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Peopling Portland's Past: A paleodemographic, osteological and funerary investigation of the burial population excavated from the site of St. Andrew's Church, Portland, UK.

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Contents

Abstract

The current project investigated the osteology, funerary archaeology and demography of the multi period site of Portland St. Andrew's Church, Dorset, UK. The osteology and archaeology of the site were united through a comprehensive analysis of human skeletal remains and the creation of a complete burial plan. Demographical data concluded typical findings regarding biological sex and age-at-death categories, minimal trauma with joint disease the most common pathological condition in this burial population. No associations were made regarding age-at-death, biological sex, or pathological conditions in relation to spatial organization of burials at the site. Comparison to other post-medieval sites concluded no differences regarding geographical location in relation to health, nutrition, and disease. This study has complimented previous research by creating a wholesome image of the equally important archaeology and osteology of the site, thus revealing further of the people of Portland's past.

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Abbreviations

PSA – Portland St. Andrew's

COC – Chelsea Old Church

SM – St. Martin's Church

PS – Pubic symphysis

AS – Auricular surface

CSC – Cranial suture closure

GSN – Greater sciatic notch

IPR – Ischio-pubic ramus

OA – Osteoarthritis

TB – Tuberculosis

OCD – Osteochondritis Dissecans

YA – Young adult

MA – Middle adult

M – Male

PM? – Probable male

F – Female

PF? – Probable female

DJD – Degenerative joint disease

LEH – Linear enamel hypoplasia

CO – Cribra orbitalia

PH – Porotic Hyperostosis

AMTL – Ante mortem tooth loss

SK – Skeleton

CV – Cervical vertebra

TV – Thoracic vertebra

LV – Lumbar vertebra

Chapter 1

Introduction and Background

1.1 Introduction

The redundant church of St. Andrews, (SY 6968711) is located on the east region of the Isle of Portland, a 'tied island' positioned approximately 5 miles south of Weymouth and forming the southernmost point of the English county of Dorset (see Figure 1). Portland St. Andrew's (PSA) was the first parochial church of Portland and was in use from the 12th century until its closure in AD 1756. Original excavations undertaken by J.M Head in 1898 revealed varying phase and structural components to the church fabric. Further excavations conducted in the 1980's uncovered human burials in and around the church foundations. At the time of this latter excavation the human remains were not analysed by an osteologist, with some not even lifted as they were reburied soon after they were photographed and recorded. The skeletal remains that were retained have since been curated at Bournemouth University. During the years since, aspects of the assemblage have been the subjects of sporadic attention as the subject of Bournemouth MSc student projects, although these works are now out-dated and were unable to integrate their results with the wider archive of archaeology from the site. Although burial management was touched on in a preliminary study undertaken at undergraduate level with regards to several communal graves at PSA, this aspect is studied in greater detail by the current project. The present study therefore sets out to record and analyse the surviving skeletal assemblage from PSA, applying modern standards and methods, with a view to placing the results in their wider archaeological context.

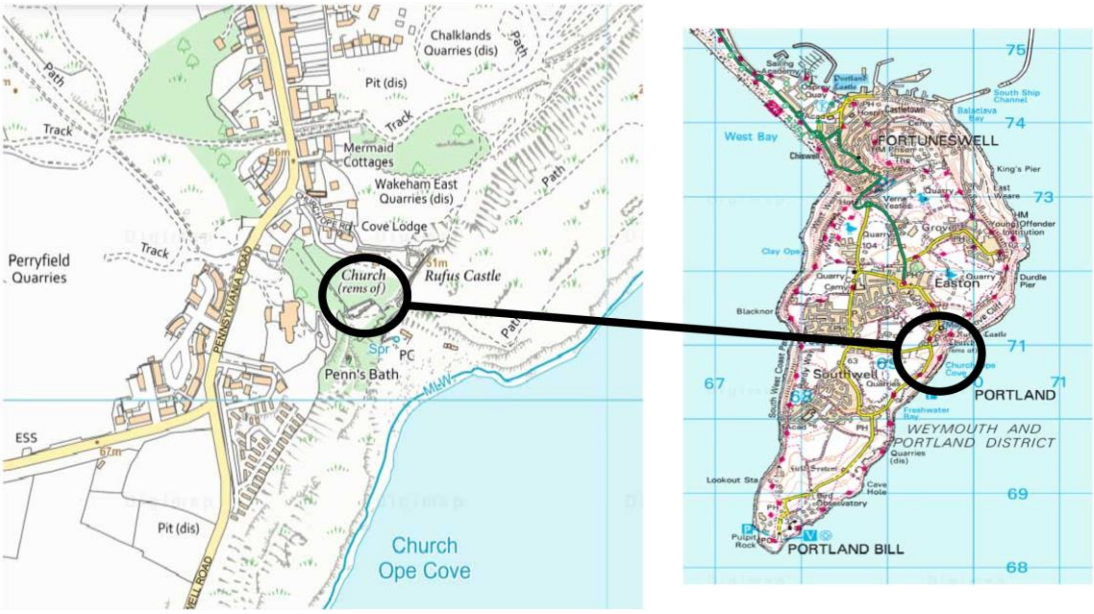

Figure 1 – Ordnance survey map showing the geographical location of Portland St. Andrew’s (circled) in relation to the Isle of Portland, UK (Digimap).

The current project presents a comprehensive skeletal analysis to investigate the past population of Portland and interpret the results in relation to the wider context of post-medieval cemetery analysis. The project also considers the arrangement and orientation of burials and phasing to further understand the demography and health status of this population sample. In order to investigate the orientation and phasing of burials located at PSA, the current project has involved study and digitization of the original burial plans recorded on the 1980’s site drawings, as part of a wider initiative to collate and interpret the overall archive from the fieldwork conducted four decades ago.

1.2 Background

Portland lies in the most southerly point of Dorset, UK. Referred to as the Isle of Portland, as in the past during extreme weather conditions the island faced exclusion from the mainland. PSA was the first church on the island. The ruined stone structure covered by the present study is thought to post-date an earlier Anglo-Saxon church on the site and was in use for five centuries before it was abandoned in the 18th century due to various structural issues. During its use, as well as post-abandonment, numerous burials took place here. During a conservation programme in the 1980's approximately eighty-five human burials was uncovered (Hunt 1982, 127), after excavation they were placed under the care of Bournemouth University (where they currently remain). This collection is of particular interest in consisting of a somewhat secluded, literally insular population, and so an in-depth skeletal analysis is further justified in this context.

The surviving ruins of the church of Portland St. Andrew's are situated in the area known as Church Ope Cove on the Isle of Portland (see Figure 2). PSA in AD 1475 was dedicated to St. Andrew (Hutchins 1863, 125). PSA fell victim to fire damage in the 13th century and later faced further structural damage after it was torched by French raiders, therefore, requiring rebuilding on numerous occasions (Head 1898, 125). Furthermore, a geological fissure caused structural damage to the church in the 16th-17th centuries (Hunt 1981, 92) as well as landslides also affecting the area during this period (Hutchins 1863, 826). Unfortunately, PSA succumbed to the aforementioned damages and issues, with the closure of the church in AD 1756.

Figure 2 – The now ruins of Portland St. Andrews (centre) and its location within the vicinity of Church Ope Cove, Portland (Photograph by Alan Hunt).

1.3 19th Century Excavations

In AD 1766 Portland's second parochial St George's Church was constructed with materials recycled from PSA, after its AD 1756 abandonment and part demolition (Hutchins 1863, 829).

Original excavations were carried out in the 1890's by J.M Head (the then owner of nearby Pennsylvania Castle) whereby phasing and original structure was determined on the ruins of PSA. Excavation commencing at the south end of the chancel clearly displayed evidence of a former foundation passing under the current one. Evidence the church was reworked in the same time period is evident as both internal and external building material appears similar (Head 1898, 124). Additionally, the later church foundations are evidently not in line with the original church foundations. Furthermore, there is apparent evidence of Saxon origin, exhibited in the walls on the northeast side of the church (Head 1898, 127). The original structure shows great workmanship claimed by Head (1898, 125), whereas the latter structure has been noted as that of the complete opposite. A trace of fire was also identified at PSA located at the east end of the first doorway and the aisle adjacent to this doorway, in the form of red and blackened marks on pavement and wall (Head 1898, 125).

1.4 20th Century Excavations

Conservation programmes were carried out in the 1970's - 80's at the site of PSA. Beginning in 1978 clearance and consolidation carried out by the Department of the Environment and the Dorset County Council (with financial aid coming from the Manpower Services Commission) began on the detached west tower of PSA (Hunt 1981, 92). In 1980 once clearance was complete, excavations began on the interior foundations of the church; the purpose of the consolidation was to recognise PSA as an ancient monument from the surviving ruins. From 1980, the Manpower Services Commission carried out excavations with funding coming from the Portland Field Research Group.

The western part of the 12th century nave was demolished in mid-13th century and a larger one constructed containing south aisle bays (Head 1981, 92). Later identified as occurring in the 14th and 15th centuries a south porch was erected and the nave extended, with the west tower constructed in the 15th century. With this feature of the west tower being of uniqueness due to its dual function, although detached from the main structure it also held great importance due to its access link to the north and south of the churchyard. The subsequent structural damage that occurred to PSA was due to a geological fissure running under the south-east corner of the chancel and east end of the aisle in the 16th and 17th centuries (Hunt 1981, 92). In response to concern over safety issues the eastern part of the aisle was removed in the latter part of the 17th century, where rebuilding occurred on the upper part of the nave wall. Furthermore, a large buttress was constructed to support the wall, during this time it appears the south wall of the chancel was narrowly restored (Hunt 1981, 92).

Areas of the nave floor appeared to be made up, with Alan Hunt (project supervisor) claiming that full understanding would only be established with further excavation. Several medieval grave covers made up the floor turning into use of a pavement. The majority of this group was provisionally assigned to the 13th century, due to the incised and raised designs present (Hunt 1981, 92). Even though church services resumed elsewhere after the closure of PSA in 1756, the presence of two headstones dated 1758 and 1764 indicated that PSA was still used a burial ground (Hunt 1981, 92). Adjacent to the north of the church, small scale excavations were carried out, demonstrating this area was used for human burials - where it became evidently clear the arrangement of the burials changed during its use of a burial ground in this area (Hunt 1981, 92).

Further excavations were carried out the following year, this time with the help of archaeology students from the Dorset Institute of Higher Education (now Bournemouth University). The excavations carried out during this part of the conservation programme entailed the opening of the adjacent north area to the church, and in the nave and aisle of the church (Hunt 1982, 127). Evidence of earlier church foundations were discovered in three areas of the nave, due to the fragmentary remains of the earliest foundations it was impossible to determine an exact date, however, it is identified as being a minimum of 18 metres in length (Hunt 198, 127).

The construction of the 12th century church coincides with the filling of the well, as this appears to be filled with builders waste. Therefore, indicating by the 12th century the pre-conquest settlement in the north area of the church had migrated or reduced (Hunt 1982, 127). PSA was identified as having a central lantern tower and to have been more elaborately built than originally thought, due to the further excavations in 1981. The beginning of the lantern tower consisted of the north door, the bases of the chancel arch and the chancel. Further, in the 12th century an adjunct was added to the south of the lantern town. A south porch was constructed in 14th century, with the nave extended by 9 metres. Following on in the 15th century a detached west tower was constructed.

As previously mentioned, landslides and other structural issues were a major concern for the stability and safety of PSA, therefore, in 1620's a wall known as 'Church Yard Banks' was constructed on the seaward side of PSA. Unfortunately, PSA faced further issues after the Southwell Landslip in AD 1675, causing considerable damage, especially with the combination of the underlying fissure. Eventual abandonment of PSA was therefore inevitable. During this part of the project in 1981 around 85 human burials were located behind the 12th century north door (see Figure 3). It was identified that burials began in this area in 14th century after the north door was blocked - with burials potentially continuing here until the opening of St George's, Reforne Church in AD 1766 (Hunt 1982, 127).

Figure 3 - Human skeletal remains being excavated outside the northern door of PSA (Photograph by Alan Hunt).

Burial arrangement changed considerably during this period at PSA, as original burials appear to be sporadically interred, in comparison to later burials which were placed in a more uniformly laid out approach. Although an exact date of when this burial arrangement changed cannot be completely determined (Hunt 1982, 127). Also, during an excavation at PSA in 1981 two communal graves were uncovered within the church itself, hypothesised by Hunt to be the result of shipwreck casualties, although no time frame can be placed onto both communal graves, it is assumed that they are associated to the post abandonment of the church (Hunt 1982, 127).

1.5 Previous Osteological Studies of the PSA assemblage

With regards to a skeletal assemblage it is important to determine an individual's likely cause of death where possible, however, it is also useful to understand as much as possible regarding their personal and individual life history for one to try to comprehend who this individual was and how they lived (Gilchrist 2000, 325). The osteological paradox is a term coined by Wood et al (1992) that explains resilience (no presence of disease = surviving ill health) or frailty (ill health) with regards to pathological lesions on the skeleton. However, this does not mean that individuals without the presence of skeletal lesions were healthy as they may have died from an acute illness or through a freak accident (for example drowning). However, it can be difficult to measure frailty of individuals as they may have a compromised immune system. Furthermore, an issue with the osteological paradox concerns the pathological lesions – for these to appear on the skeleton the individual would need to survive the disease for a considerable period of time.

Additionally, it is advantageous to combine the knowledge of individual identity as well as a group in determining how that connection works (Tyrrell and Frazer 2000, 3). Although an ‘osteobiographical’ approach analysing a single individual can gather a fruitful amount of data, analysing a ‘population’ sample can delve deeper into a specific community and provide a more holistic view of activity, nutrition, disease and overall lifestyle these individuals led. Data gathered on: biological sex, age-at-death, trauma and pathology enables anthropologists to understand how an individual or population lived, survived and ultimately died (Byers 2012, 174).

Through the bones and teeth of an individual life events can be recorded, therefore, providing an insight into the health of populations (White and Folkens 2005, 309). Teeth are exceptionally important as they directly interact with the environment, providing a wealth of knowledge not only on the health of individuals but their diet too (White and Folkens 2005, 309). Teeth are also an important factor in age estimations of individuals, especially younger individuals regarding tooth eruption (Hillson 2005, 5). Deborah Allen conducted initial post-excavation analysis on the human remains from PSA in 2000, whereby the dental health and oral hygiene of this population sample was investigated, by using a combination of mixed dentition (both juvenile and adult). A comparative site (Blackfriars, Suffolk) was used; however, this was concluded to be of limited use as the sample size from PSA was too small (31 burials altogether, 26 adult and 5 juvenile skeletons). Allen noted the location of the original bone reports was unknown as well as documentation regarding the majority of burials. Although a few drawings were available of burials in situ from the church grounds, their placement in relation to the church was unclear. It was concluded that for future work dental wear and prevalence of caries should be investigated further, as well as considering the demographics of the sample in order to determine patterns and/or differences.

Other data that can be collated from human remains includes that relating to stature, there are many factors which may influence an individuals stature, such as: age, sex and hereditary factors (Cornwall 1974, 193). Nutrition (especially during infancy and childhood) plays a pivotal role with regards to affecting ones height and growth spurts during adolescence (Boix and Rosenbluth 2017, 33; Victora et al 2008, 302). Benjamin Woolgar recorded human height of the PSA skeletal collection in 2001 during a MSc project at Bournemouth University. There were a couple of issues with this project, the first being the ratio of male to female in the sample (18:2) indicating an unbalanced ratio of the population itself. Secondly, the formula used for the stature estimation derives from Trotter and Gleser (1952; 1958), whereby the sample consisted of American military personnel from WWII and individuals from the Korean War. Therefore, the stature estimation formula was not appropriate or applicable for this sample, as individuals from PSA are of an archaeological context, not a modern one (Jantz 1992, 1234). Woolgar identified that going forward the unmarked graves should be investigated in order to determine their location to the church itself. Furthermore, Woolgar mentioned, as there is no record available as to who is interred within the unmarked grave DNA analysis would of likely potential use in the future.

Paleopathology plays an important role regarding the analysis of archaeological collections (Buikstra 2019, 11). In order to establish an ancient disease the first step in the process is to observe and distinguish pathological changes to bone, then to determine a pattern across a skeletal sample (Buikstra 2019, 13). Regarding the PSA collection, there were two previous MSc students whereby paleopathology was observed and analysed, these projects were carried out by Ann Robilliard in 2002 and Amy Raes in 2004.

Robilliard (2002) investigated the presence of degenerative joint disease (DJD) of the skeletal assemblage from PSA. This study analysed six specific DJD's, with the focus on adult skeletal material (as DJD's are associated with age, therefore, infants and juveniles were excluded). An issue with Robilliard's study found due to the minute sample size for females with osteoarthritis, comparisons could not be carried out. Furthermore, Robilliard stated documentation regarding several burials was missing, as these were clearly visible in photographs and excavation drawings etc. Furthermore, Robilliard expressed the importance of having one collective plan displaying all burials at Portland St. Andrew's which at the time did not exist.

In addition, Raes (2004) conducted a skeletal analysis of the PSA collection with regards to skeletal health indicators and used two comparative sites, one urban and one rural population (St Augustine the Less and the Isle of Ensay). Various health indicators were identified and recorded for this population sample, such as metabolic disease and neoplastic disease etc. However, no clear distinctions of skeletal health indicators were identified from the comparative studies (Isle of Ensay and St Augustine the Less) to PSA (Raes 2004, 116). Further study on the skeletal assemblage, such as recording non-metric traits may aid in determining dominant and recessive traits to assist in the investigation of Portland's population. Furthermore, a limited amount of specific diseases/variations were identified in the study, therefore, it would be beneficial to explore these in greater detail, to identify potential links to the population itself.

As mentioned, the unpublished student theses (above) suffer from a lack of a clear single plan of location of the communal graves identified at PSA. However, Jon Milward (of Bournemouth University) has recently produced an extensive plan of Portland St. Andrew's containing the locations of the communal graves and church structural evidence. The current project has further improved this situation by combining this extensive plan with a plan of the single interments as recorded at excavation. This will enable other researchers to survey the relationships of those interred in relation to the church itself.

1.6 Understanding the spatial organization of a churchyard

Burials with their contents enable anthropologists to extract a wealth of knowledge from the human remains, such as: diet, ancestry, pathology, and health of an individual (Bahn 1984, 136). It was in the 8th century where burial in churches and churchyards was introduced to England by Cuthbert, Archbishop of Canterbury (Smith 1852, 13; Rugg 2000, 266). With regards to the individuals interred at PSA it is important to consider 'grave types', relating to the means of burial, as in the overall structure of the grave and how the body may be contained, such as: coffin, earth grave, cist burial etc (Buckberry 2007, 117). However, money has been identified as a primary concern, not style or location when it came to the burial of an individual, as well as their connection to a specific parish (Williams-Ward 2017, 29). Socio-economic status played an extensive role in cemetery organization in the post-medieval period in England, those of higher status buried in the southern side of the church and individuals identified as the lower end of the hierarchy buried in the northern area of the churchyard (Parker Pearson 1999, 14). Furthermore, assemblages that span the medieval and post-medieval periods like PSA, can lead to a number of difficulties, such as causing difficulties in determining the stratigraphic data, for example in terms of intercutting graves or coffins being placed on top of one another (Boyle 2015, 40).

With regards to the funerary context, attention is focused on the organization of the corpse, funerary monuments as well as the skeletal material itself (Ucko 1969, 264). Cultural patterns and social status of individuals interred within a churchyard may be determined once the spatial organization has been analysed (Craig and Buckberry 2010, 128). Intramural burials were identified as having a greater social status than lay individuals who were interred in the churchyard (Adams 2006, 6). However, Houlbrooke (1999, 193) found that individuals buried in the church itself or the churchyard was in fact dependent on the space available and not associated to the social views of burial within the churchyard. Within enclosed churchyards, through excavation it becomes evident that limited burial space is an issue, due to the presence of overlapping graves (Kenzler 2015, 149).

