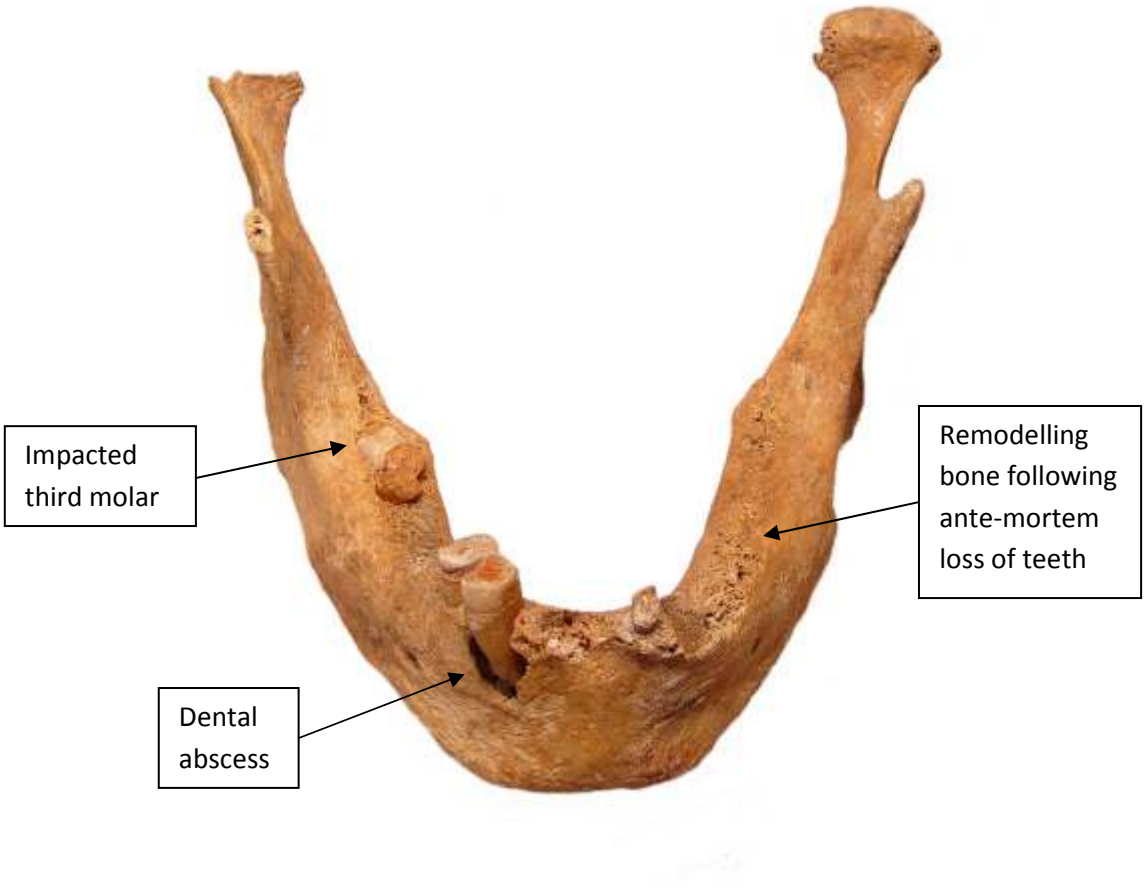

Plate 1: *Prolific ante-mortem loss of dentition with a dental abscess and impacted 3rd molar*