Regarding the surviving processes of mortuary practices, it is vital to understand both the place and space of death (Charles and Buikstra 2008, 21). The importance of burying the dead gives the living a way to view their ancestors. Furthermore, a living identity is then created due to long term placement of the dead (Silverman

2008, 4). Through spatial practice it was believed that holiness could be physically located, therefore, leading to consciousness of interment. Whereas, the funeral itself and the physical memorials are associated more with prayer (Harding 2002, 5).

Funerary practice in post-medieval England is of a complex nature, including monuments marking the grave, the funeral itself, organization, and structural changes to location of those interred as well as textiles used in the burial process (Cox 1998, 1). A continuation for a process that had occurred for centuries, majority of individuals buried in England from AD 1558-60 were interred into unmarked graves (Gittings 1999, 166). Positioning of human remains when interred can aid in identifying materials/fabrics in which they were buried in, for example it may be evident that funerary shrouds had been used if an individual appears to have their arms across their chest – due to them being tightly wrapped (Buteux and Cherrington 2006, 27). A tightly fitted shroud around the body enables those handling the corpse, making it easier to handle in a coffinless burial. However, if there was the presence of a coffin then the shroud could be loosely fitted to the body (Horrox 1999, 99).

Some instances display divisions between social classes, with some churches displaying further imbalances, for example individuals whose cause of death was suicide were buried in the unfavourable vicinity of the church ground in the northern region (Gittings 1999, 150). Furthermore, individuals denied burials within consecrated grounds involved: criminals, unbaptised children and those who committed suicide (Rugg 2000, 265-6).

Intercutting burials were present in the northern area to the church of PSA. There are a few reasons for which graves may be intercutting, including: burials were consciously avoided, not marked, or were simply not remembered. Burials taking place in community cemeteries were placed in neat rows, in supine position with their heads normally positioned west (Tarlow and Battell-Lowman 2018, 31-2). Graves displaying evidence of intercutting of one another may be associated with execution cemeteries, as they vary in burial orientation, with overcrowding another possibility. In community cemeteries most individuals are buried in supine position with heads west and feet easterly facing. However, intercutting graves vary in positioning supporting the idea there was either no presence of a burial marker or previous burials were simply not remembered or purposely avoided after burial (Tarlow and Battell Lowman 2018, 31-2).

1.7 Aim and Objectives

1.7.1 Aim

The current study seeks to characterise the burial population excavated in the 1970/80’s from the church and churchyard of St. Andrew’s Church, Portland in terms of demography, health and disease and funerary practice in comparison to contemporary cemetery populations from elsewhere in Britain.

1.7.2 Objectives

After reviewing the previous section, this project sets out to achieve the following objectives:

- To produce a comprehensive digital plan of all burials situated at Portland St. Andrew’s.
- To conduct a comprehensive skeletal analysis of the entire collection of human remains from Portland St. Andrew’s held at Bournemouth University.
- To understand the rationale of the three communal graves interred within the church foundations.
- To examine the positioning of human remains and their relationship to the church itself.
- To analyse the demography and to determine the relationship the skeletal assemblage from Portland St. Andrew’s has in the wider post-medieval context.

Chapter 2
Materials

The PSA collection consisted of both articulated and disarticulated human remains. The articulated human remains for the current study amassed to seventy-four individuals. Disarticulated material was also analysed and recorded; however, these were omitted in current project. In relation to adult and non-adult remains, the proportion of adult skeletal remains was far greater than non-adult remains (59 adults: 15 non-adults). Completeness of the skeletal material from PSA is displayed in Table 1, with 41.9% of the collection analysed situated in the <25% completeness category. Furthermore, preservation of the skeletal remains was recorded as grade 0-1 according to McKinley 2004 (15-6). Whereby grade '0' is indicative of 'surface morphology being clearly visible with fresh appearance to bone and no modifications' and grade '1' is indicative of 'slight and patchy surface erosion'.

Table 1 - Completeness of human skeletal remains at PSA.

Completeness	No. of skeletons (n = 74)	%
<25%	31	41.9
25-50%	23	31.1
50-74%	12	16.2
>75%	8	10.8

Methods

2.1 Burial Plans

According to reports within the archive, human skeletal material excavated at PSA came from the north area adjacent to the church. Although there is no single record of this, only single drawings containing several burials. Therefore, it is vital that the single burials are digitized in order to create a wholesome image. This will enable an improved understanding of the interments at PSA and the relationship between individuals to the church itself and even wider, the community. Once a digital plan is produced there are several factors that can be observed, such as: location of burials, positioning of remains and if there are any relationships between burials, overall revealing what the burial distribution could tell us. The original site drawings of the single interments were scanned and traced over in Adobe Illustrator. Afterwards, burials were manipulated into their correct positions, thus creating a single digitized plan.

2.2 Skeletal Analysis

While previous research has been conducted on the skeletal material from PSA, the data has never been produced into one collective format. The intention of this project is to fully analyse the skeletal assemblage in order to establish a potential presence of uniqueness about this island population from the medieval/post-medieval period in England. With that being said, the aim of the current study is to conduct a comprehensive human skeletal analysis of the PSA collection, this involves recording the following: bone presence; completeness/preservation of bone; biological sex, age-at-death, pathology, stature and non-metric traits. By combining a digitized plan of burials at PSA to the osteological analysis – this will allow the current project to integrate the osteology with the archaeology.

A pro forma created solely for the purpose of this project will be used for recording the osteological data with separate forms for adult and non-adult remains (see Appendix C). With the aim to produce an extensive record for each skeleton within the collection. Data will then be collated and manipulated into graphs and tables to identify prevalence or anomalies with the assemblage. Bone presence on said form contains two keys – 'presence' of bone is coded in red, with a key for 'fragmented' (coded in red hachures). If an area of bone comprises of 3 or more fragments, for the sake of the current study the latter key will be used. Osteological summaries have been produced for all human remains examined (see Appendix A).

Where specific scoring has been carried out regarding age-at-death estimations and biological sex determination methods, relevant photographs will be taken in order to store a visual aid for scoring/methods. In order to catalogue relevant photographs correctly the Buikstra & Ubelaker (1994) standards will be followed. Radiography may be useful to confirm diagnosis (after macroscopic investigation) - an example of this could be in the form of evidence of bone healing alongside altered shape of bone – by using radiography presence of a fracture may be evident. Consideration would then need to be taken with regards to access to radiographic machinery and the costs associated, as well as access and transport of human remains.

There are several key methods that cover cranial and post cranial features of the skeleton used to analyse human remains. With regards to the biological sexing of an individual, main areas of the skeleton that are of focus include the pelvis and skull, the following methods listed below will be used to determine the biological sex of an individual (see Table 2). In the current study Klales et al (2012) method will be used, this is an extension of Phenice (1969) method whereby the 3 features of the os coxae (ventral arc, medial aspect of ischio-pubic ramus and subpubic concavity) are graded from 1 – 5 (1 = female, 2 = probable female, 3 = undetermined, 4 = probable male, 5 = male).

Furthermore, the greater sciatic notch (GSN) has also been identified as a key feature to score in regard to sex determination (Walker, 2005). A further feature in the pelvis includes the pre-auricular sulcus – if this feature is present this indicates female (Buikstra and Ubelaker, 1994). Furthermore, certain features of the skull are scored 1-5 (1 indicating female with 5 indicating male), these features include: mastoid process; nuchal crest; supra orbital margin/ridge and mental eminence. With reference to the mandible in British skeletal assemblages the mental eminence is not identified as being a significant diagnostic feature, therefore further features of the mandible should be analysed (Brickley 2004, 23). In the current study alongside scoring for the mental eminence, other features scored on the mandible include: gonial angle and the mandibular angle. Further supported in the latest guidelines 'Updated Guidelines to the Standards for Recording Human Remains' regarding the features of the mandible (Brickley and Buckberry 2018, 33).

Table 2 - The methods used for biological sex determination for the current study.

Author(s)	Method	Assessment	Scoring system
Klales et al (2012)	Os coxae: ventral arc, medial aspect of ischio-pubic ramus, subpubic contour	Biological sex	3 features graded 1-5
Walker (2005)	Greater sciatic notch	Biological sex	1-5
Buikstra & Ubelaker (1994)	Pre-auricular sulcus	Biological sex	0-4
Buikstra & Ubelaker (1994)	Features of skull: mental eminence, mastoid process, supra orbital margin, glabella, nuchal crest	Biological sex	1-5

With regards to aging a skeleton, the favoured region used for analysis in adults is the os coxae, with bone epiphyses and dentition the preferred choice for non-adults (see Table 3). Areas of focus in the pubic region include: pubic symphysis (PS) and the auricular surface (AS). Brooks and Suchey (1990) developed a six-phase method scoring the PS; this replaced a ten-phase method devised by Todd (1920). The Suchey Brooks method for age-at-death estimation is identified as the most reliable due to its 94% accuracy rate (Sarajlic and Gradascevic 2012, 54). However, due to the fragility of this bone it is not always available to examine. Lovejoy et al (1985) devised an eight-phase method to score the AS with a revised method from Buckberry and Chamberlain (2002). Cranial suture closures (CSC) are another method used to assess the age-at-death estimations of individuals (Meindl and Lovejoy 1985). This method involves assessing 10 sites on the ectocranial surface of the skull and grading the suture on a scale of 0-3 (with ‘0’ indicating ‘open’ and ‘3’ indicating ‘complete obliteration’).

Table 3 - The methods used for the current study in relation to age-at-death estimations.

Author(s)	**Method**	**Assessment**	**Scoring system**
Brooks & Suchey (1990)	Pubic symphysis	Age-at-death	6 phases
Buckberry & Chamberlain (2002)	Auricular surface	Age-at-death	5 features scored from 1-3, 1-5
Lovejoy et al (1985)	Auricular surface	Age-at-death	Phase 1 (age 20-24) – Phase 8) age 60 +)
AlQahtani et al (2010)	Tooth eruption and dental development	Age-at-death	28 weeks utero – 23 years of age
McKern & Stewart (1957); Schaefer et al (2009)	Epiphyseal union	Age-at-death	Prenatal - adult

Dental development and tooth eruption are the best age indicators for non-adults. It helps that teeth are one of the most common elements found in a forensic and archaeological context (White and Folkens 2005, 364). Non-adult age-at-death estimations can also be assessed via epiphyseal union, although this differs across populations as well as the sex of the individual (females have earlier fusion times compared to males). For the current study both dentition, in terms of tooth eruption and dental development (AlQahtani et al 2010) and epiphyseal union times (McKern and Stewart 1957; Schaefer et al 2009) will be examined. As it has been identified there is an overlap with tooth eruption and the beginning of epiphyseal union times, therefore, demonstrating techniques complement each other (White and Folkens 2005, 373).

Another component of a biological profile includes the estimation of an individual's stature, due to a known relationship between height and skeletal dimensions (Christensen et al 2019). Methods used for estimating stature require the knowledge of the individual's known biological sex first, therefore, causing issues and potential misleading stature estimations if the incorrect formulae are followed. For the current study, stature estimation will be measured using Trotter's (1970) formulae. Due to inaccuracies with recording the medial malleolus, other long bones will be preferred over the tibia. Measurements listed in Buikstra and Ubelaker's 1994 standards will be recorded for as many skeletal elements as possible for the purpose of this study.

Recording bone completeness can depend on the research questions of the study, including joint surfaces with regards to recording prevalence of pathological conditions. Furthermore, surface preservation is also another component to be recorded, previously Behrensmeyer's (1978) method was used, however, animal bone weathered differently to human bone. Surface preservation of skeletons in the PSA assemblage will be recorded using the system in the 'Guidelines to the Standards for Recording Human Remains' (McKinley 2004, 16) - graded from 0-5+ (0 indicating no modification to bone and 5+ indicating extensive penetrating erosion).

Varying levels of accuracy arises with the aforementioned methods, some preferred over others, therefore, for the purpose of this project, all methods will be taken into consideration. When analysing human remains, bone preservation can affect scoring/identifying, and in some instances, bones may be missing. Therefore, for the purpose of this project, scoring and grading will be recorded for as many of these features visible on the remains to gain as much data as possible.

An additional chief component within this project is to produce a digital plan of the single interments of those believed to be located north to the church foundations. These are to be digitally produced in the software programme Adobe Illustrator. Once a digital plan exists, this will enable manipulation of the data in the sense of movement of burials in order to establish their location in relation to adjacent burials and to the church itself.

Chapter 3

Results

3.1 Demographic Analysis

A pilot osteological analysis was carried out in the authors undergraduate project for one box of human remains (containing contexts: 3003, 3005, 3005 and 3085). These contexts were chosen for analysis as it was mentioned within archive documents as being of interest, with the potential of association to the communal graves at PSA. Unfortunately, near the completion of the undergraduate project it was evident that these contexts were in fact not associated with the communal graves. Furthermore, as they are used in the teaching collection at BU, it was identified at the beginning of the current study that upon organizing contexts into their correct boxes that in fact, several bones from the previously mentioned boxes were missed from initial analysis. Consequently, the pilot analysis was disregarded and all osteological data for the current study freshly collated.

Sk numbers (in the range of three thousand) included in the sex, age-at-death and stature sections are individuals where their burial place is known. The burial location for said individuals is the northern area of the churchyard (see Figure 4). However, in the pathology section of this chapter there are a few instances where skeletons from an area (at present) are unknown have been included (this will be stated).

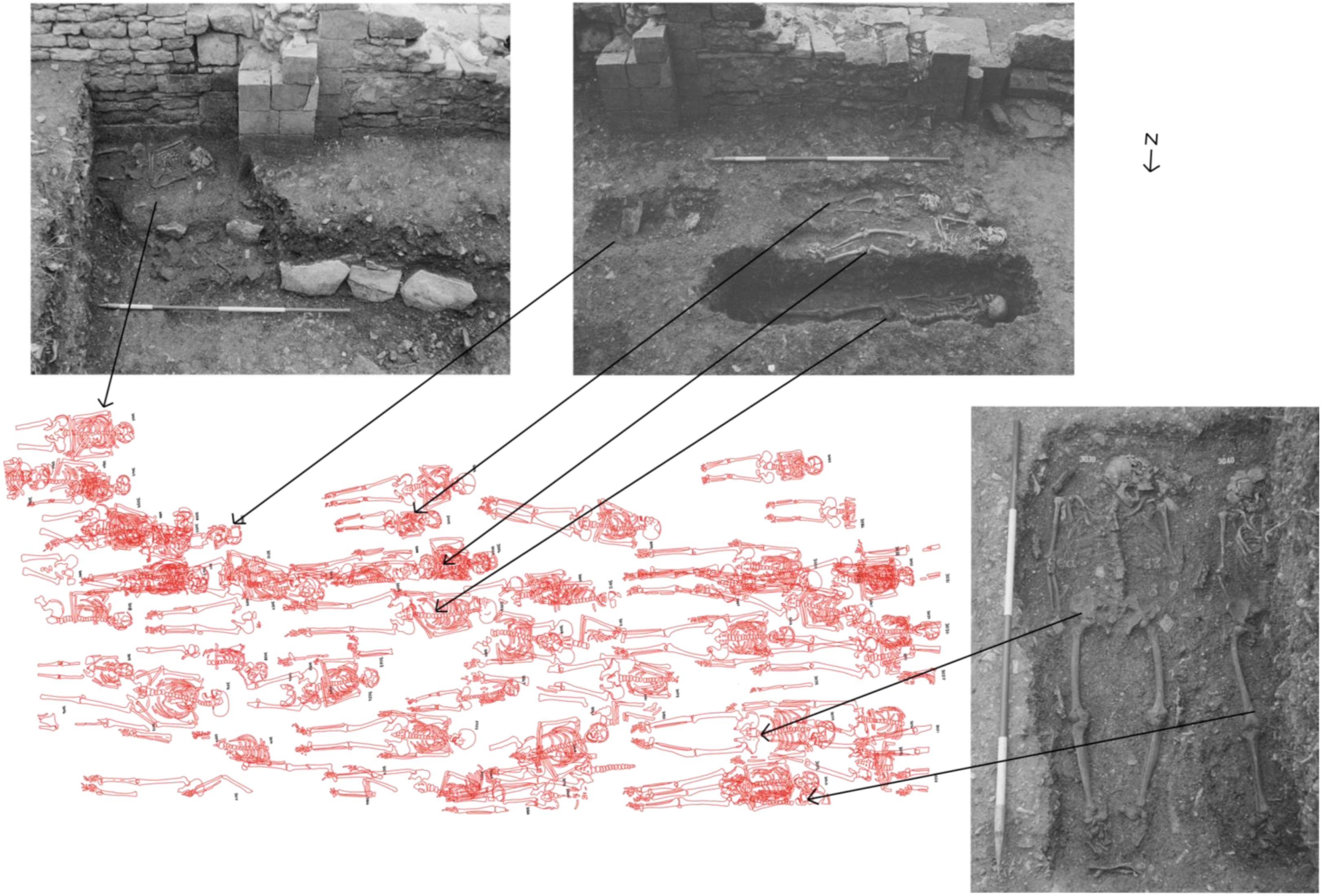

Figure 4 – This burial plan was created to produce a wholesome image of northern area burials (including original site photographs by Alan Hunt).

3.1.1 Biological Sex Determination

There were fifty-nine adults in the PSA collection, out of these biological sex was determined for thirty one adults (excluding probable/undetermined sex). The categories for sex differences included the following, female and probable female (PF?), male and probable male (PM?), undetermined (see Table 4). With the remainder twenty-three individuals unassigned a biological sex at this stage due to insufficient skeletal material being present, rather than genuine ambiguity in the remains studied.

Table 4 - The total number and % of adult population at PSA where biological sex was determined.

Sex	**Total**	**%**
Female (and PF?)	16	27
Male (and PM?)	19	32
Undetermined	1	2
Unobservable	23	39
	59	**100**

3.1.2 Age-at-death Estimation

Age-at-death estimations were calculated for the skeletal assemblage at PSA using the various methods set out in Chapter 2 (scoring the pelvis and skull for adults and dentition and epiphyseal union for non-adult remains). Previous literature demonstrates varying age categories used in analysis, therefore, for the purpose of this study the age categories stated in Buikstra and Ubelaker's (1994) standards have been used (see Table 5). The six categories are as follows: infant (birth-3 years), child (4-12 years), juvenile (13-19 years), young adult (20-35 years), middle adult (35-50 years) and old adult (50 + years).

Table 5 - Data collated from the PSA collection from the northern area of the churchyard with regards to age-at-death estimations using Buikstra and Ubelaker (1994) age categories.

Age-at-death estimation	**Total**	**%**
Infant (0-3 years)	1	1
Child (4-12 years)	10	14
Juvenile (13-19 years)	1	1
Young adult (20-35 years)	3	4
Middle adult (35-50 years)	5	7
Old adult (50 + years)	17	23
Unassigned	37	50
	74	**100**

Individuals whereby biological sex was determined, and age-at-death estimations were achieved are displayed in Table 6. Due to the broader age categories the Buckberry and Chamberlain (2002) method was applied in the current study.

Table 6 – Individuals from PSA where both biological sex and age estimations were recorded.

Sk no.	Sex	Age estimation (years)
3049	Male	29-88
3051	Female	29-88
3056	Female	16-65
3028	Female	39-91
3020	Female	29-88
3042	Male	39-91
3053	Probable Female?	39-91
3059	Male	29-88
3041	Female	39-91
3029	Probable Female?	29-88
3013	Male	53-92
3072	Male	16-65
3025	Female	21-38
3023	Male	29-81
3026	Male	29-88
3037	Male	25-29
3003	Male	29-81
3062	Male	29-88
3070	Female	21-38
3067	Female	53-92
3038	Male	29-88
3057	Male	16-65
3024	Female	35-39
3009	Female	39-91
3043	Undetermined	29-88

Regarding age-at-death estimation for non-adults, the most reliable method used is that of dental development in terms of dental eruption over skeletal analysis (Cunha et al 2009, 3). Recording epiphyseal union of postcranial elements was used to further support this (Buikstra and Ubelaker 1994; Schaefer et al 2009). Diaphyseal length was not measured with the non-adult remains in the current project, however, dentition was noted and where possible this has been used alongside (where possible) epiphyseal union to support an age-at-death estimation. Although, in the current project there has been no access to the use of an x-ray machine – this would have been beneficial in terms of age indication of concealed (macroscopically) permanent teeth, to then compare to Al Qahtani's (2010) illustration to aid in age-at-death estimation via dental development and eruption.

3.1.3 Stature

Numerous factors such as sex, age-at-death and the environment can all play a role in affecting ones stature (Cornwall 1974, 193). Thus demonstrating the importance of gathering as much data as possible, however, use of the most suitable formulae is vital. For the current project Trotter's (1970) formulae for different body types in relation to 'white' and 'black' equations was used to calculate stature of those interred at PSA. By using various formulae with regards to body types, it enables the one with the smallest error to be used overall (Zakrzewski 2018, 39), in the current study Trotter's 1970 'blacks' formulae had the lowest error (see Table 7).

Table 7 – Data collected from known males and females from the PSA collection in relation to stature using Trotter's 1970 'blacks' formulae.

Sex	Total	Mean (cm)	SD	Range (cm)
Female	5	156.43	3.55	152.99 – 162.31
Male	10	165.43	3.26	160.24 – 168.91

Due to the method requiring the biological sex of the individual to be known, only fifteen adults were used in this analysis (5 females and 10 males). Conversely, stature was not collated for non-adults as their biological sex was not recorded in the current project. To summarise the demographics thus far, the table below (see Table 8) states the skeletons from the PSA assemblage where sex, age-at-death and stature has been recorded.

Table 8 – All skeletons in the northern area of the churchyard where stature has been calculated (using Trotter's 1970 formulae for 'blacks') alongside their biological sex and age-at-death estimations.

Sk number	Male/Female	Age-at-death (years)	Stature (cm)
3049	Male	29-88	165.72
3042	Male	39-91	168.13
3068	Male	-	165.35
3016	Male	-	168.91
3013	Male	53-92	167.07
3023	Male	16-65	160.24
3026	Male	29-88	168.65
3039	Male	-	161.69
3003	Male	29-91	167.36
3038	Male	29-88	161.15
3056	Female	16-65	152.99
3020	Female	29-88	162.31
3040	Female	-	154.48
3041	Female	39-91	156.45
3024	Female	35-39	155.93

3.2 Pathological Observations

3.2.1 Dental Pathology

Dental pathology was recorded during osteological investigation for the PSA assemblage, the following pathology was recorded: caries, calculus, periodontal disease, linear enamel hypoplasia (LEH), antemortem tooth loss (AMTL) and the presence of periapical lesions. As mentioned in the methodology section – dental pathology was recorded via presence only, no scoring systems were applied, except for periodontal disease whereby Ogden's 2008 scoring system was utilized. All dental pathology recorded on the PSA assemblage has been summarised below (see Table 9).

Table 9 - Overall dental pathology recorded on the PSA skeletons.

Dental pathology	Total of individuals	%
Caries	24	32
Calculus	25	34
Periapical lesion	4	5
LEH	20	27
Periodontal disease	20	27
AMTL	14	19

Out of the seventy-four individuals analysed in the current study thirty- two had teeth present for analysis. There was a total of twenty-six articulated remains from the northern area of the churchyard where dental pathology was recorded, two of those were non-adult remains (sk 3083 and sk 3005) with the remainder consisting of adult remains. Out of the twenty-four adult remains there was one individual where sex was 'undetermined' and two individuals whereby not enough skeletal material remained to analyse biological sex. To summarise dental pathology from the PSA collection in relation to an individual's age and sex see Table 10.

Table 10 – Dental pathology recorded on the PSA assemblage in relation to sk number, biological sex, and age estimations (‘P’ indicates presence).

Sk no.	Sex	Age	Caries	Calculus	Periapical lesion	LEH	Periodontal disease
3056	F	16-65	-	P	-	P	Mild
3020	F	29-88	P	P	-	P	Mild-moderate
3040	F	-	P	P	-	P	Mild-moderate
3042	M	39-91	P	P	-	P	-
3059	M	29-88	P	P	-	-	Mild-moderate
3056a	-	-	P	P	-	-	-
3068	M	-	P	P	-	-	Mild-moderate
3041	F	-	P	P	-	P	Mild-moderate
3016	M	-	P	P	P	P	Mild-moderate
3023	M	16-65	P	P	-	P	Mild
3026	M	29-88	P	P	-	P	Mild-moderate
3039	M	-	P	P	-	P	Mild-moderate
3018	M	-	P	P	-	-	-
3003	M	29-81	P	P	P	P	Mild-moderate
3007	F	-	P	P	-	P	Mild-moderate
3062	M	29-88	P	P	-	-	Mild
3069b	-	-	P	P	-	P	-
3070	F	21-38	P	P	-	P	Mild
3033	M	-	P	P	P	P	Mild-moderate
3057	M	16-65	P	P	-	-	-
3069a	M	-	-	P	-	P	Mild-moderate
3024	F	35-39	P	P	-	P	Mild
3009	F	39-91	P	P	-	P	Mild-moderate
3043	U	29-88	P	P	-	P	Mild-moderate

Periodontal disease is associated with the inflammation of tissues surrounding the teeth as a response to the build-up of calculus. This disease is characterised by the presence of horizontal alveolar resorption, with the possibility of affecting all teeth (Aufderheide and Rodriguez Martin 1998, 401). Dentition affected due to the alveolar bone resorption resulting in the tooth becoming exposed and losing support, this eventually leads to AMTL (Kinaston et al 2019, 771). Periodontal disease for the PSA assemblage was scored using Ogden’s (2008) method. Of the twenty individuals recorded as having periodontal disease: six were recorded as ‘mild’ with the remaining fourteen recorded as ‘mild-moderate’. AMTL may be caused from pathology, trauma or intentional purposes that results in premature loss of permanent teeth. AMTL is associated with age due to the risk of trauma and increase in susceptibility of dental pathology (Kinaston 2019, 770).

Dental caries is characterised by the destruction of organic compound and identified as being a multifactorial disease. This disease is both transmissible and infectious, with diet and dental treatment having large roles (Hillson 1996, 282). Caries is one of the most common diseases to affect the human body, affecting individuals of both sexes of any age, all whilst not affecting everyone equally (Hillson 2001, 261). In some cases there may be multiple dental pathology affecting an individual, for example sk 3033 (an adult male of unknown age) exhibits calculus, periodontal disease, caries and the presence of a periapical lesion of the maxilla (see Figure 5).

Figure 5 – Multiple dental pathology affecting the maxilla and teeth of sk 3033.

LEH is caused via a disruption in growth resulting in a defect to the structure of the tooth. The disruption to growth may be caused through numerous factors, such as trauma, infectious disease, cultural activities, or nutritional deficiencies (Aufderheide and Rodriguez Martin 1998, 405). Malnutrition has been identified as the most common cause associated with this condition (Aufderheide and Rodriguez Martin 1998, 407). LEH presents itself as horizontal pits or grooves on the tooth surface (see Figure 6).

Figure 6 – LEH present on sk 3033 (adult male of unknown age).

3.2.2 Metabolic Disease

Metabolic diseases are characterized by skeletal alterations in terms of formation, resorption or mineralization or a combination of all three (Brickley and Mays 2019, 531). Individuals suffering from poor health may be vulnerable to many pathological conditions, therefore, in some cases co-occurrence may arise, for example scurvy and rickets affecting an individual at different stages of their life (Brickley and Mays 2019, 551).

- ***Scurvy***

A deficiency in vitamin C results in a retardation in skeletal growth in non-adults. Absorbic acid is found in food sources such as marine fish, however, citrus fruits have extreme concentrations (Aufderheide and Rodriguez Martin 1998, 310). The following symptoms may be present on individuals who suffer with scurvy: swelling of gums; ante-mortem tooth loss; mobility causing pain, blood loss and prone to infectious conditions (Brickley, Ives and Mays 2020, 51-2).

According to Ortner and Ericksen (1997, 213) macroscopic skeletal indicators of scurvy include hypertrophic lesions and porosity, in a response to inflammation of bone, for example through bleeding. During osteological analysis of the PSA assemblage, sk 3006 (an infant) exhibited the aforementioned skeletal indicators (see Figure 7). Although scurvy may develop during infancy and early childhood, it tends to occur typically between 9 – 14 months of life. Infants are unable to synthesis vitamin C, therefore, demonstrating the importance of them retaining it from other food sources (i.e from human breastmilk). Human breastmilk contains enough vitamin C for the infant’s needs, therefore, scurvy is seen to be absent in infants who consume at least some breastmilk, provided the mother does not have a vitamin C deficiency (Fain 2005, 126).

Scurvy affecting adults is most likely due to restricted food access, examples include specific institutions (prisons), long sea voyages or food supply disruptions due to natural disasters or war (Maat 2004, 77).

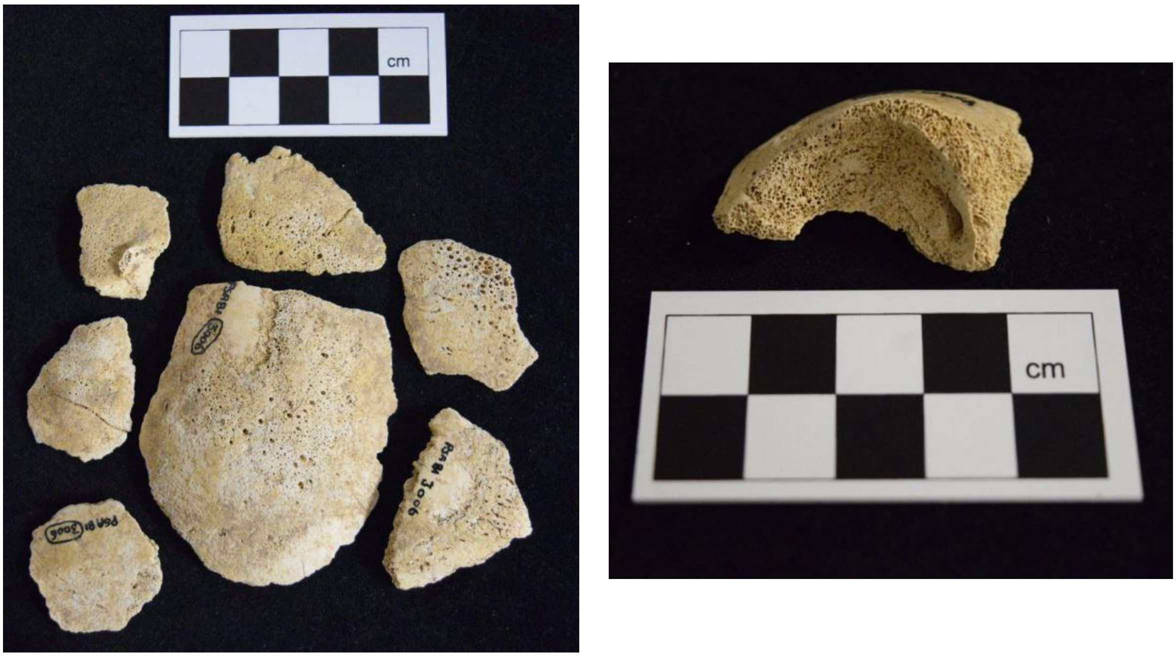

Figure 7 - These images display skeletal indicators of scurvy on sk 3006 (an infant) on various cranial fragments and present on the right orbit.

- ***Vitamin D Deficiency – Rickets/Osteomalacia***

Vitamin D deficiencies cause bone issues with formation during growth and remodelling due to poor mineralization (Brickley and Mays 2019, 540). In children the term ‘rickets’ is used, whereas, for adults the term is referred to as ‘osteomalacia’ (Aufderheide and Rodriguez-Martin 1998, 305). The most common cause of rickets is through lack of vitamin D due to diet, sunlight, or a combination of both (Wharton and Bishop 2003, 1390). The lower limbs are the most affected long bones, unless the disease occurred during infancy, then upper limbs are more commonly affected. Bowing typically of tibiae and fibulae occurs (see Figure 8), depending on timing of the disease and severity - there may be a noticeable deformity permanently (Brickley and Mays 2019, 541).

Figure 8 – Residual rickets evident on sk 3030 (adult of unknown age or sex) as the left and right fibulae display a bowing effect.

A vitamin D deficiency experienced by individuals in adult life is referred to as osteomalacia (Aufderheide and Rodriguez Martin 1998, 309). To manifest on the skeleton, osteomalacia requires a longer deficiency to be apparent, as the disease relies on bone turnover (Brickley and Mays 2019, 546). Furthermore, Individuals who experience skeletal lesions in adult life, however, believed to be a present from infancy and non-adult period – the term ‘residual’ rickets may be used (Brickley et al 2018, 43).

3.2.3 Congenital Abnormalities

Block vertebrae

Block vertebrae occurs due to separation failure of vertebral segments. This may cause neural arches to unite or vertebral bodies to unite or a unification of both. Isolated single block vertebrae may appear as a familial trait and mostly within the cervical region (Barnes 2012, 92). If there is a presence of multiple block vertebrae this may be referred to as ‘Klippel Feil Syndrome’. This condition involves the fusion of two or more vertebral sections (Aufderheide and Rodriguez Martin 1998, 60). The aetiology of this condition is unknown, however, clinically it is recognised due to a shorter neck with limited neck movement – if affecting the cervical vertebrae (Lewis 2019, 599). A case of block vertebrae was identified from sk 3018 (an adult male of unknown age) at PSA (see Figure 9).

Figure 9 – Vertebral segmentation failure of C3 and C4 of sk 3018.

Not only does this congenital abnormality affect the cervical region, the thoracic and lumbar vertebrae may also be affected. As well as sk 3018, another individual from PSA displaying a congenital defect of the spine was sk 3069a (adult male of unknown age) involving the thoracic region (see Figure 10). A differential diagnosis of trauma may result in areas of fusion within the spinal column.

Figure 10 – Fusion of T3 and T4 (of sk 3069a), a congenital abnormality known as ‘block vertebrae’.

Spondylolysis

This defect of the spine causes a separation at the *pars interarticularis* (Lewis 2019, 599). Due to the additional forward/backward movement of the vertebral column, this condition may cause considerable health issues (Aufderheide and Rodriguez Martin 1998, 64), however, this condition may also be asymptomatic. Majority of cases occur on L5 (Waldron 2019, 730), due to the non-union of fragments sclerotic bone is formed – evident on L5 of sk 3072 (see Figure 11).

Figure 11 – Inferior articular facet of L5 of sk 3072 (male aged 16-65 years) with evidence of unilateral spondylolysis.

3.2.4 Joint disease

Osteoarthritis

Osteoarthritis (OA) is the most common joint disease, affecting synovial joints. Skeletal manifestations of OA include marginal osteophyte development, joint surface porosity, contour alteration of the joint and the presence of eburnation (Waldron 2019, 721). There are two types of OA: primary - usually resulting later in life caused through numerous factors including trauma and mechanical stress; secondary – as the name suggests secondary to another condition, in most cases due to trauma (Waldron 2019, 721-22). OA was recorded in the PSA assemblage to varying degrees and affecting numerous joint surfaces (see Figure 12).

Figure 12 - The presence of eburnation and porosity on the joint surface of the dens of sk 3068 (male adult of unknown age) is indicative of OA.

OA was recorded when eburnation was present on the joint surfaces, many joint surfaces were affected on the PSA assemblage, areas most affected consisted of the upper and lower extremities, with the TMJ the least affected joint surface (see Figure 13).

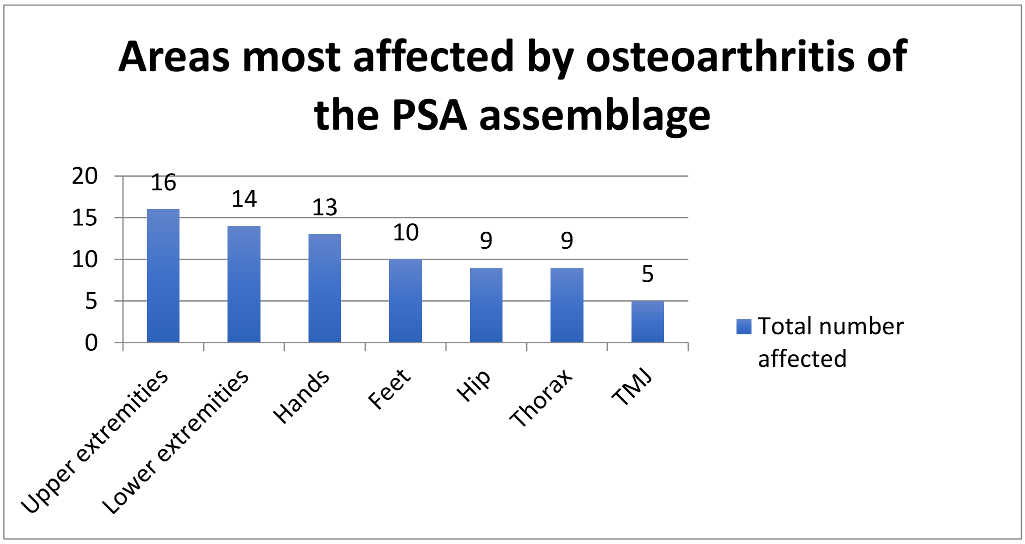

Figure 13 - Distribution of OA recorded on the PSA assemblage in terms of various joint surfaces.

OA was present on a total of twenty-eight individuals from the PSA assemblage. Concerning biological sex of the PSA assemblage the most affected were males (see Table 11), with the most affected age group consisting of the ‘old adult’ category (see Table 12).

Table 11 - The total number of individuals from PSA with OA in relation to their biological sex.

Sex categories	Total number
Male	12
Female	9
Probable female?	2
Probable male?	1
Undetermined sex	4

Table 12 - Individuals from the PSA assemblage where OA has been recorded in relation to their age categories as listed by Buikstra and Ubelaker (1994).

Age categories	Total number
Young adult	1
Middle adult	4
Old adult	11
No age estimation	12

Degenerative Joint Disease (DJD) of Spine

DJD of the spine is characterised by bone alterations such as osteophytes, porosity, subchondral sclerosis, and eburnation (Aufderheide and Rodriguez Martin 1998, 96). Figure 14 provides an example of DJD in the PSA assemblage. Degeneration of the spine is particularly common in the cervical region (Waldron 2019, 730). DJD of the spine affects the discs themselves, whereas the apophyseal joints are those affected with regards to spinal arthritis. Furthermore, 'Schmorls nodes' is a term used to describe a herniated spine defect (Aufderheide and Rodriguez Martin 1998, 97). Schmorls nodes were identified on ten individuals in the PSA collection within the '3000' numbering system.

Figure 14 – C2-C6 of sk 3058 displaying DJD of the spine due to the osteophyte development, porosity, and sclerotic bone present.

Gout

Gout is categorized into primary or secondary, with the condition causing acute or chronic phases clinically (Waldron 2019, 744). Gout normally affects one joint, most commonly affecting: interphalangeal joints or the first metatarsal-phalangeal joint (Aufderheide and Rodriguez Martin 1998, 110). Primary gout affects males more than females, with genetic factors playing a role. In the 18th century, gout was common disease, which may be due to the presence of lead in sustenance (Waldron 1998, 744). Concerning the PSA assemblage there was one individual (sk 2014/22) who displayed skeletal indicators of this condition, a lesion of the 1st metatarsal (see Figure 15). *Hallux valgus* may be a differential diagnosis with regards to the medial side of the head of the first metatarsal showing areas of lytic change. As Dittmar et al 2021, 97) explained when analysing four Cambridge skeletal collections as these lesions may appear as early stages of *hallux valgus*. It is important to note that the burial location of this individual is currently unknown.