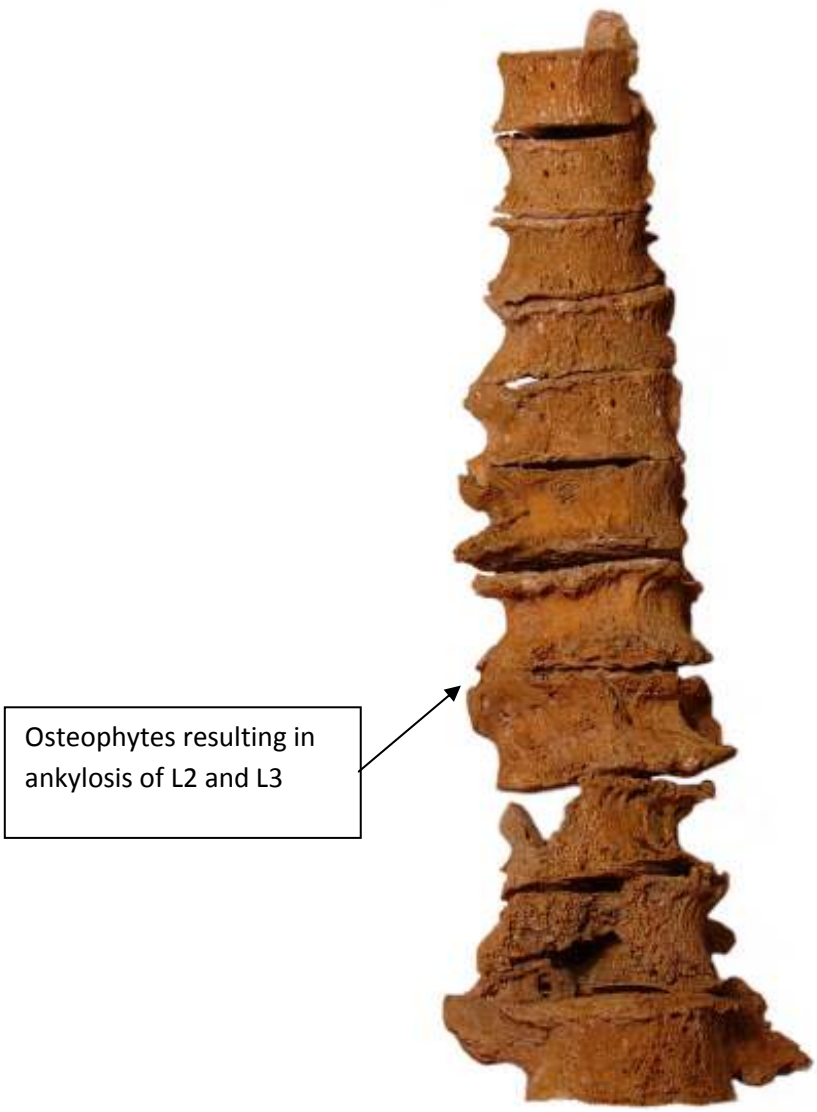

Plate 2: *Degenerative Joint Disease in the lower spine manifested by large osteophytes and ankylosis of L2 and L3.*

Summary: The skeletal remains of SK102 are of fair condition and are 50-75% complete. They represent an old male adult individual of 1.68m stature. Ante-mortem tooth loss was noted to be high and the individual also suffered a dental abscess. Prolific degenerative changes were observed in the lower spine consistent with degenerative joint disease (osteoarthritis), including the ankylosis of two lumbar vertebrae. Clinically, approximately 80% of all people over 55 years old will exhibit some signs osteoarthritis (Vigorita 2008) and while in some individuals there may be underlying conditions leading to a predisposition to the condition (i.e. osteoporosis), it is

primarily associated with aging (Salter 1999). An average of 12.1% of individuals from Anglo-Saxon sites across Britain are affected by spinal joint disease (Roberts and Cox 2003).

SK106 [Grave 1]

Inventory: Four fragments of long bone, tibia or femur.

Completeness: <25%

Condition: Poor (Grades 4, 5).

Dental Inventory and Pathology: None

Age Assessment: Adolescent/Adult

Sex Determination: Unobservable

Stature: Unobservable

Platymeric Index: Unobservable

Platycnemic Index: Unobservable

Non-Metric Traits: Unobservable

Skeletal Pathology: None

Summary: Four fragments of poorly preserved long bone, possibly femur or tibia, recovered from the backfill of Grave 1.

SK113 [Grave 4]

Inventory: Cranial fragments (no observable orbits); Incomplete right humerus; Incomplete femora and tibiae.

Completeness: <25%

Condition: Poor (Grades 4, 5).

Dental Inventory and Pathology:

113	*Observable Dentition*	*Observable Tooth Sockets*	*Ante-mortem Loss*	*Caries*	*Calculus*	*Periodontal Disease*	*Enamel Hypoplasia*	*Abscess*
n	6	0	-	0	0	-	1	-

Age Assessment: Adult

Sex Determination: Unobservable

Stature: Unobservable

Platymeric Index: Unobservable

Platycnemic Index: Unobservable

Non-Metric Traits: Unobservable

Skeletal Pathology: None

Summary: SK113 was represented by a poorly preserved skeleton that was less than 25% complete. Dental attrition indicated that the individual was an adult. It was neither possible to determine sex nor to undertake any metric analysis due to the preservation of the skeletal elements. No pathological changes were observed.