Figure 15 - A lesion of the 1st metatarsal (of sk 2014/22), indicating the presence of gout.

3.2.5 Neoplastic Disease

Button Osteoma

Button osteomas are benign ivory like tumours on the ectocranial surface of bone (Aufderheide and Rodriguez Martin 1998, 375). There was one individual from the

PSA collection who exhibited a button osteoma – sk 3059, a male aged 29-88 years (see figure 16). Prevalence of osteomas are associated to a varied age distribution, however, those aged between 30 and 50 years have higher incident peaks (Marques 2019, 648).

Figure 16 – Located on the sagittal suture (parietal bones) of sk 3059 is the presence of a button osteoma.

Metastatic carcinoma

Bones commonly affected by metastatic carcinoma include the following: sternum, major long bones, skull, pelvis, ribs, and vertebrae (Aufderheide and Rodriguez Martin 1998, 388). There was one individual from PSA displaying the presence of metastatic carcinoma – sk 3044 (assumed male). However, this individual was not fully excavated, therefore, some bones listed above were not available for analysis (such as pelvis and major long bones). However, the bones present exhibited skeletal indicators of metastatic carcinoma in the form of lytic and prolific reactions (see Figure 17).

Figure 17 – These images (top left– sternum, top right – endocranical surface, bottom left - rib fragments, bottom right - right posterior surface of scapula) of sk 3044 (male of unknown age) demonstrate the lytic and prolific reactions present on the skeleton indicating metastatic carcinoma.

Due to the osteoblastic nature of the skeletal lesions of sk 3044 it may indicate prostate cancer (osteological analysis indicated male) as the most likely form, however, this cannot be fully diagnosed. As it has been noted that the most common cancers that metastases include prostate and breast cancer (Aufderheide and Rodriguez Martin 1998, 388). However, differential diagnoses of the following cancers should be considered: kidney, thyroid or lung – as these also metastasise to bone (Marques 2019, 696).

3.2.6 Infectious Disease

Osteomyelitis

Osteomyelitis is an infection mainly caused by bacteria (Aufderheide and Rodriguez Martin 1998, 172). There are three phases to osteomyelitis in a clinical setting: acute, subacute, and chronic (Aufderheide and Rodriguez Martin 1998, 172). Osteomyelitis may affect any bone and affect an individual at any age (Lew and Waldvogel 2004, 369). The left fibula of sk 3003 (a male aged 29-81 years) displayed the characteristic features of osteomyelitis with a cloaca apparent (see Figure 18). In skeletal remains the presence of a cloaca is the best diagnostic feature (Roberts 2019, 309). A cloaca is a drainage channel whereby pus can drain to outside of the bone (Waldron 2009, 85).

Figure 18 - An infectious disease (osteomyelitis) present on the left fibula of sk 3003, with the cloaca also visible (at the post-mortem break), identifiable through the smooth edges (red arrow indicates the cloaca).

Periostitis

The inflammation of the periosteum can be caused a few ways and is not always the result of an infection (Aufderheide and Rodriguez Martin 1998, 179). Uneven distribution of periosteal new bone is evident across the diaphysis over a lengthy period (Roberts 2019, 289). There was evidence of periosteal reaction on several PSA skeletons (see Table 13), however, burial location is unknown for a number of these skeletons (2014/21 (1), U/S, 2014/23 (1), 2014/22).

Periostitis is a term used inconsistently with regards to periosteal new bone formation. It is important to record location of lesions and to look at the skeleton as a whole, not only isolated bones. To record the type of lesion for example lamellar/sclerotic or woven bone or if there is a combination of both as this can indicate whether a lesion was healed, active or healing at the time of death (Weston 2008, 51). Due to the overlap of lesion characteristics across disease categories, caution should be taken for interpretation of periosteal reactions (Weston 2008, 58).

Furthermore, Roberts (2019, 289) claims that locations containing periosteum closer to the skin surface (tibia) - periostitis secondary to trauma is most distinguished.

Table 13 - Skeletons from PSA who displayed evidence of periosteal reaction.

Sk number	Sex	Age-at-death	Bone(s) affected	Type of lesion - lamellar/sclerotic (S) or woven (W)
3049	PM?	29-88 years	L & R tibiae, L femur	Sclerotic
3041	Female	39-91 years	L & R tibiae	Woven
3039	Male	-	L & R femora and tibiae	Sclerotic
3031	-	-	L tibia	Woven
2014/21 (1)	Male	29-88 years	L & R ulnae	Sclerotic
U/S	Male	53-92 years	L & R tibiae	Sclerotic
2014/23 (1)	Male	29-81 years	L & R tibiae, L femur	Sclerotic
2014/22	Male	29-88 years	L & R femora, L tibia, L fibula	Sclerotic

TB of Hip/Septic Arthritis

Upon analysis of the PSA assemblage, sk 3034 (adult of unknown age or sex) appeared to have multiple pathological conditions occurring in their pelvic region, especially on left acetabulum. Eburnation is visible on the left acetabulum and left femoral head, therefore, indicating the existence of OA (Waldron 2019, 719). There is a vast amount of lytic activity in the acetabulum and surrounding bone, with potential cloacae visible, thus possibly indicating osteomyelitis (Roberts 2019, 309).

Another pathology thought to be affecting the hip joint is Tuberculosis (TB), this is caused by a species of *Mycobacterium tuberculosis* complex (Roberts and Buikstra 2019, 321). TB was common in the medieval period until mid-19th century (Roberts and Buikstra 2019, 322). TB is treated now with antibiotics (Roberts and Buikstra 2019, 321), however, these were not available in the post-medieval period. A differential diagnosis of septic arthritis was made. Septic arthritis most commonly affects the knee and hip (Aufderheide and Rodriguez Martin 1998, 178). As septic arthritis in the early and final stages appear akin to tuberculosis arthritis (Roberts 2019, 314). It is evident that sk 3034 had numerous pathological conditions affecting their pelvic region (see Figure 19).

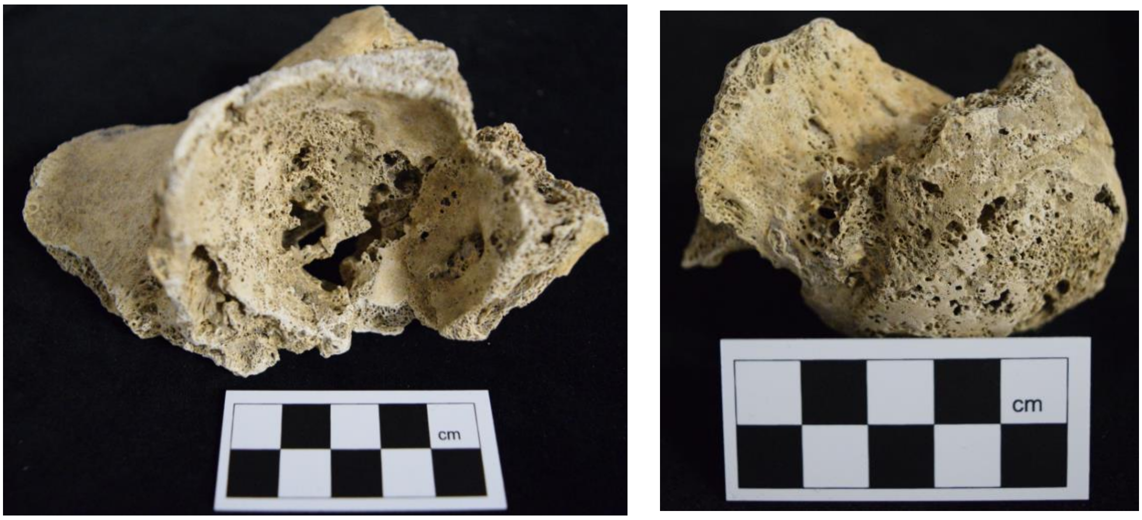

Figure 19 - The left acetabulum (left photograph) and the left femoral head (right photograph) of sk 3034 (adult of unknown age or sex), appears multiple pathology are occurring, such as OA (eburnation present) and some sort of infection (due to the lytic effect), potentially TB.

3.2.7 Circulatory Disease

Porotic Hyperstosis (PH), Cribra Orbitalia (CO) and anaemia

Porotic hyperostosis (PH) is characterised by evenly distributed ectocranial lesions (Aufderheide and Rodriguez Martin 1998, 348). Cribra orbitalia (CO) lesions are similar appearance to PH; however, they are solely located in the orbits (Aufderheide and Rodriguez Martin 1998, 349). CO was identified in several skeletons of the PSA assemblage; an example includes the right orbit of sk 3008 (see Figure 20). Across a population CO is more commonly found than PH (Walker et al 2009, 115). Individuals with iron deficiency anaemia may have CO present with more evidence in the form of PH (Grauer 2019, 518), however, correlation is not causation with regards to CO causing iron deficiency anaemia (Walker et al 2009, 116).

Figure 20 – CO on the right orbit of sk 3008 (child aged 3-8 years).

CO and PH were recorded on their appearance on bone and not graded using a specific scoring system for the current project. Table 14 below displays the skeletons from the assemblage, their sex, whether they are an adult/non-adult and any presence of CO or PH.

Table 14 - Presence of CO and/or PH recorded on the PSA assemblage, alongside demographic data associated with the skeletons.

Sk no.	Adult/non-adult	Sex	CO	PH
3020	Adult	F	L orbit	-
3040	Adult	F	L & R orbits	Bilateral
3013	Adult	M	-	Bilateral
3023	Adult	M	-	Bilateral
3007	Adult	F	L & R orbits	Bilateral
3024	Adult	F	L & R orbits	Bilateral
3009	Adult	F	L orbit	Bilateral
3083	Non-adult	-	L & R orbits	-
3045	Non-adult	-	L orbit	-
3006	Non-adult	-	-	-
3008	Non-adult	-	R orbit	-

Osteochondritis Dissecans (OCD)

This involves the fragmentation of articular cartilage and subchondral bone either partly or completely separating from the joint surface (Aichroth 1971, 440). Previous literature demonstrates the most affected joint surface is the medial condyle of the femur (Kessler et at 2013, 325). OCD was recorded in a couple instances (sk 3037 and sk 3067) at PSA – for example sk 3067 (female aged 53-92 years) displays OCD on the medial condyle of the left femur (see Figure 21). A depression will remain visible even if a thin layer of bone covers the condyle (Grauer 2019, 501).

Figure 21 - Medial condyle of the left femur of sk 3067 there is evidence of osteochondritis dissecans.

3.2.8 Trauma

Abnormal stress applied to bone consequently causes a fracture (Redfern and Roberts 2019, 213). Whilst analysing the PSA collection little trauma was found on the skeletal remains, consisting of long bone fractures, clavicular and vertebral fractures alongside the hand and foot bones (see Table 15). All fractures from the PSA assemblage were evidently healed, therefore, indicating the individual lived with them for some time.

Table 15 – All fractures identified on the PSA assemblage.

Sk number	Sex	Age-at-death	Fracture type	Location of fracture
3068	Male	-	Salter- Harris Rib	Right ulna Left rib
3053	Probable female?	39-91 years	Compression	Lumbar vertebra
3042	Male	39-91 years	Compression	2nd Lumbar vertebra
3004	Female	-	Smith's	Right radius
3038	Male	29-88 years	Avulsion	L 4th prox phalanx
3037	-	-	Clavicular	Right clavicle
3025	Female	21-38 years	Metatarsal	Right 5th metatarsal

Salter-Harris Fracture

The presence of a deformity may be the result of premature fusion of the plate with the displaced portion (Salter and Harris 1963, 598). The aforementioned deformity can be noted on the right ulna of sk 3068 (an adult male of unknown age) – where the styloid process is located (see Figure 22).

Figure 22 – Abnormal appearance of the styloid process of the distal ulna of sk 3068 (an adult male of unknown age) indicating a Salter-Harris fracture.

Compression Fracture

A wedge-shaped vertebra can lead to kyphosis due to the misalignment created, degree of kyphosis depends on the severity of the compression of vertebral body (Aufderheide and Rodriguez Martin 1998, 25). The extreme and sudden impact of a compression fracture results in a diverse fracture pattern (Redfern and Roberts 2019, 214). Sk 3053 (PF? aged 39-91 years) indicated a LV compression fracture (see Figure 23). Compression fractures are typically due to accidental mechanisms, occasionally owing to a fall (Redfern and Roberts 2019, 243).

Figure 23 - A lumbar vertebra of sk 3053 exhibits a compression fracture.

Additional fractures in the PSA assemblage

Identified on right distal radius of sk 3004 was a Smith's fracture (see Figure 24). This type of fracture most commonly occurs due to a fall on a flexed wrist (Woodyard 1969, 328), also fragility fractures of the axial skeleton may also be a result of osteoporosis. Furthermore, one avulsion fracture was identified in the PSA assemblage, this fracture occurred on the left 4th proximal phalanx of sk 3038 (a male aged 29-88 years). Also present in the assemblage was a clavicular fracture of sk 3037 (a young adult of unknown sex). In addition sk 3025 (a female aged 21-38 years) had a fracture of the right 5th metatarsal (see Figure 25).

Figure 24 - Smith's fracture of right radius of sk 3004 (a female of unknown age).

Figure 25 – Fracture of right 5th metatarsal fracture of sk 3025 (female aged 21-38 years).

3.2.9 Pathological Conditions of PSA Assemblage

Morbidity is an important factor in relation to past populations; therefore, skeletal manifestations of pathological conditions were recorded during skeletal examination. Numerous diseases including the following were analysed: metabolic, infectious, joint, circulatory, neoplastic and congenital abnormalities alongside trauma were recorded in the current study. The pie chart below (see Figure 26) demonstrates the various diseases and trauma regarding the population of PSA and the percentage of said diseases, with joint disease most affecting the skeletal assemblage.

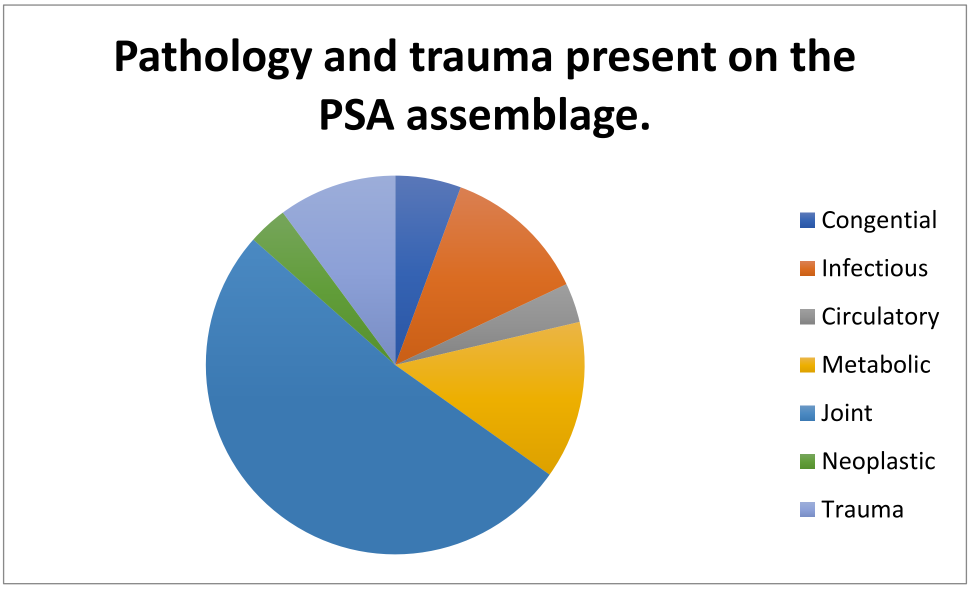

Figure 26 – This pie chart demonstrates the percentage of various pathological categories affecting the PSA assemblage.

Conversely, it was important to determine if there was a correlation with regards to trauma and pathology in relation to spatial organization of the churchyard. This was achieved using the digitized plan of the burials in the northern area adjacent to the church (see Figure 27). Evidently there is no significance, as pathology varies across the northern interments in connection to burial plot. Figure 27 does not depict all pathology recorded on the PSA assemblage – it just provides an overall image to demonstrate there is no correlation with regards to pathology or trauma and interment.

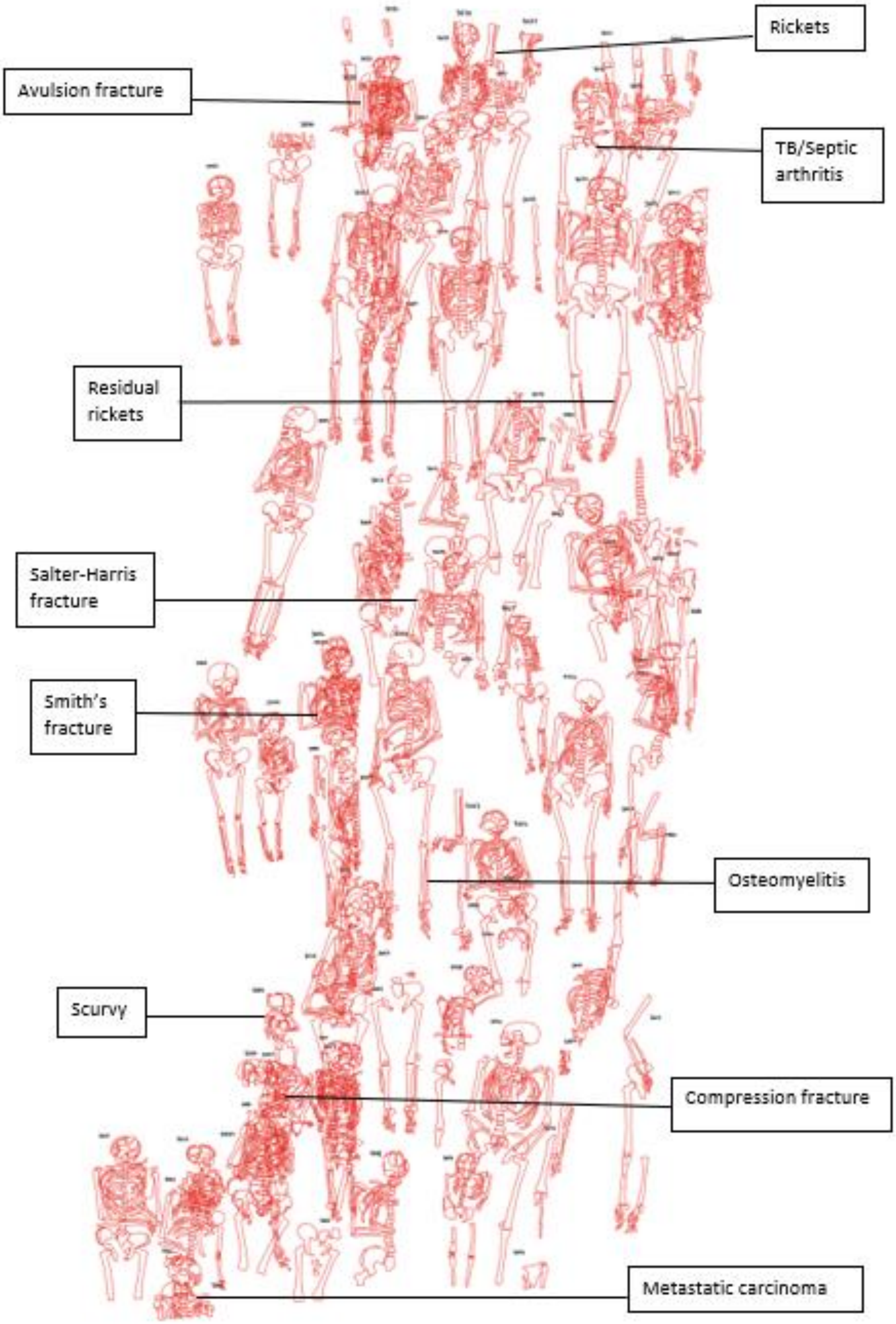

Figure 27 - Pathological conditions and trauma identified on skeletons located in the northern area of the churchyard at PSA.