SK120 [Grave 3]

Inventory: Cranial fragments (1 orbit observable); Mandible; T5-L5 Vertebrae; 8 left ribs and 12 right ribs; Incomplete left humerus, left radius and ulna; Complete right ulna; Fairly complete left femur and tibiae; Fairly complete ilia; Incomplete ischia and incomplete left pubis; Complete sacrum; Incomplete scapulae and right clavicle; Complete left patella; 1st and 2nd right metacarpals and 2nd left metacarpal; Right trapezium; 4 hand phalanges and 2 foot phalanges.

Completeness: 50-75%

Condition: Fair (Grades 2, 3).

Dental Inventory and Pathology:

120	*Observable Dentition*	*Observable Tooth Sockets*	*Ante-mortem Loss*	*Caries*	*Calculus*	*Periodontal Disease*	*Enamel Hypoplasia*	*Abscess*
n	7	12	0	0	3	3	0	0

Age Assessment: Age: 30+. Medial clavicle fused. Auricular surface stage 3-5 (some post-mortem surface erosion). Dental Attrition, stage 3; age 20-30.

Sex Determination: Possible Female. Pelvic morphology, female; Cranial morphology, unobservable; Metric data, indeterminate.

Stature: Unobservable

Platymeric Index: 76.6 (Platymeric).

Platycnemic Index: Unobservable.

Non-Metric Traits: None

Skeletal Pathology: Cribra orbitalia Grade 3 (Stuart-Macadam 1991). Micro- and macroporosity present in the left orbit. Right orbit unobservable.

Summary: 50-75% of the skeletal remains of SK120 were present and their condition was fair. However, many of the long bones were incomplete and it was not possible to undertake metric analysis for the purposes of estimating stature or assessing sex. Female traits were observed in the cranium and pelvis but these were incomplete. Assessment of age was based upon epiphyseal fusion and observations of the auricular surface, though the latter were limited by post-mortem erosion to the surfaces. The individual was estimated to be over 30 years of age at death. Dental attrition suggested that the individual might have been younger, between 20-30 years, but only half of the mandibular dentition was observable and it is not clear if this age is comparatively underestimated due to maxillary ante-mortem tooth loss or preferential chewing patterns. Cribra orbitalia was noted; this condition is generally thought to be related to megaloblastic or haemolytic anaemia occurring during childhood, possibly due to parasitic infection (Walker et al. 2009) and is recorded as present in an average of 7.6% of individuals from the Anglo-Saxon period in Britain (Roberts and Cox 2003).

SK123 [Grave 5]

Inventory: Complete Cranium (both orbits observable); Mandible; C1-C5, T1-T2, T5-L5 Vertebrae; 11 left ribs and 8 right ribs; Complete humerii, radii and ulnae; Complete femora, tibiae and fibulae; Fairly complete ilia, ischia and right pubis; Incomplete left pubis; Fairly complete sacrum; Fairly complete scapulae and clavicles; Complete patellae; Fairly complete sternum; 5 right metacarpals; 1st and 4th left metacarpals; 4th and 5th right metatarsals; 1st and 3rd left metatarsals; Tali; Left scaphoid; Right capitate; Calcaneii; Left Cuboid; Left Talus; 12 hand phalanges and 1 foot phalanx.

Completeness: 75>%

Condition: Fair (Grades 1, 2 and 3).

Dental Inventory and Pathology:

123	*Observable Dentition*	*Observable Tooth Sockets*	*Ante-mortem Loss*	*Caries*	*Calculus*	*Periodontal Disease*	*Enamel Hypoplasia*	*Abscess*
n	12	31	4	0	9	6	0	0

Age Assessment: Age: 35+. Medial clavicle fused. Auricular surface stage 4-6 (only partly observable).

Sex Determination: Male. Pelvic and cranial morphology, male; Metric data, male.

Stature: 1.78m (Femur)

Platymeric Index: 84.3 (Eurymeric).

Platycnemic Index: 70.8 (Eurycnemic).

Non-Metric Traits: Right femoral plaque, right transverse foramen bipartite.