Chapter 4

Burial Archaeology

4.1 Burial in an Archaeological and Social Context

PSA is a multi-period site covering the medieval to post-medieval period in Britain, therefore, for the purpose of this project - literature will discuss both periods, with a better emphasis relating to the post-medieval period. With a great focus on pathology and demographics, osteoarchaeology dominates the field, therefore, overtaking the investigation into the cultural and social aspects of burial archaeology (Tarlow 2015, 4). Cemetery analysis not only reveals information regarding chronology and grave good significance, evidence may also be revealed on social status, gender and relationships with individuals and the wider community (Parker Pearson 1999, 12). By combining the osteological data (explained in the previous chapter) in relation to biological sex and age-at-death estimations, there may be clear distinctions regarding burial zoning in the churchyard of PSA. To understand this clearer, the digitized burial plan will be used. The following digitized plan (see Figure 28) displays all known burial locations at PSA in order to acknowledge the spatial organization of said burials in relation to the church.

Figure 28 - This digitized plan illustrates all known burials at PSA, including the single interments in the northern area and the three communal graves within the church (church plan produced by Jon Milward,

The significance of studying a church within its community is somewhat greater than as an isolated architectural phenomenon (Rodwell 1989, 34). By investigating a burial ground, it enables several investigations to take place, including changing relationships; mortality and disease; beliefs regarding death; and how social relationships may have changed over time (Tarlow 2015, 5). The bizarre paradox that the life of an individual is revealed in the physical remains after death rather than the process of death itself (Parker Pearson 1999, 3).

Traditions of burial and commemorative displays can illustrate both individual and community attitudes with regards to the following: religion, family, gender identity and ethnicity. Although commemorative displays are important, these have been acknowledged as shadowing true accounts relating to wealth and power within society. This is why it is vital that individuals excavated from archaeological excavations are examined much closer, in terms of period of use of the site itself and location of burials in said cemetery and the land in which it occupies (Tarlow 2015, 6). Social contexts in relation to past funerary practices can be investigated and identified by archaeologists through the act of burial (Parker Pearson 1999, 5).

Earlier burials may also have been dispossessed of their grave markers due to clearance occurring at various stages. This may be the case for several reasons: families migrating or abandoning plots; grounds maintenance or to permit contemporary monuments being erected (Mytum 2006, 102).

4.2 Orientation and Skeletal Burial Positioning

There are multiple positions in which the deceased can be placed into upon burying, including some of the following positions: supine (with arms flexed or extended), prone, crouched (Parker Pearson 1999, 6). Although arm burial positions have changed, it is important to note that these are not definitive indicators, for example due to the decomposition process after death arms may move due to the abdomen expanding (Atzbach 2016, 35).

Orientation of majority of individuals buried during the late medieval period (AD 1050-1550) were in an east-west alignment, with the head situated west, in a supine position (Pearson Parker 1999, 6; Roberts 2018, 51). West-east burial orientation was the ideal position due to the deceased facing east towards the high altar and for Judgment Day (Augenti and Gilchrist 2011, 505; Kenzler 2015, 150; Atzbach 2016, 34). Other cemeteries, such as St John's Hospital Cemetery, Cambridge also demonstrate that the consensus for burial positioning consisted of the absence of grave goods and the body in supine position in west-east alignment (Cessford 2015, 78). As evidenced in Figure 28 individuals at PSA were interred in an E-W alignment including the intramural communal graves and burials situated in the northern area of the churchyard.

As mentioned earlier, burials not only occurred outside the churchyard, at various points in time intramural burials took place. During the excavation in the 1980's, there were three communal graves located within the church foundations, two in the western area of the church and the third communal grave situated near to the northern door (see Figure 29).

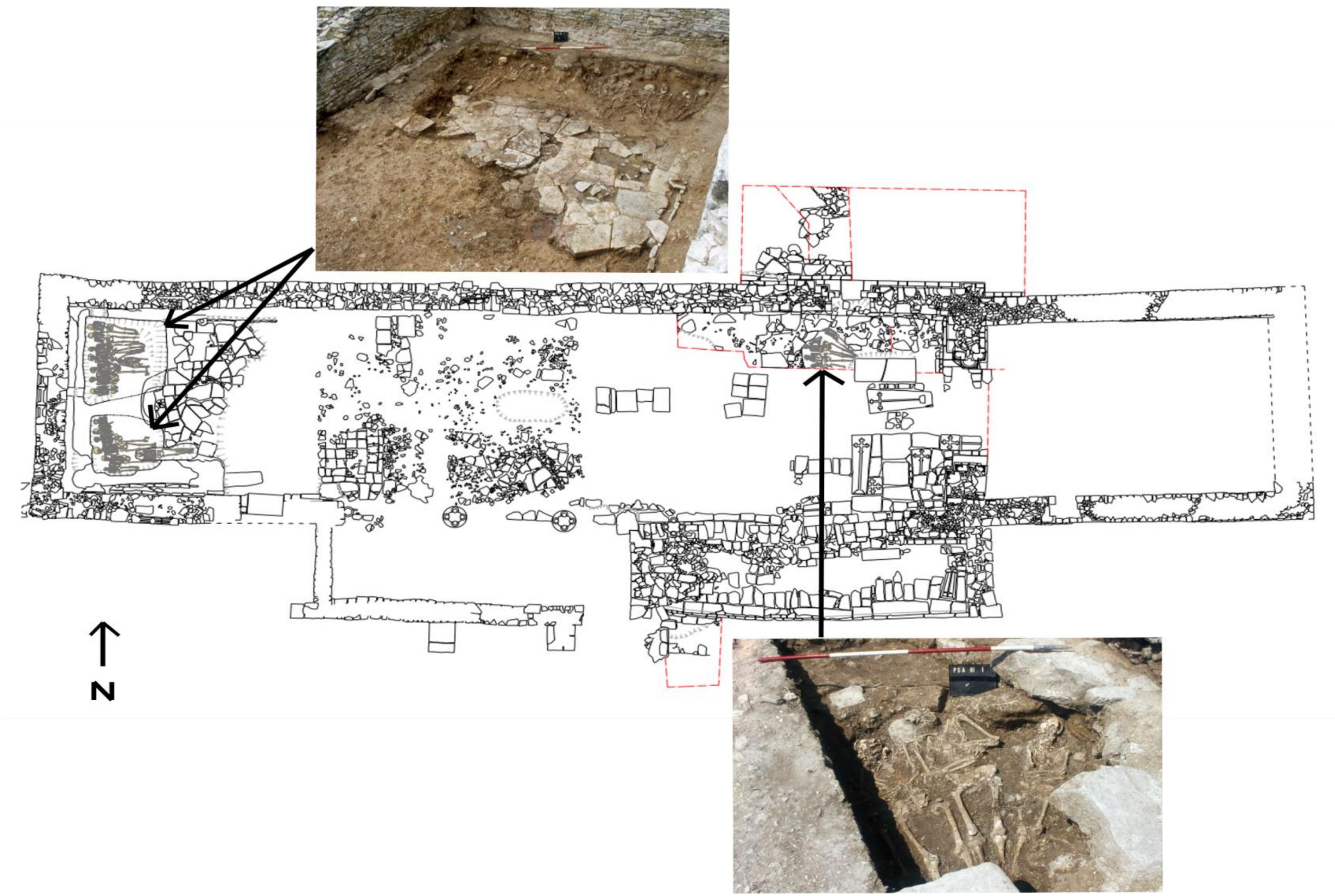

Figure 29 – This digitized plan produced by Jon Milward displays the church foundation with the three communal graves present, site photographs attached show the communal graves before they were reburied.

Identified in the nave of PSA were several grave memorial fragments (mostly in the use of tomb slabs), these were interpreted as being re-used for flooring of the church. Medieval memorials were identified as being recycled for use of pathways and walls in churches (Mytum 2006, 102). Therefore, it is important to remember that in some cases the human remains below the grave marker may not relate due to the recycling of gravestones. Furthermore, burial plots chosen for families may also be marked up before any of the family members are interred in the plot, or where some family members have died before the plot was purchased and therefore are buried elsewhere (Renshaw and Powers 2016, 160).

4.3 Material Culture/Coffin Fixtures/Furnishings of Burial

There were numerous factors that were associated with post-medieval burial grounds, these consisted of identifying some of the following: earth-cut graves, lead coffins, wooden coffins, iron handles, buttons with the occasional breast plate – all with the potential to distinguish social hierarchy (Sayer 2011a, 200).

Material culture has an integral part in the reconstruction of the burial process, for example the production of coffins involves the use of handles and nails that are used in furniture production, with craftsmen usually producing the memorials (Mytum 2004, 13). Majority of lay individuals were buried coffinless within the churchyard (Horrox 1999, 104). Out of the seventy-five burials from the northern area of PSA located on the Harris matrix, the types of graves identified at PSA included evidence for thirteen wooden coffins (17.3%), four cist burials (5.3%) and fifty-eight earthen burials (77.3%).

Individuals wrapped in only a shroud were sometimes identified as being a ‘poor’ grave (Atzbach 2016, 34). However, from 1666 fines were given out to the living regarding burials that took place where the deceased were buried in something other than a shroud. In the later medieval period, the preferred burial material was linen, whether that being shroud or sheet (Cox 1998, 115). Linen was supposedly chosen as the preferred burial choice due to convenience (Gittings 1984, 11); however, Litten (1991, 72) claims that it was more of an indicator regarding socio-economic status.

A ‘decent’ burial was established as using a coffin as a minimum in the early 18th century, with them widely being used in the following century (Houlbrooke 1999, 193). By the 19th century gravestones became affordable and therefore purchased by a wider audience of society (not just for the wealthy) therefore changing the funerary industry (Sayer 2011b, 116). Although, it must be noted that individuals who received pauper burials were not interred in any coffin furniture, as evidenced in the literature in comparison with poor and wealthy parish burial grounds in the 19th century (Hoile 2018, 210).

After the reformation, in terms of medieval monument styles, permanent memorial traditions were established – via the development of grave markers/headstones and chest tombs, with continuation regarding use of grave slabs (Mytum 2006, 107; Renshaw and Powers 2016, 160). Coffins identified as being more expensive often contained greater individual components, such as grips or breastplates. Breastplates are a great indicator for chronological change concerning archaeological assemblages, as these items are most accurately dated (Hoile 2018, 211). Although not fully understandable, there was one instance at PSA (sk 3039) where death information was present (see Figure 30). Nearing the end of the 17th century stamped tinplate breastplates were established (Litten 1998, 14).

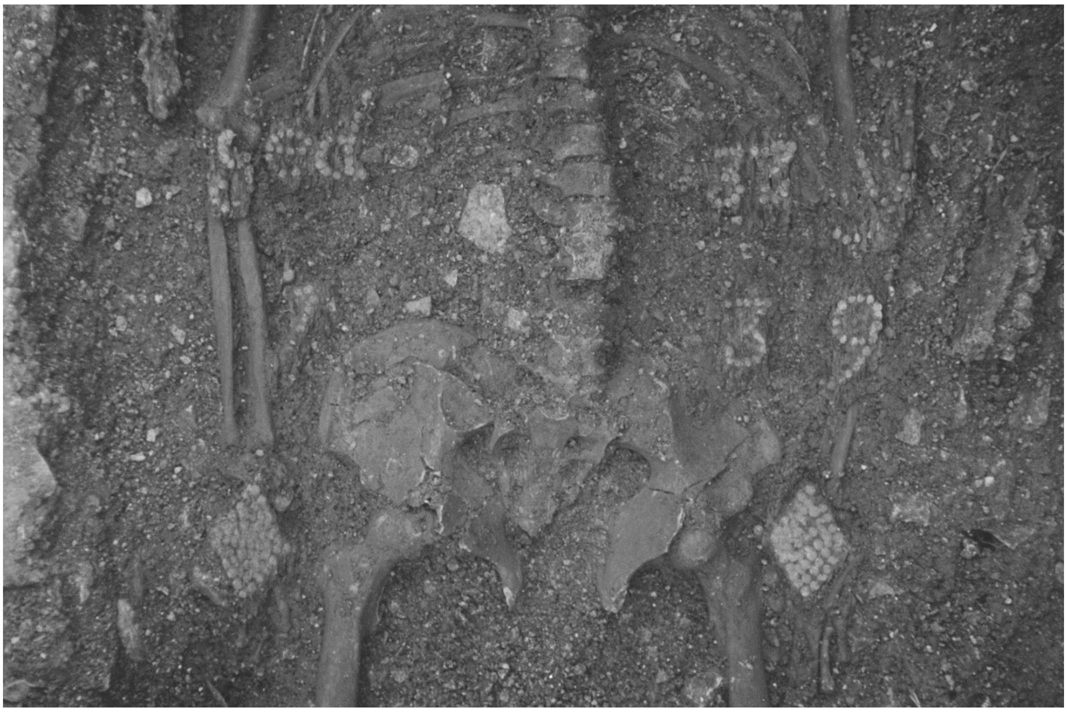

Figure 30 – Coffin/burial material relating to the death information in situ associated with skeleton 3039 (Photograph by Alan Hunt).

During the 18th century, the number of headstones dramatically increased (Mytum 2006, 107), with the grave slab common practice in 18th century, with chest tombs appearing more elaborate, therefore, associated more with the elite (Mytum 2004, 24). There were two chest tombs located at PSA in the south side of the churchyard;

although information was illegible their designs indicate 17th/18th centuries (see Figure 31). External ledgers were frequently used in 16th-18th centuries, sometimes inscribed, carved, and shaped into the coffin or body, more commonly associated with the elite (Mytum 2004, 29).

Figure 31 – Located south-west to the church foundation of PSA are two chest tombs (photograph taken by the author).

4.4 Burial Rationale

At a vestry meeting held on 27th February 1772, it was suggested that all inhabitants of the isle of Portland capable of labour would come together to help build around St. Andrew's grounds, in order to save it since its closure in AD 1765, as the area had become waterlogged (Bettey 1970, 79). As well as the landslides affecting the area over numerous years, this may have led to future burials taking place in the northern area of the church grounds, in a way to ensure their final resting place was not disturbed. There may be no association or unusual reasoning for those interred in the north area to the church grounds other than the link to space. PSA was of a modest nature and with a growing population could not cope; therefore, burials were required to occur in the northern vicinity of the church (Bettey 1970, 75).

With reference to the pressures met with burial space, an increase in the usage of pits in open spaces and the churchyard itself was generated (Houlbrooke 1999, 177). Upon identifying a collective burial, an important role of the investigative process would be to determine the relatedness between individuals in said grave (Stojanowski and Schillaci 2006, 54). However, as it has been established the communal graves at PSA were reburied with a funeral taking place (see Figure 32). Therefore, analysis for potential familial links cannot be achieved at this stage. Death rates were high throughout the 16^{th}-18^{th} centuries; during this time it was normal practice for communal burials (Mytum 2004, 15). Furthermore, during the 19^{th} century, communal graves were often used to bury paupers in, therefore, demonstrating those in poverty received a punishment regarding their final resting place (Rugg 2000, 269).

Figure 32 - A funeral took place before the reburial for the intramural communal graves located in the western church foundations at PSA (Photograph by Alan Hunt).

Reverting to the aim of the current study was to determine if there was any links to morbidity, age-at-death or sex differences relating to the burial location of those interred at PSA. The following section demonstrates how this has been achieved through the combination of osteological material and the archaeology of the site. Osteological summaries and pro forma used to collate skeletal data for the current project are in Appendix A however, they have been summarised in this chapter with regards to the Harris matrix and through the digitized burial plan of the northern area of the churchyard. It is important to note that not all skeletons listed on the Harris matrix were available for analysis, at this moment they are unaccounted for. Therefore, for the benefit of the reader, the following annotated burial plan (see Figure 33) was produced to illustrate the skeletal material included in this study.

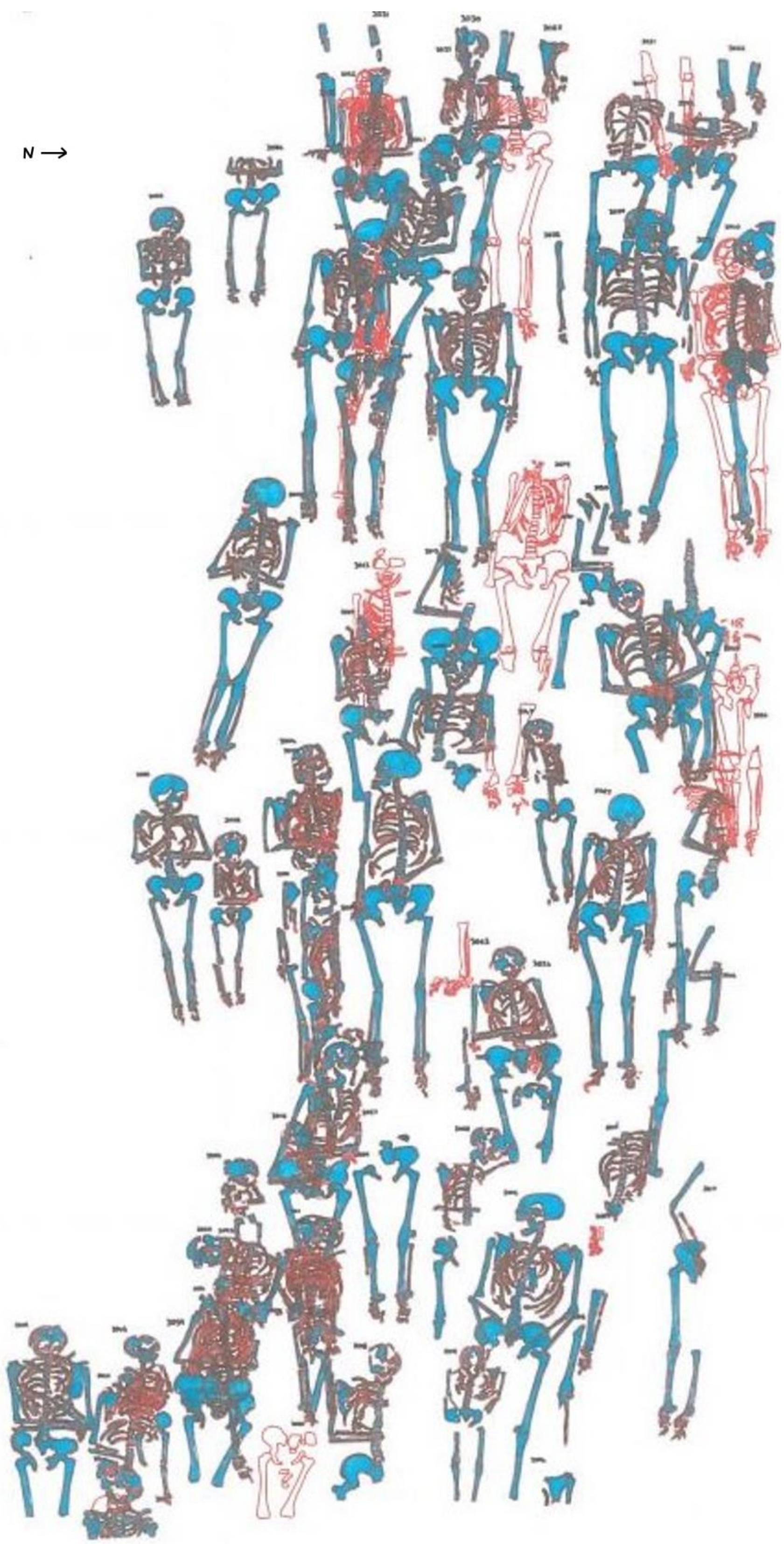

Figure 33 - This digitized plan demonstrates the individuals (shaded in blue) have been osteologically analysed in the laboratory, the individuals not shaded are currently unaccounted for.