Skeletal Pathology: Two fractures. The first fracture is well healed and to the lateral third of the left clavicle (see Plate 3). The bone has enlarged appearance at the site of the smooth bone callus where the fracture has healed. The bone is well aligned, though slight displacement has occurred with the medial 2/3rds of the diaphysis positioned anteriorly to the lateral third. The clavicle was not complete and any shortening of the element could not be assessed. The second fracture consists of an intra-articular fracture to the proximal end of the 1st left proximal hand phalanx (thumb), on its lateral aspect (see Plate 4). The fracture type is that of an avulsion fracture of the collateral ligament (See Berger and Weiss 2004, p. 180) and is denoted by discontinuity of the articular surface marked by a cleft in the bone running antero-posteriorly across the lateral corner of the base. The fracture is well healed and aligned, with no evidence of secondary joint disease.

Additional Observations: Green staining to the left hand side of the 4th lumbar vertebrae.

Plate 3: *Healed Fracture of the Left Clavicle (Top: normal right clavicle)*

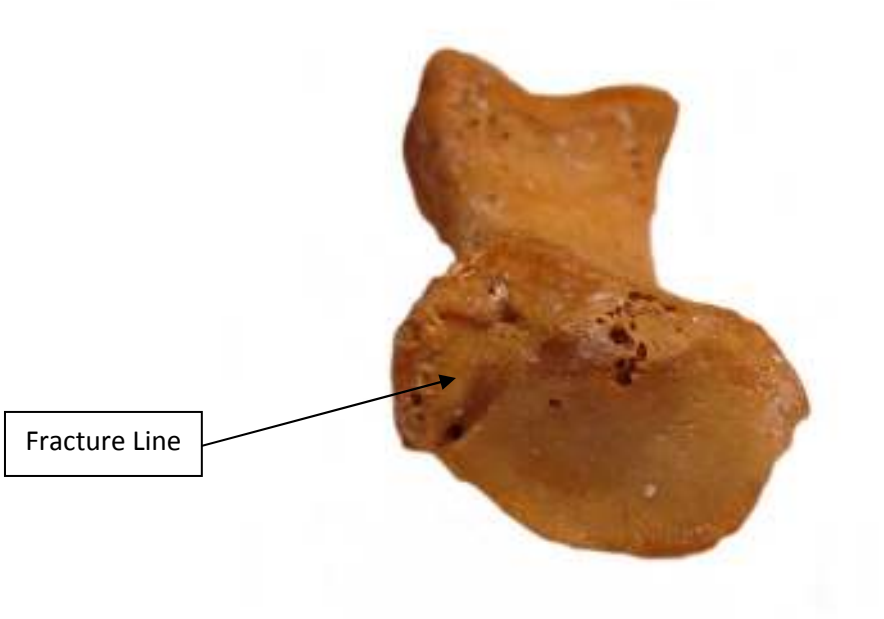

Plate 4: *Collateral Avulsion Intra-articular Fracture, Base of the 1st Proximal Hand Phalanx (thumb)*

Summary: The skeletal remains of SK123 are of fair condition and are 75>% complete. They represent a middle adult male individual of 1.78m stature. Ante-mortem tooth loss was noted with subsequent high levels of attrition on the remaining posterior dentition. Little pathology was noted in the spine. Two cases of trauma were observed in the left arm, however. One well healed fracture of the left clavicle and one well healed intra-articular fracture to the left 1st proximal phalanx were recorded. Fractures to the clavicle are recorded in 2.1% of those observable across sites dating to the Anglo-Saxon period (Roberts and Cox 2003). Fractures to the clavicle most commonly occur as a result of a direct fall onto the shoulder or sometimes a fall onto an outstretched hand where forces are transmitted through the hand and forearm to the clavicle (Salter 1999). Given this latter scenario, it is possible that the intra-articular fracture observed to the left thumb may have occurred at the same time as the fracture to the clavicle. In young and middle aged adults, fractures of the clavicle are usually associated with a moderate or high energy impact injury resulting from falling from a height, vehicle accident or sporting activity such as horse-riding (Iannotii and Williams 2007). Collateral ligament avulsion fractures of the base of the proximal phalanx are also frequently caused by athletic activities (Berger and Weiss 2004). Fracture to the hand bones is only recorded in 1.0% of those observable from contemporary sites (Roberts and Cox 2003).

SK126 [Grave 6]

Inventory: Complete Cranium (both orbits observable); Mandible; C1-L5 Vertebrae; 12 left ribs and 12 right ribs; Almost complete humerii with complete radii and ulnae; Incomplete right femur, tibia and left fibula with complete left femur, tibia and right fibula; Incomplete right ilium, ischium and pubis; Fairly complete left ilium, ischium and pubis; Incomplete sacrum; Incomplete scapulae and complete clavicles; Complete left and incomplete right patellae; all metacarpals; 2nd, 4th and 5th right metatarsals; 5 right and 6 left carpals; all right and 3 left tarsals; 8 proximal, 10 middle and 6 distal hand phalanges; 1 proximal foot phalanx.

Completeness: 75>%

Condition: Fair-Poor (Varied) (Grades 2, 3, 4 and 5).

Dental Inventory and Pathology:

126	*Observable Dentition*	*Observable Tooth Sockets*	*Ante-mortem Loss*	*Caries*	*Calculus*	*Periodontal Disease*	*Enamel Hypoplasia*	*Abscess*
n	32	24	0	1	27	14	0	1

Age Assessment: Age: 50+. Auricular surface stage 7; dental attrition 40+.

Sex Determination: Female. Pelvic and cranial morphology, female; Metric data, female.

Stature: 1.53m (Radius)

Platymeric Index: 89.0 (Eurymeric).

Platycnemic Index: 77.0 (Eurycnemic).

Non-Metric Traits: Right mastoid foramen extrasutural; left double superior atlas facet.

Skeletal Pathology: Three fractures. One healed ante-mortem fracture to the distal left radius (Colles Fracture) with a co-occurring avulsion fracture of the styloid process of the ipsilateral ulna (See Plate 4). Colles fractures are common in the elderly and are the result of a fall onto an outstretched hand; co-occurrence of an avulsion fracture to the styloid process of the associated ulna is common (Salter 1999). The Colles fracture is well healed but significant posterior angulation has occurred of approximately 30 degrees. No secondary degenerative joint disease is present to the distal articular surface of the radius though extensive remodelling of the distal radioulnar joint was noted. Also present is an unhealed ante-mortem subtrochanteric fracture of the right femur that was identified on site from the position of the fractured fragments *in situ* (See Plate 5), indicating non-union of the fracture. Despite the complete lack of apposition between the proximal and distal diaphyseal parts, there is significant remodelling of bone around the fractured edges in the form of smooth and porotic lamellar bone growth, in some

places with a fibrous, spiculated appearance, indicating that the bone had been fractured at least 4 weeks prior to death (Vigorita 2008). The fractures edges were irregular and in part had the appearance of rounded trabecular bone. A substantial area of bone, proximal to the fracture edge in the proximal portion and distal to the fracture edge in the distal portion, had a roughened, spiculated appearance to the periosteal surface, suggesting that some 'soft callus' was still present at the fracture edges. The fracture was oblique and the proximal and distal portions overlapped approximately 10cm *in situ*, with the distal portion displaced medially alongside the laterally lying proximal part, caused by a post-traumatic muscle spasm.