4.5 Association of Burials in Relation to Biological Sex

Completion of the skeletal analysis of the PSA human remains, the data was cross examined against the Harris matrix produced to determine if there was a correlation with biological sex and location of interments. It is evident that the skeletal remains interred in the northern area of the churchyard at PSA were buried with no spatial correlation in regards to biological sex of said individuals (see Figure 34).

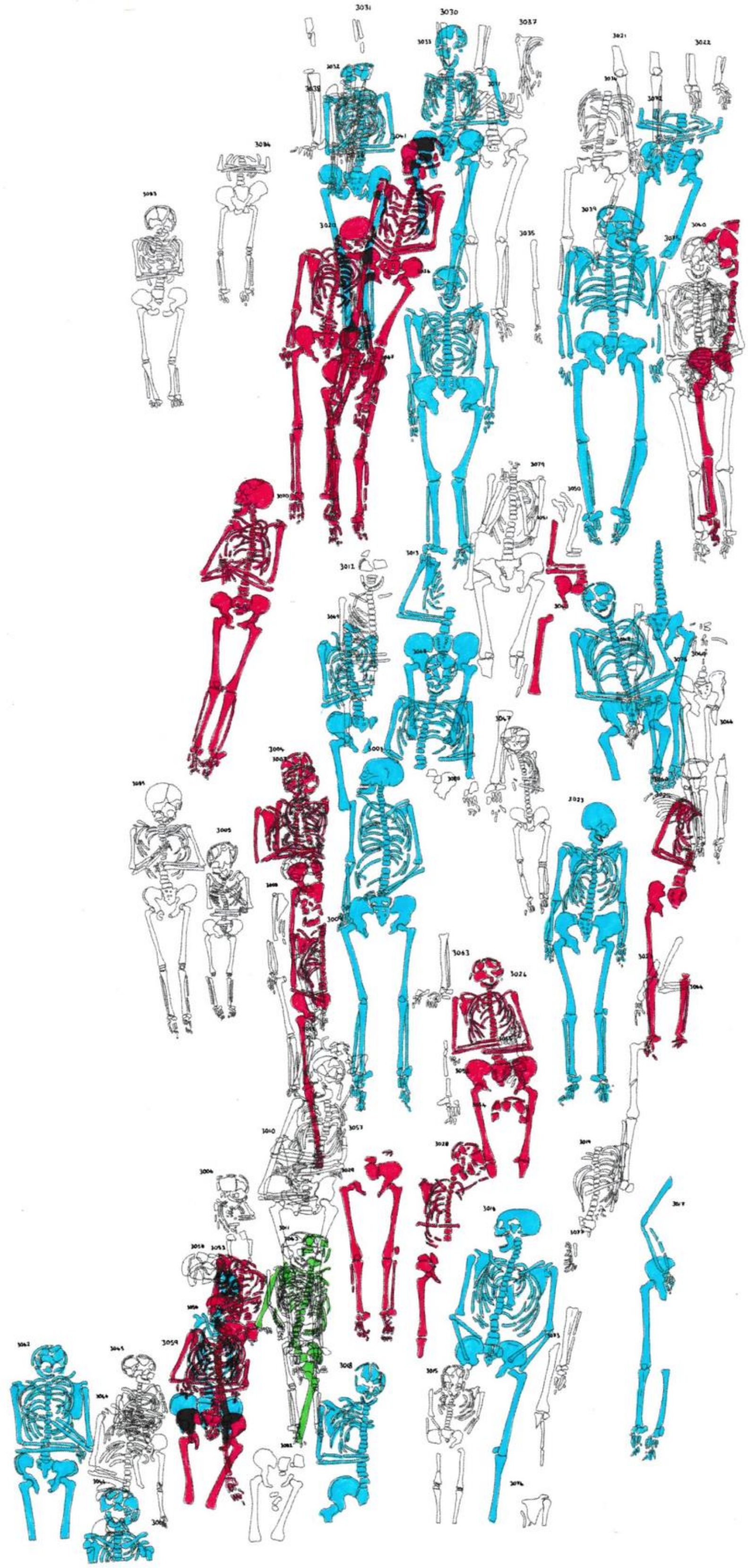

Figure 34 – Annotated digitized plan of burials in the northern area displaying the adult population where biological sex was recorded using the following colour system: blue = male/probable male?, pink = female/probable female?, green = undetermined.

4.6 Association of Burials in Relation to Adult and Non-adult Remains

Another aspect of burial interpretation was to investigate if there was any spatial organization with regards to adult and non-adult remains at PSA. By using the Harris matrix produced and information collated through skeletal investigation there was no causal link identified (see Figure 35).

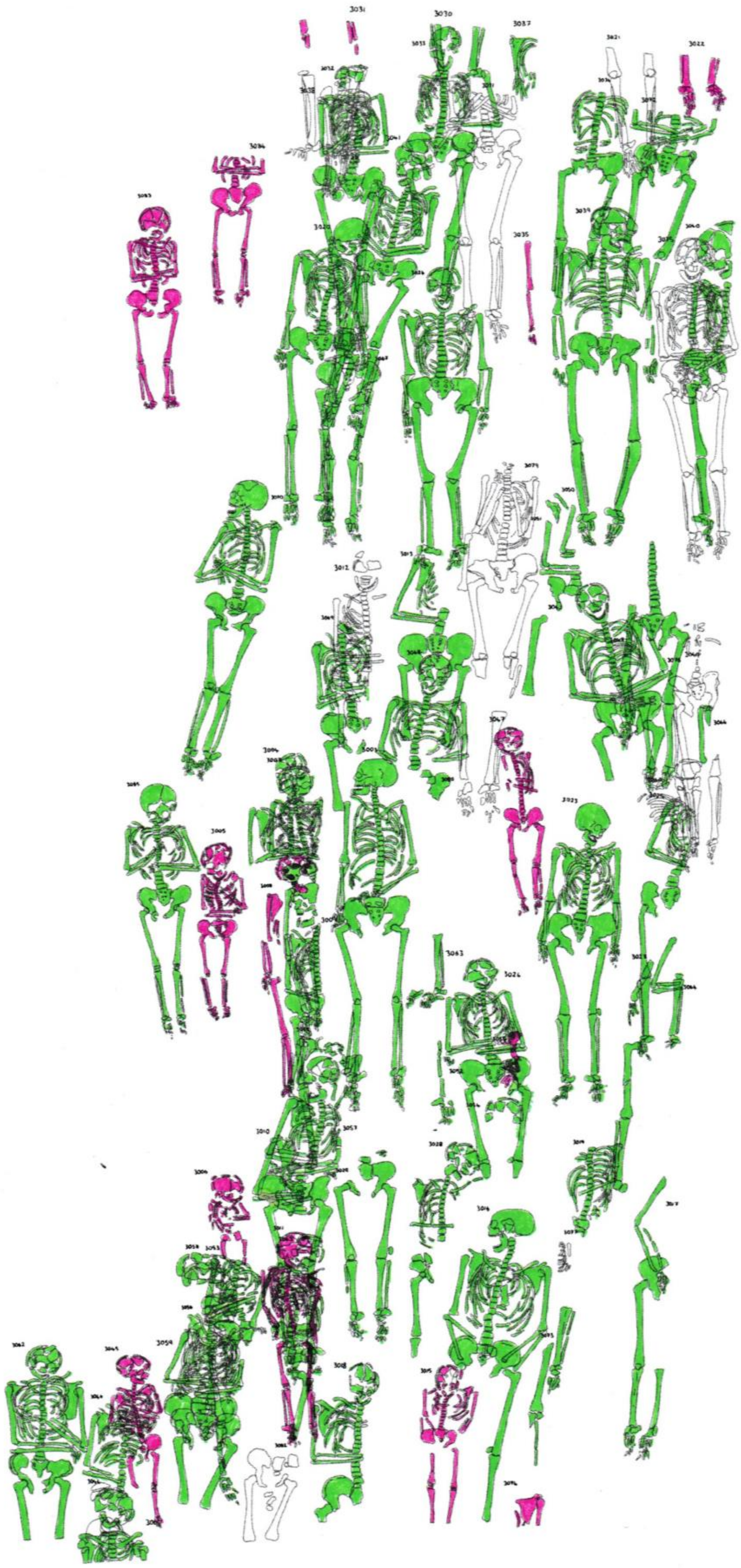

Figure 35 - Annotated digitized burial plan indicating the location of adult and non-adult burials in the northern area of the churchyard at PSA (green = adult, pink = non adult remains).

4.7 Age-at-death in Association of Burial Location

Further investigation was conducted into the age categories of those interred at PSA using Buikstra and Ubelaker (1994) categories: infant, child, juvenile, young adult, middle adult and old adult. The site Harris matrix was used to display the various age categories identified through skeletal investigation (see Figure 36). It is apparent there is no association to the age-at-death estimation of individuals in relation to their burial position. Sk numbers that have no colour surrounding them indicate that no age assessment was carried out in the analysis due to too little skeletal material.

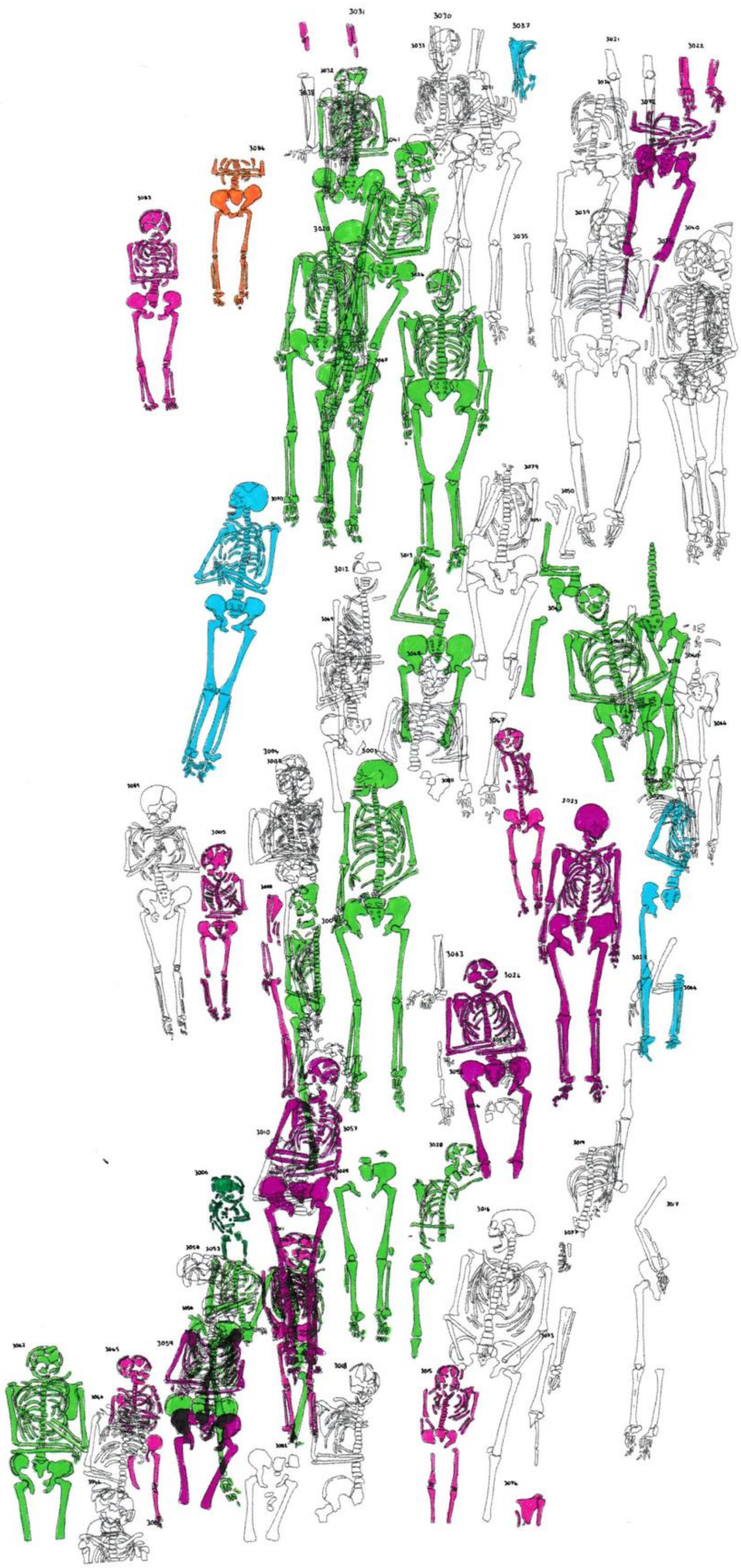

Figure 36 – A colour coded digital plan of burials in the northern area demonstrating the relationship of those interred at PSA (infant = dark green, child = pink, juvenile = orange, YA = blue, MA = purple, old adult = green).

4.8 Burial Type and Coffin Material

Another factor explored with this assemblage was in relation to the burial type, concerning coffin material and furniture. Although they were digitized for the current study, the original burial drawings were used to identify the type of burial present at the site. There was evidence in terms of coffin nails and plates, as well as cist remnants for four burials at PSA. The site Harris matrix was used to determine if there were any relationships regarding said burial types (see Figure 37). Conversely, there appears to be a clear relationship with regards to chronology of the burials in relation to burial type at PSA. Remnants of cist burials are apparent in few earlier burials at PSA, whereas, some of the more recent burials at the site display evidence of coffin use. Regarding sk 3056/3059 and 3057/3058 from the original site drawings it is unclear the exact burials that involved a cist burial, therefore, for the purpose of this project all four have been recorded in this burial type category.

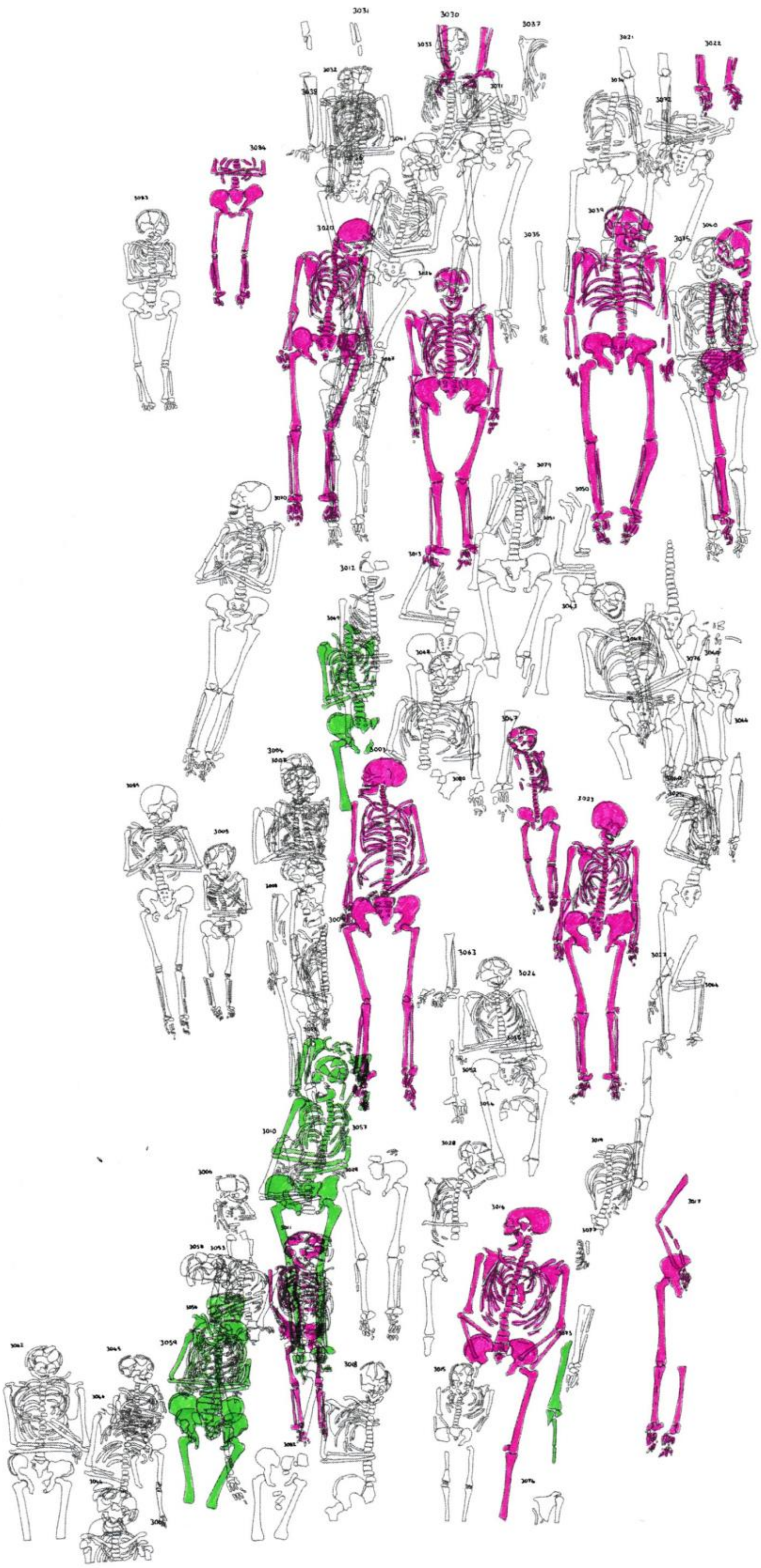

Figure 37- A colour coded digital plan showing burial types identified at PSA in the northern area, in relation to cist remnants and coffin materials (cist = green, coffin material = pink).

Chapter 5

Discussion

5.1 Intramural Burials

Individuals buried within a church were categorized of having wealth and a higher status in society (Boyle & Keevill 1998, 87). This also applies to the grave in which an individual is buried, for example gender or social class may affect the depth or shape of grave (Parker Pearson 1999, 5). According to location in relation to the high altar and church led to various areas within the cemetery valued differently. Therefore, displaying social roles within a society could be displayed, due to the burial custom of the different categories of individuals buried (Jonsson 2009, 119). Regarding spatial organization within the church, the chancel was acknowledged as the most holy area (Daniell 1997, 95). However, Gittings (1984, 40) claimed any eschatological purposes that a funeral ritual held changed after the reformation with the sole purpose to serve as the disposal of the corpse, with no direct theological significance attached.

Originally intramural burials were restricted to senior religious personnel, however, due to the desire to be buried near the high altar, intramural burial became more common (Augenti and Gilchrist 2011, 503). In the later post-medieval period, hazards to health were a concern regarding the organization of churchyards, alongside the superstition of disturbing the dead (Sayer 2011a, 202). An English cleric Thomas Lewis stated in the late post-medieval period that burials within churches should cease, due to the public health risks – such as stench and risk of disease (Jenner 2005, 618-19).

5.2 Demographic Comparison

After the skeletal investigation was conducted on the population sample, the next important step was to determine the relationship the site has with the wider post-medieval population. Demographics are investigated through sex and age-at-death data; however, this data can be affected due to poor preservation of skeletal material available (Wright and Yoder 2003, 47). Comparative sites from the post-medieval period in Britain selected for this current study include St. Martin's (SM) in Birmingham and Chelsea Old Church (COC) in London. Due to the period of time that PSA was in use (1300's-1700's) meant that post-medieval comparisons were used instead of the medieval period. The following comparisons in this chapter have been produced in order to understand if there were any relationships or notable differences for the sites mentioned against PSA. Due to the location of PSA in relation to the comparative sites there may be certain differences as PSA is a coastal, island population in comparison to the other two sites in urban environments.

5.2.1 Post-medieval Comparison for Stature

Stature was not recorded in the current study for non-adult remains due to the usefulness of data collected. Non-adults were most likely facing malnutrition or suffering from an illness thus relating to their death at a young age. It is common knowledge that when health is affected there are various repercussions; therefore, indicating stature may not be a true account therefore producing anomalies of the data. Stature was recorded only when the biological sex of the adult individual was identified, due to the regression formulae used (Trotter's 1970 method) for 'black' males and females.

For all three sites the male average height scored higher than female average height, which is expected (see Figure 38). However, the female mean of PSA (156.43 cm) scored lower than SM (159.1 cm) and COC (163.4 cm) sites. Regarding male heights for all three sites, PSA scored the lowest (the same case for the PSA female assemblage (PSA – 165.43 cm, SM = 171.8cm, COC = 168.4cm). These results are questionable, as it is known that height correlates with health and wellbeing. Therefore, with PSA being a coastal location with fresh air and marine diet stature should potentially be greater than those living in unsanitary, crowded accommodation where pollution and diseases were rife. On the other hand due to the island locality of Portland other issues around health and living arose, such as penetrating damp in housing during the long and awful winter months potentially causing various health issues for individuals.

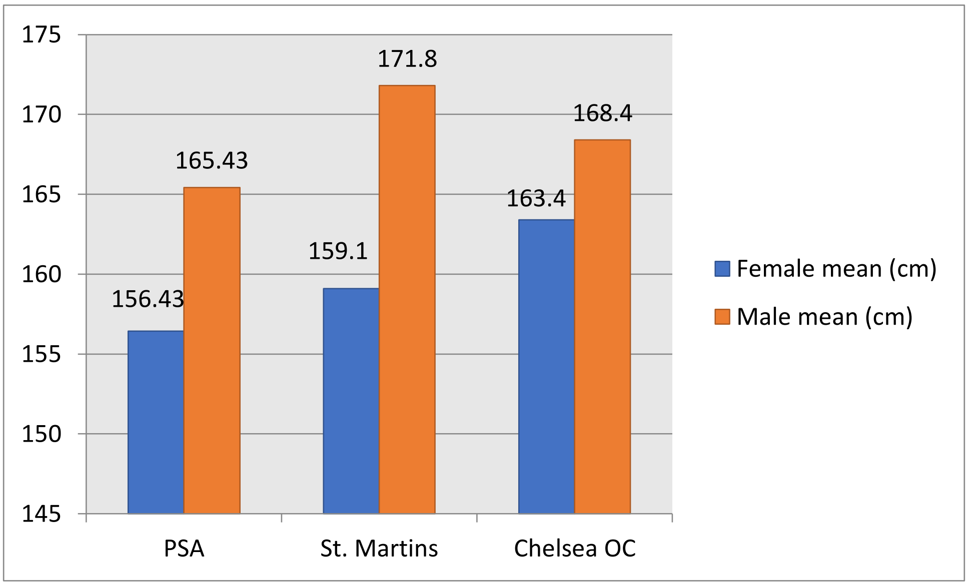

Figure 38 - The female and male mean (values recorded in cm) for stature recorded at PSA, St. Martin's, and Chelsea Old Church.

5.2.2 Post-medieval Comparison for Biological Sex Differences

The ‘male’ category for all three post-medieval sites consisted of a similar result, with ‘male’ categories scoring greater than ‘female’ categories for all three sites (see Figure 39). Figure 39 also displays the clear distinction with both the ‘female’ and ‘male’ categories both displaying a similar incline of distribution across the sites. It is evident from this graph that PSA had an enormous amount of individuals unassigned a sex, this is most probably due to the poor preservation and lack of skeletal material of the PSA assemblage.

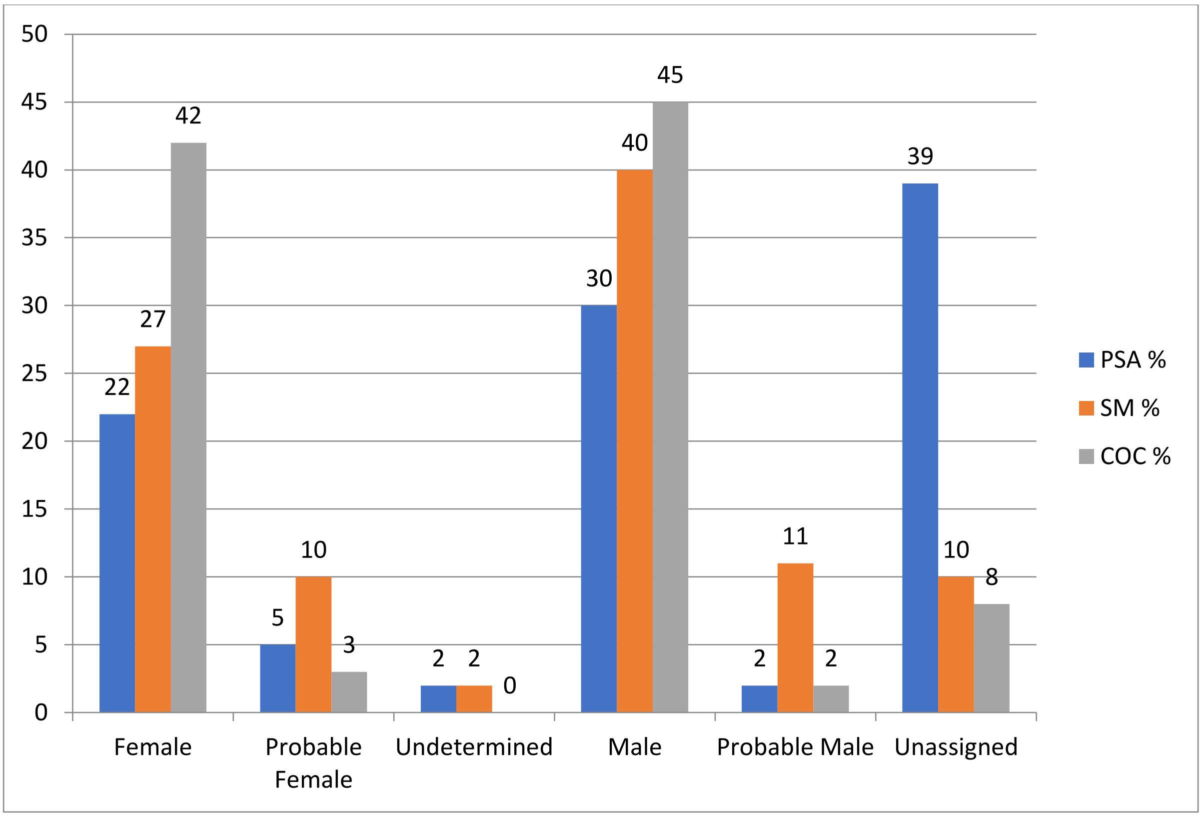

Figure 39 - The biological sex differences recorded for Portland St. Andrew’s, St. Martin’s and Chelsea Old Church.

5.2.3 Post-medieval Comparison for Age-at-death Estimations

With all three sites it is evident that the 'adolescent' category has the least amount of individuals dying during this period. The 'old adult' category had a greater amount than all other categories (for both PSA and COC), with PSA scoring the highest out of all three sites. Out of all three assemblages SM scored the highest for the MA category, with COC following not too far behind (see Figure 40).

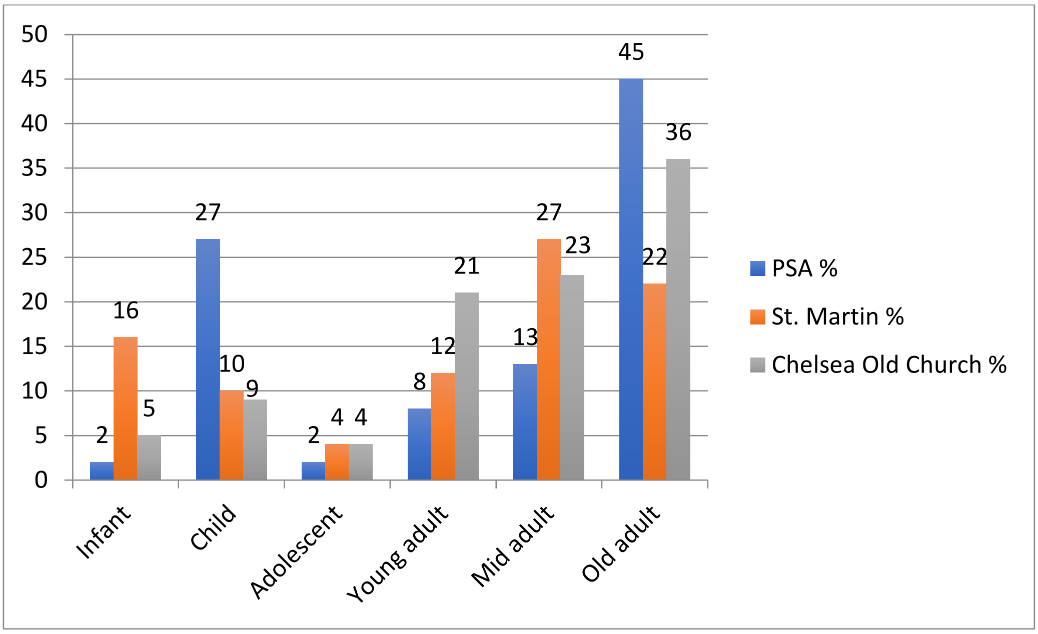

Figure 40 - The percentage of population from all three sites in relation to the various age-at-death categories.

Regarding non-adult categories, the 'child' category scored the greatest, with the highest of all sites being PSA. However, out of all three sites PSA had the lowest percentage of the 'infant' category. The deficit of infant burials identified at PSA could be due to a number of reasons, for example infant burials may be located in the grounds separate to where the northern area was excavated in the 1980's. In some cases infant burials are found in close proximity to the church foundations due to the convenience and necessity of smaller and shallower graves, compared to the deeper burials that would be required for adult burials (Anderson 2007, 98). Furthermore, due to the increased rate of decay of infant/child remains due to taphonomic factors and/or shallow depth of the grave these are also possible explanations (Lucy 1994, 21-34).

It is important to note that due to the fact that age categories may differ in literature, for example PSA and St. Martin's both used Buikstra and Ubelaker (1994) age groups: infant (birth- 3 years); child (4-12 years); juvenile (13-19 years); young adult (20-35 years); middle adult (35-50 years); old adult (50+ years). Whereas, COC used more specific age categories (perinatal; 1-6 month; 7-11 month; 1-5 years; 6-11 years; 12-17 years; 18-25 years; 26-35 years; 36-45 years; >46 years) – for the purpose of this study the specific age groups used for COC were condensed into the same age categories as PSA and SM (to enable a more effective comparison).

5.2.4 Post-medieval Comparison of Pathological Conditions

By studying nutritional stress and identifying pathological lesions this may enable anthropologists to assess the health status of archaeological collections (Lewis 2002, 15). In archaeological remains joint disease is the most common pathological condition (Waldron 2019, 719). Joint disease was the most prevalent disease in the PSA and COC assemblage, whereas, both congenital disease and trauma scored higher for the SM assemblage (see Figure 41). Therefore, demonstrating that although PSA and COC vary in location (rural to an urban environment) pathology such as joint disease affected both populations similarly. Furthermore, prevalence of both circulatory and neoplastic diseases scored low with all three sites.

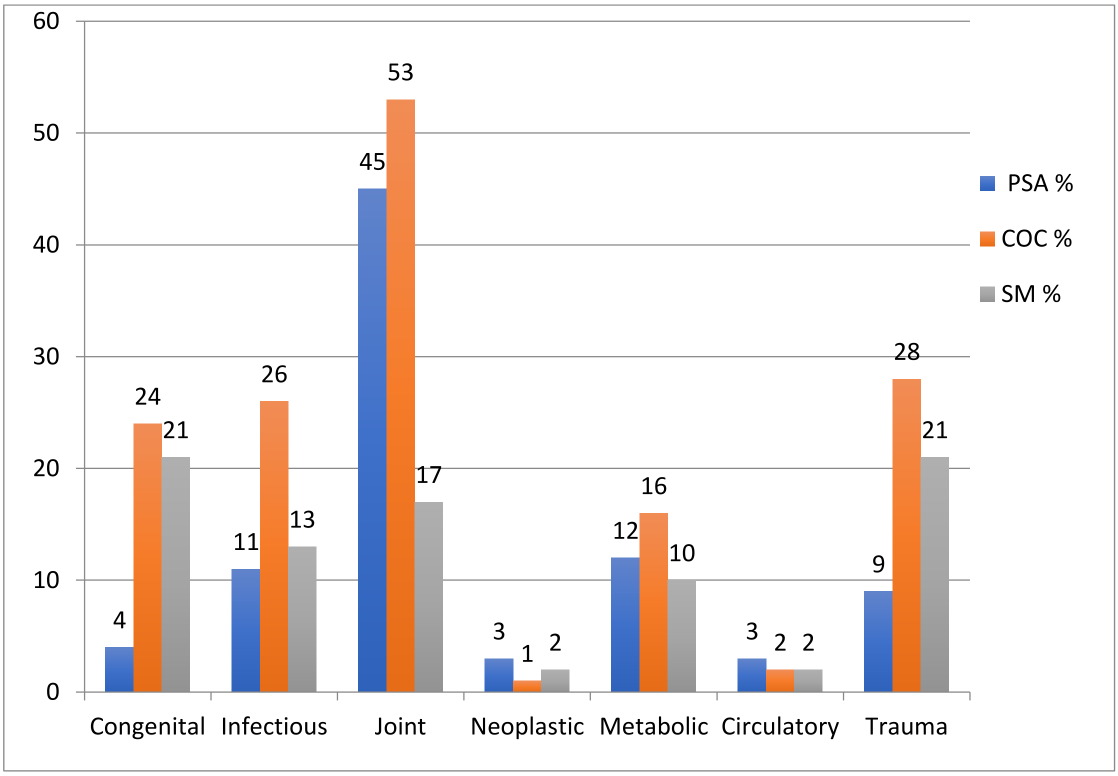

Figure 41 - The prevalence of pathological conditions and trauma rates in relation to PSA, St. Martin's and Chelsea Old church.

It is important to consider the limitations when using comparative sites within a study. For example, different researchers and institutions use various recording methods. Some studies may also receive extra funding or grants and therefore research may be conducted at a deeper level, this is the case for one of the comparative sites in this study (St. Martin's) with funding/further research into metabolic conditions. Furthermore sample representation should be contemplated, as researchers work with skeletons that have been excavated so they may not be representative of the population (for example individuals with high/low status or infants buried elsewhere in the churchyard.

To conclude this chapter, the current study found no specific relationship with regards to the geographical location of PSA and the comparison sites. Therefore, indicating that living on an 'island' locality such as PSA, had no significant effect with regards to pathology and demographics in the wider post-medieval period. Furthermore, there was a greater number of males buried at PSA and both comparative sites, therefore indicating similarities for the post-medieval burial population. In relation to age-at-death estimations the 'old adult' age category had a greater percentage of individuals for both PSA and COC, whereas SM had majority of the adult assemblage greater for the 'middle adult' category. As expected, as a universal matter the adult male stature was higher in all three sites compared to the female average. Furthermore, the most common disease in archaeological samples (joint disease) scored greater with PSA and COC, therefore, showing that despite the different geographic locations of all three sites used in the current project there were no significant differences found regarding palaeopathological lesions. Overall, demography assessed in this project indicates no clear distinction with vicinity of the population (rural/coastal at PSA against urban for SM and COC) as expected to begin with.

Chapter 6

Conclusion and Future Work

6.1 Conclusion

To conclude a comprehensive digital plan was produced of the single interments originating the northern area adjacent to the church of PSA. From this digital plan it enabled the following section to be determined. First and foremost, there is no association to spatial organization of burials in relation to age-at-death, biological sex or pathology of the PSA assemblage. Buried in the northern area of the churchyard there was a greater ratio of M:F (18:13) burials. Various pathology and trauma was noted on the skeletal material, however, the most common being joint disease. Age-at-death estimations of the assemblage mostly consisted of two categories 'child' and 'old adult', with the 'old adult' category the greatest. The intramural burials which consist of the three communal graves require further investigation, due to the skeletal remains never been examined or lifted. Reasons as to who these individuals are, how they possibly died and ultimately how they lived and ended up in these communal graves remains unanswered at this time.

6.2 Limitations

Over the course of the current project a few limitations were encountered. First, the limited laboratory time placed enormous pressure at the beginning (time to lay the skeleton out in anatomical position to analyse age-at-death, sex, stature, pathology) in between classes and any free time allocated. With the additional task before analysis concerning sorting all skeletal material into their correct boxes, as over the years some had become misplaced and used for teaching purposes. However, the positive to this ensured all skeletal material was in the correct location for analysis.

Second, the digitization of burial plans was originally going to be carried out on AutoCAD, after spending a significant amount of time using this software, a switch to other software occurred. Adobe Illustrator then became the software of choice for digitizing the burial plans of PSA. Last, came the greatest limitation faced of this current project Covid-19, effectively closing campus (with global ramifications too), altogether for six months.

6.3 Future Work

Various burial practices (in terms of coffin nails/plates and remnants of cist burials) identified at PSA demonstrate the stratigraphy of burials interred there. For future work it would be valuable if this data were to be utilised in terms of radiocarbon dating. This information may provide a wealth of knowledge in terms of exact dates of those interred in the northern area of the churchyard.

Another topic that would be beneficial to investigate with the PSA burial population is stable isotope analysis. This would allow population growth and birth spacing of individuals buried at PSA to be determined. Diet of this burial population could be identified through said investigations, especially with Portland being a coastal location. Additionally, weaning practices may also be investigated through such analyses.

As previously mentioned, there is photographic evidence the intramural communal burials were reinterred at the time of excavation. However, could it be deemed necessary in the future to exhume for further scientific investigation to understand the rationale of their burial location. Additionally, the current project has not determined a definite reasoning behind said burials, therefore, further investigation is deemed essential.

Providing potential for future non-adult skeletal studies comprising biological sex and metric data, as these were not investigated in the current project. The current project recorded non-metric traits, although previous literature states Portland as being an 'isolated community', therefore, this topic can be delved into further for potential familial links. Furthermore, aDNA analysis could possibly be conducted in future studies to determine sex, identify disease pathogens or familial links with the PSA burial population.

Alongside dental pathology, in the current project dental wear was documented, although not fully explored. Consequently, future studies could delve deeper into this topic to potentially divulge into the diet of this burial population. In addition, radiography was not possible in the current project due to numerous reasons, this would be a great as a confirmatory tool in cases where malnutrition or deficiencies are exhibited on skeletal remains – for example the presence of Harris lines on long bones. Furthermore, radiography would have been a significant tool with non-adult remains in terms of age-at-death estimations with regards to dental development and eruption. To conclude, future studies may benefit from the use of different recording methods compared to the methods used in the current study.

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Figures

Figure 1 - Ordnance Survey, 2021. Portland, UK, 1:5,000 [online map]. EDINA: Digimap.

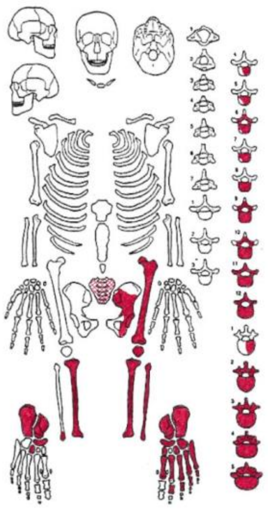
Available from: OS Roam (edina.ac.uk).

Ordnance Survey, 2021. Portland, UK, 1:40,000 [online map]. EDINA: Digimap. Available

from: OS Roam (edina.ac.uk)

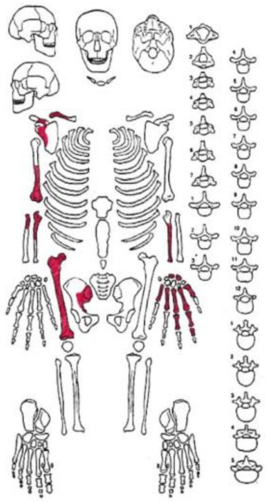
Photographs included in this thesis have either been taken by the author or are from the original site archives where Alan Hunt is the author (as stated with the photograph).