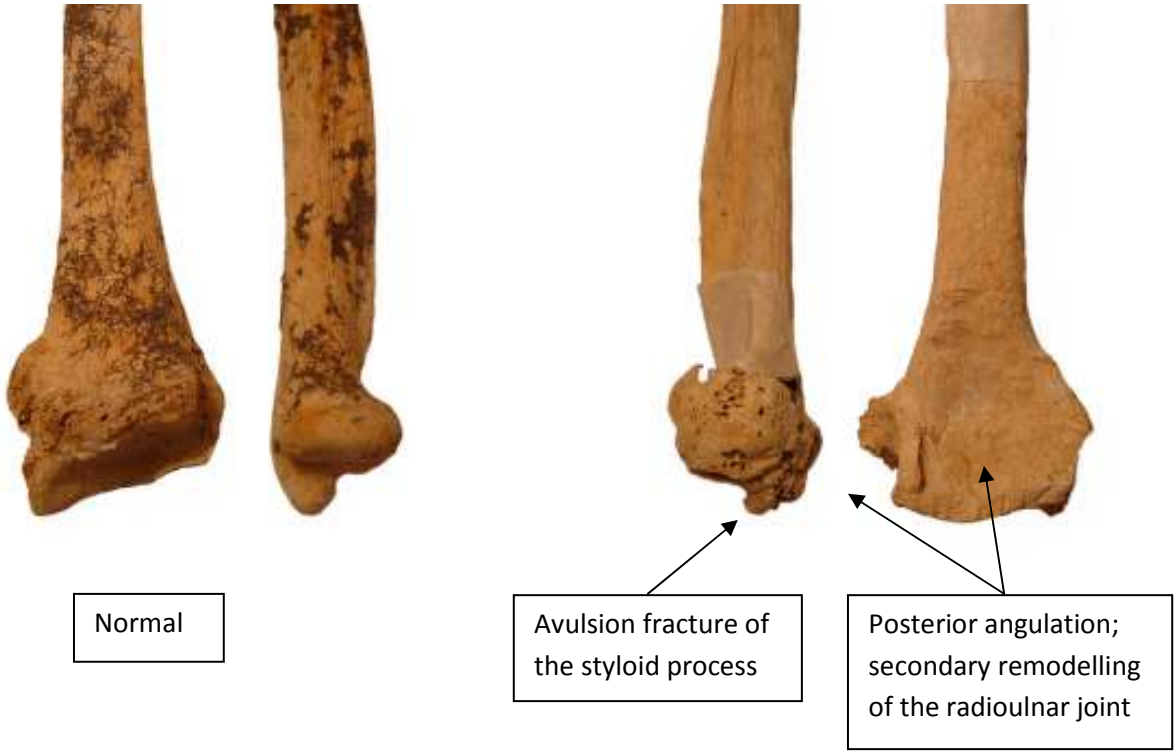

Plate 5: *Colles Fracture of the Left Radius with Co-Occurring Avulsion Fracture of the Ulnar Styloid Process. Anterior View.*

Plate 7: *Unhealed Ante-Mortem Subtrochanteric Fracture of the Femur as positioned in situ (Inset: Detail of fracture surfaces)*

In addition, a developmental defect was noted in the cervical vertebrae in the form of block vertebrae, whereby C2 and C3 were fused together via synostosis of the zyapophyseal joints. This is the result of a segmentation failure during the development of the vertebrae. C2 and C3 are the most commonly affected vertebrae in this condition and the symptoms are mild if present at all (Barnes 1994). Some degenerative joint disease was present in the C3-C4 and C7-T1 zygapophyseal joints, which was probably secondary to the block vertebrae. Other than these changes only very minor joint disease was observed in the spine. Some minor degenerative joint disease was also present in the superior aspects of the acetabula (hip) manifested by evidence of microporosity and subchondral cysts. Loss of height was also noted in one lumbar vertebrae,

possibly L2 or L3, resulting in shortening of the anterior vertebral body, most notably on the left hand side resulting in anterolateral wedging. This may have been the result of a compression fracture secondary to osteoporosis, with which Colles fractures are also associated (Brickley and Ives 2008, Salter 1999). Such an underlying condition may also have contributed to the unusual femoral facture. However, the pathognomic biconcavity of vertebral bodies noted clinically in the gross pathology of osteoporosis was absent in the spine.

Summary: SK 126 represents an old female adult of a stature of 1.53m. The skeletal remains were fairly complete but poorly preserved. Nonetheless, several pathological conditions were noted, namely a well healed Colles fracture to the left radius with co-occurring avulsion fracture to the styloid process of the ipsilateral ulna as well as an unhealed ante-mortem subtrochanteric fracture of the right femur. A loss of height of one of the lumbar vertebrae may be a result of a compression fracture indicating an underlying condition of osteoporosis, which may have predisposed this individual to the fractures sustained. Block cervical vertebrae (C2-C3) were also noted, occurring as a developmental defect but likely to have been asymptomatic. Fractures of the radius have been noted in 1.2% of those observable from contemporary sites (Roberts and Cox 2003). Fractures of the femur in the Anglo-Saxon period, however, were rare, with a prevalence rate of only 0.7% (Roberts and Cox 2003) and clinically are often associated today with high velocity impact injuries, such as those caused by motor vehicle accidents. Such fractures are unstable and commonly lead to massive internal haemorrhage and shock (Salter 1999).

SK131 [Grave 9]

Inventory: Incomplete cranium (both orbits observable); Mandible; T12-L5 Vertebrae; 5 left ribs and 3 right ribs (with many diaphysial fragments); Complete humerii and right radius with incomplete left radius and ulnae; Complete left femur and incomplete right femur, tibiae and fibulae; Incomplete iliae, right ischium and left pubis; Incomplete sternum; Incomplete sacrum; Incomplete scapulae; complete clavicles; Complete right patella; Tali; Left Calcaneus; Left 1st Cuneiform; 1 unsided Navicular.

Completeness: 50-75%

Condition: Fair (Grades 1, 2 and 3).

Dental Inventory and Pathology:

131	*Observable Dentition*	*Observable Tooth Sockets*	*Ante-mortem Loss*	*Caries*	*Calculus*	*Periodontal Disease*	*Enamel Hypoplasia*	*Abscess*
n	27	29	0	0	19	0	8	0

Retention of the deciduous second mandibular molars.

Age Assessment: Age: 18-24. Dental attrition 18-24; Epiphyseal fusion 17-25.

Sex Determination: Female. Pelvic morphology, possibly female; Cranial morphology, female; Metric data, female.

Stature: 1.61m (Humerus)

Platymeric Index: 85.6 (Eurymeric).

Platycnemic Index: Unobservable.

Non-Metric Traits: Septal Aperture Left Humerus.

Skeletal Pathology: None

Summary: The skeletal remains of SK131 were 50-75% complete and in fair condition. Epiphyseal fusion and dental attrition assessment indicated that these remains represented a very young adult individual, aged between 18 and 24 years at death. A dental anomaly was noted consisting of the retention of the second deciduous mandibular molars; therefore, no second mandibular permanent premolars were present. No skeletal pathology was observed.

SK140 [Grave 11]

Inventory: Cranial fragments (no orbits observable); 3 Thoracic and 2 Lumbar vertebral arches; 1 left rib and 2 right ribs; Incomplete humerii; Incomplete femora, tibiae and fibulae; Incomplete ilia; Incomplete left scapula.

Completeness: <25%

Condition: Fair (Grades 3, 4 and 5).

Dental Inventory and Pathology:

140	*Observable Dentition*	*Observable Tooth Sockets*	*Ante-mortem Loss*	*Caries*	*Calculus*	*Periodontal Disease*	*Enamel Hypoplasia*	*Abscess*
n	2	0	-	0	0	-	0	-

Age Assessment: Age: 14-20 (16-18?). Dental development, 11.2+-13.7+; Epiphyseal fusion, 11-20.

Sex Determination: Unobservable

Stature: Unobservable

Platymeric Index: Unobservable

Platycnemic Index: Unobservable

Non-Metric Traits: Unobservable

Skeletal Pathology: None

Summary: SK140 represented the remains of an adolescent, with a total age range of between 14 and 20 years at death, though most skeletal indicators observed suggested an age in the middle range of this estimate, of between approximately 16 and 18 years. The remains were less than 25% complete and poorly preserved. No dental or skeletal pathology were noted.

SK188 [Grave 12]

Inventory: Cranial fragments (no orbits observable); 3 Cervical, 16 Thoracic and 32 Lumbar vertebral arches; 6 left ribs and 4 right ribs; Possible incomplete ulna, unsided; Incomplete femora, tibiae; Incomplete left ilium; Incomplete left clavicle.

Completeness: <50-75%

Condition: Poor (Grades 4 and 5).

Dental Inventory and Pathology:

188	*Observable Dentition*	*Observable Tooth Sockets*	*Ante-mortem Loss*	*Caries*	*Calculus*	*Periodontal Disease*	*Enamel Hypoplasia*	*Abscess*
n	15	0	-	-	-	-	-	-

Age Assessment: Age: 3-4 months. Dental development, 3-6 months; Epiphyseal fusion, <1-2 years.

Sex Determination: Unobservable

Stature: Unobservable

Platymeric Index: Unobservable

Platycnemic Index: Unobservable

Non-Metric Traits: Unobservable

Skeletal Pathology: None

Summary: The remains of SK188 represented a young infant aged between 3 and 4 months. The remains were between 50-75% complete but poorly preserved so metric analysis was not possible. However, the dentition present provided an accurate age at death. No skeletal pathology was observed.

SK193 [Grave 15]

Inventory: Incomplete femora and unsided fragment of tibia.

Completeness: <25%

Condition: Poor (Grades 4 and 5).

Dental Inventory and Pathology:

193	*Observable Dentition*	*Observable Tooth Sockets*	*Ante-mortem Loss*	*Caries*	*Calculus*	*Periodontal Disease*	*Enamel Hypoplasia*	*Abscess*
n	0	0	-	-	-	-	-	-

Age Assessment: Age: Unobservable (adolescent/adult).

Sex Determination: Unobservable

Stature: Unobservable

Platymeric Index: Unobservable

Platycnemic Index: Unobservable

Non-Metric Traits: Unobservable

Skeletal Pathology: None

Summary: Only poorly preserved fragments of femora and tibia were present from which liitle osteological observations could be made. The size and robustness of the fragments suggested that the individual was at least of older adolescent age and may well have been adult. No pathology was observed.

Context 208 [No Grave]

One long bone fragment was recovered from context [208]. The fragment measured 3.5 x 1.5cm approximately. It is likely that the fragment is human bone and may have originated from a humerus; however, there no diagnostic anatomical landmarks were observed and the cortex was heavily eroded, so no conclusive identification could be made.

4. Conclusion

Approximately half of the assemblage of the human skeletal remains from the Kingston Down Anglo-Saxon burial ground was in fair condition and over half were over 50% complete. Those that were less complete also tended to be those that were in poorer condition. Although the bone was observed to be light and very fragile, the careful re-excavation of the graves has yielded skeletal remains of sufficient bone content to enable the age, sex and/or stature of 70% of those retrieved to be determined. It is clear that both adults and sub-adults are present in this assemblage despite the post-deposition disturbance and that sufficient osteological evidence can be obtained to provide a representative demographic profile of the population. To date, the remains of two males and three female/possible females have been identified as belonging to either very young adult, middle adult or old adult age groups, in addition to two sub-adults that were identified through osteological analysis to be an infant and an adolescent.

There was no duplication of elements within any one context and therefore, each context contained the remains of only one individual. It is very likely the human remains recovered were still associated with their original grave. The re-deposition of the human remains following the excavation of the graves in the 18th century appears not to have had any direct deleterious impact on the condition of the skeletal elements although elements from some graves have clearly been lost through either artificial removal or taphonomic factors i.e. burrowing.

Despite the preservation conditions, several interesting and, indeed, rare examples of pathological conditions were observed that provide a unique source of information regarding the lifestyle and health of the Anglo-Saxon population at Kingston Downs. Five examples of traumatic injury were found in addition to one metabolic and one developmental condition as well as one case of severe spinal degenerative joint disease. In addition, one case of osteoporosis was suspected. Cases of dental disease were also noted throughout the assemblage. Some elements also exhibited stain marks assumed to be caused by *in situ* corrosion of once associated grave goods. Any further skeletal remains excavated would have significant potential of adding to the osteological evidence already obtained from the small sample analysed here. As illustrated, it is likely that the bio-profile of the incumbents of the majority of any individual graves re-excavated could be determined using osteological analytical techniques with the potential for future study into the funerary archaeology and related areas outlined in the current regional research framework.

5. Future Recommendations

The osteological analysis of the sample of human remains recovered from the recent archaeological investigations at Kingston Down Anglo Saxon burial ground indicates that future excavations would reveal further human skeletal remains that are of sufficient bone content to yield useful data regarding the health and lifestyle of the population. It should also be possible to establish the bio-profile of the individuals interred in graves with sufficient skeletal content.

AMS dating of the human remains may be possible where bone is present in sufficient quantities and in a suitable state of preservation, if any independent dating evidence is required.

Stable isotope analysis of the dental sample should also be considered. This can be used to provide information on origins and migration as well as diet that cannot be obtained through other means.

The human skeletal remains in this assemblage are very fragile and are not suitable for use as a teaching assemblage. However, modern curation techniques such as 3D scanning would permit the public to access and visually appreciate the skeletal remains, creating an opportunity to create a virtual educational resource.

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THE ARCHIVE

Type	No	Type	No
Skeleton Recording Form A	11	Skeleton Recording Form L	1
Skeleton Recording Form B	7	Skeleton Recording Form P	2
Skeleton Recording Form D	7	Skeleton Recording Form Q	3
Skeleton Recording Form E	7	Skeleton Recording Form R	2
Skeleton Recording Form F	2	Skeleton Recording Form S	0
Skeleton Recording Form G	2	Skeleton Recording Form V	0
Skeleton Recording Form H	7	Skeleton Recording Form W	4
Skeleton Recording Form I	7	Articulated Anglo-Saxon Inhumated Db	1
Skeleton Recording Form J	7		
Skeleton Recording Form K	4		