Appendix A – Osteological pro forma and summaries



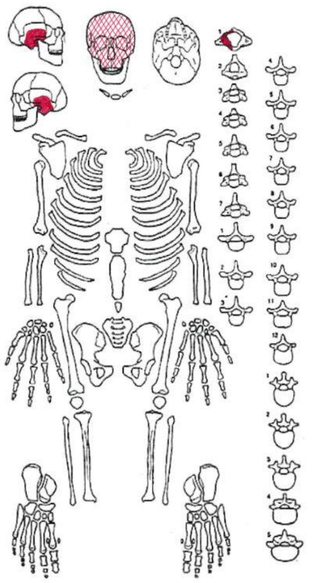
3049:

Vertebrae and lower extremities available only. PM?/U (pelvis only). L auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Schmorls nodes present on 3 vertebral bodies. Eburnation present on L distal metatarsals. Using Trotter and Gleser's 1970 method stature (from L femur) was estimated at 5 ft 5.



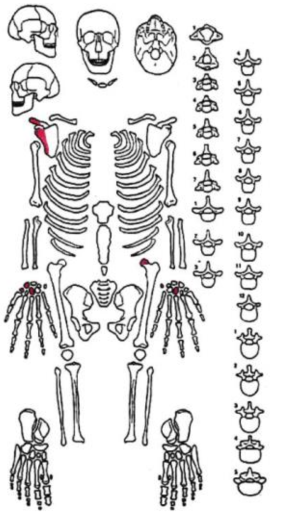
3051:

Alongside bones recorded on pro forma, a great quantity of rib and vertebral fragments also present. Female (pelvis only). Auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Eburnation present on L forearm, and hand, R humerus and clavicle. DJD of spine present. MNI = 2 (additional L 2nd metatarsal).



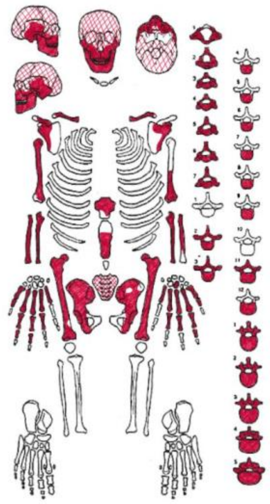
3054:

Skull fragments (including auditory ossicles stapes and incus) and C1 fragment only present. PF? (skull only). Eburnation present on C1.



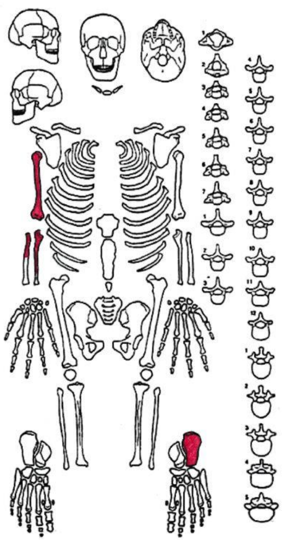
3055:

Alongside bones recorded on pro forma, numerous unidentified rib fragments also present. No pathology to report.



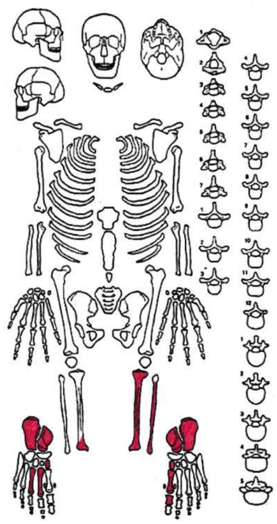
3056:

Alongside bones recorded on pro forma L and R rib fragments and some unidentified vertebral fragments also present. Female (from skull and pelvis). L and R auricular surface = aged 30-34 years using Lovejoy et al 1985 method. Dental pathology was recorded – calculus and LEH was identified, with periodontal disease recorded as 'mild' according to Ogden (2008). Dental wear was also present on majority of teeth. Eburnation present on L an R TMJ, upper extremities, femora, L SIJ. MNI = 4 (alongside 3056a + b, additional R cuneiform, rib and vertebral fragments. Using Trotter and Gleser's 1970 method stature (from R humerus and R radius) was estimated at 5ft.



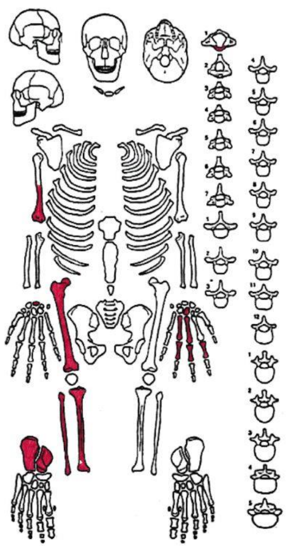
3064:

No sex, age-at-death estimations or pathology were recorded due to too little skeletal material.



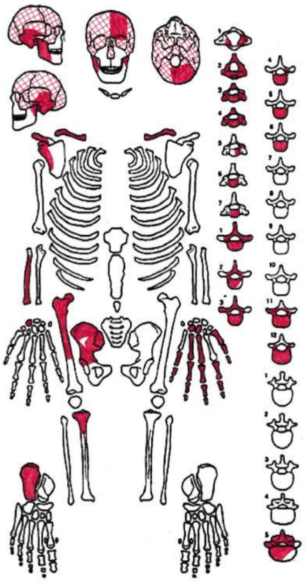
3063:

Evidence of fusion of epiphyses on L lower extremities = young adult. No pathology to report. Metal mark present on L fibula.



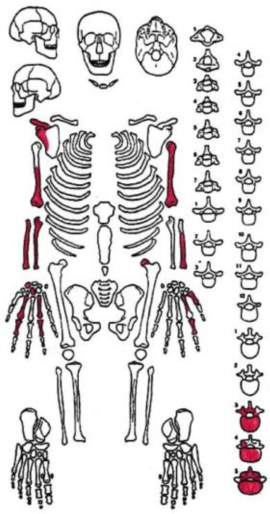
3027:

Alongside bones recorded on pro forma, vertebral fragments and pelvic fragment also present. Strong muscle attachments on R femur.



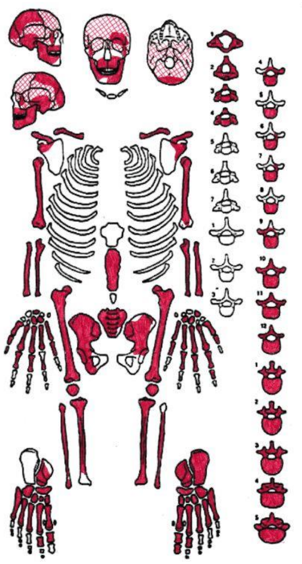
3028:

Alongside bones recorded on pro forma, rib fragments also present, alongside numerous vertebral and scapula fragments. Female (from skull and pelvis). R auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Eburnation present on R TMJ and L hand. DJD of spine evident. Porosity present on L and R clavicles.



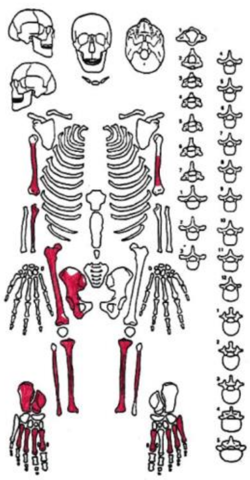
3010:

Alongside bones recorded on pro forma, rib and vertebral fragments also present. No sex, age-at-death estimations or pathology were recorded due to too little skeletal material.



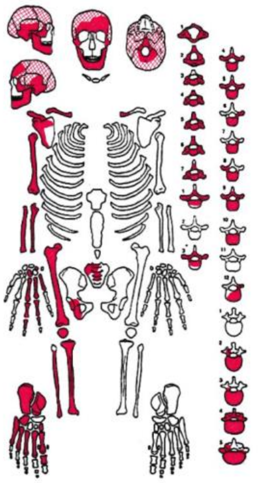
3020:

Alongside bones recorded on pro forma, rib, vertebral and scapulae fragments also present. Female (skull and pelvis). L and R auricular surface = aged 35-39 years - using Lovejoy et al 1985 method. Dental pathology was recorded – caries, calculus, AMTL and LEH was identified, with periodontal disease recorded as 'mild to moderate' according to Ogden (2008). Eburnation present on: L and R upper and lower extremities, L scapula and clavicle. Cribra orbitalia present on L orbit. Metal markings on L humerus and tibia, R clavicle and 4th metatarsal. MNI = 2 (additional fibula fragments and 4th metatarsal). Using Trotter and Gleser's 1970 method stature (from R humerus) was estimated at 5 ft 3.



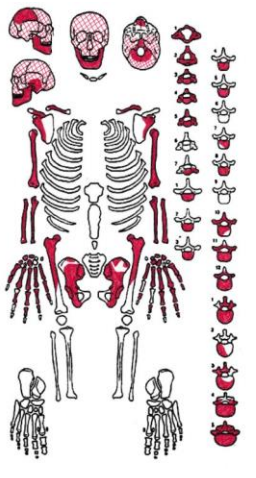
3017:

Alongside bones recorded on pro forma, rib fragments also present. PM? Eburnation present on: R humerus, femur, tarsals. MNI = 2 (additional R femur).



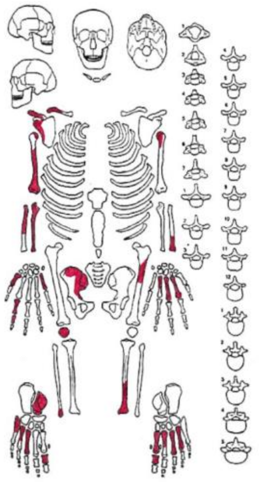
3040:

Alongside bones recorded on pro forma, rib, scapulae, skull, pelvic and vertebral fragments also present. Female (skull only). Dental pathology was recorded – caries, calculus, AMTL and LEH was identified, with periodontal disease recorded as 'mild to moderate' according to Ogden (2008). Cribra orbitalia present on L and R orbits, porotic hyperostosis also present. Arachnoid granulation present. Schmorls nodes present on 4 vertebral bodies. Eburnation present on: R hand and foot, upper and lower extremities, L and R TMJ. Using Trotter and Gleser's 1970 method stature (from R humerus, radius, ulna) was estimated at 5 ft 1. Metal marks present on R rib fragment and femur and mandible. MNI = 2 (additional maxilla, vertebral fragment and 2 teeth.



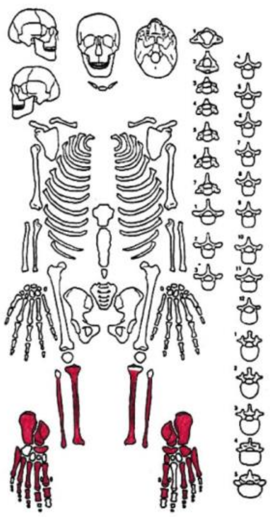
3042:

Alongside bones recorded on pro forma, rib, scapulae, skull, pelvic and vertebral fragments also present. Male (from skull and pelvis). L and R auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Dental pathology was recorded – caries, calculus, AMTL and LEH was identified. Strong muscle attachments on L and R upper and lower extremities, R clavicle. Eburnation present on L and R humerii, R carpal, L metacarpals. Schmorls nodes present on 2 vertebral bodies. Non-metric trait = mandibular torus. Using Trotter and Gleser's 1970 method stature (from L and R humerii, L ulna) was estimated at 5 ft 6.



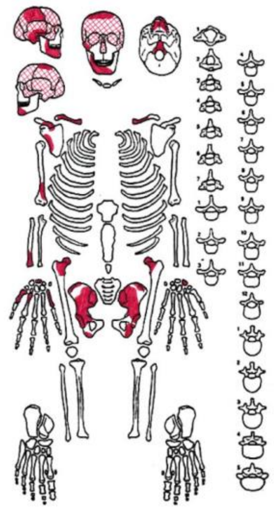
3053:

Alongside bones recorded on pro forma, rib, scapulae, skull and vertebral fragments also present. PF? (pelvis only). R auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Eburnation present on: R ulna, L radius, R 1st metacarpal, a rib fragment. DJD of spine present. Compression/wedge fracture present on 1 lumbar vertebra. MNI = 2 (additional R ulna fragment. Porosity present on R clavicle, SIJ, L tibia, L and R humerii and metatarsals/phalanges.



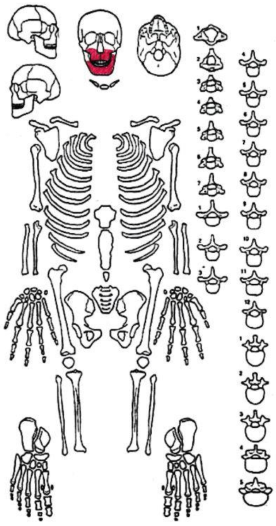
3030:

Alongside bones recorded on pro forma a rib fragment also present. No sex or age-at-death estimation recorded. Evidence of curving in fibulae = residual rickets. Porosity, lipping and osteophyte growth on majority of foot bones. Eburnation present on L 3rd metatarsal.



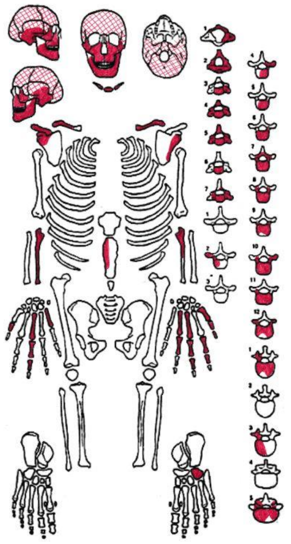
3059:

Alongside bones recorded on pro forma, rib, scapulae, skull, pelvic and vertebral fragments also present. Male (pelvis only). L and R auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Dental pathology was recorded – caries, calculus was identified, with periodontal disease recorded as ‘mild to moderate’ according to Ogden (2008). DJD of spine present. Eburnation present on: L carpal. Arachnoid granulation present. Button osteoma on sagittal suture evident.



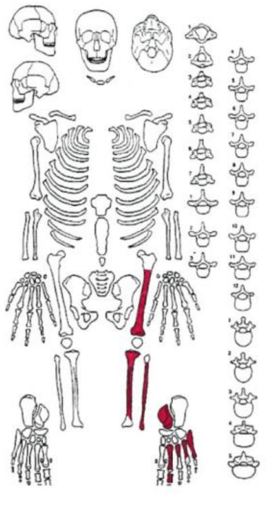
3056a:

No sex or age-at-death estimations were recorded due to too little skeletal material. Dental pathology was recorded – caries, calculus and LEH present.



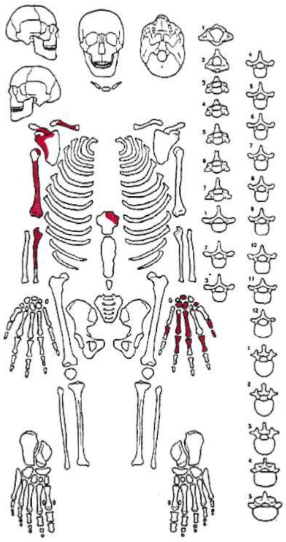
3068:

Alongside bones recorded on pro forma, rib, scapulae, skull, pelvic and vertebral fragments also present. Male (from skull only). Dental pathology was recorded – caries, calculus and AMTL was identified, with periodontal disease recorded as 'mild to moderate' according to Ogden (2008). Eburnation present on C2, L tarsal. DJD of spine present. Styloid process of R ulna unusual appearance = Salter Harris fracture present. Healed L rib fragment also present. Using Trotter and Gleser's 1970 method stature (from R ulna) was estimated at 5 ft 6. MNI = 2 (additional R ulna fragment and 3rd metacarpal.



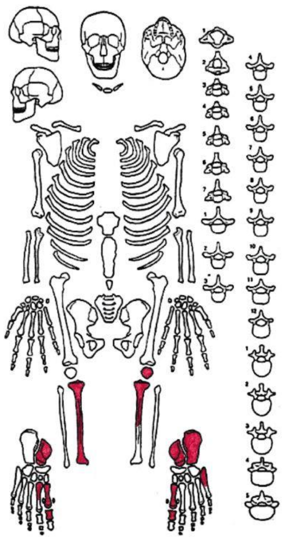
3048:

No sex, age-at-death estimations were recorded due to too little skeletal material. Woven periosteal new bone present on L 4th metatarsal.



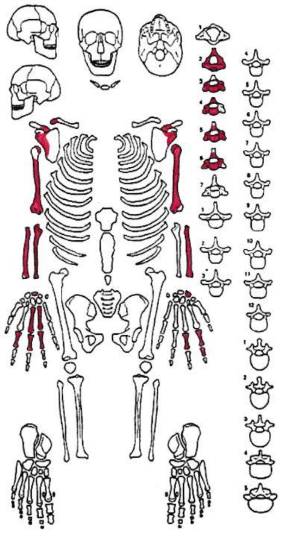
3046:

Alongside bones recorded on pro forma, rib, skull, pelvic and vertebral fragments also present. No sex, age-at-death estimations were recorded due to too little skeletal material. DJD of spine present. Schmorls nodes present on 1 vertebral body. Deep 2 clavicular sulcus present. MNI = 2 (additional 2 juvenile fragments).



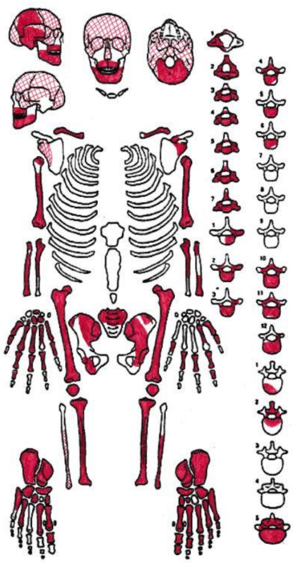
3065:

No sex, age-at-death estimations or pathology were recorded due to too little skeletal material. MNI = 2 (additional 1st foot phalanx).



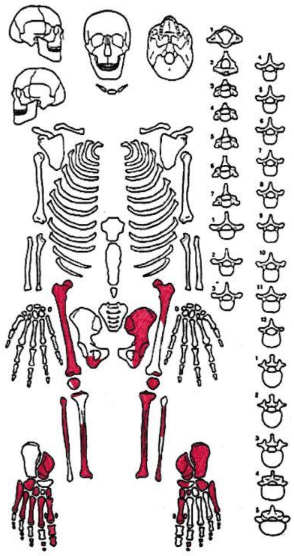
3058:

Alongside bones recorded on pro forma, rib, skull and vertebral fragments also present. No sex, age-at-death estimations were recorded due to too little skeletal material. DJD of spine present (C2-C6). Eburnation present on R carpal.



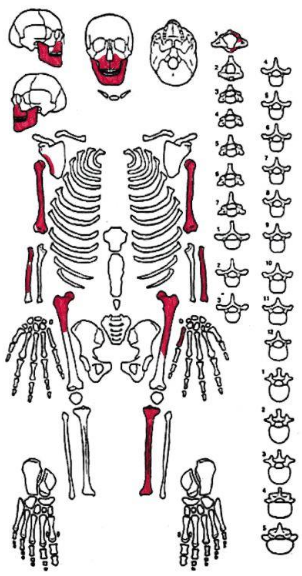
3041:

Alongside bones recorded on pro forma, rib, scapulae, skull and vertebral fragments also present. Female (using skull and pelvis). Dental pathology was recorded – caries, calculus, LEH, AMTL was identified, with periodontal disease recorded as 'mild to moderate' according to Ogden (2008). Dental wear also present. L and R auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Arachnoid granulation present. Eburnation present on: L and R upper and lower extremities, tarsals, L SIJ. Periosteal new bone formation present on L and R tibiae = Periostitis/non-specific infection. Using Trotter and Gleser's 1970 method stature (from L humerus) was estimated at 5 ft 1. Non-metric trait = bilateral septal aperture.



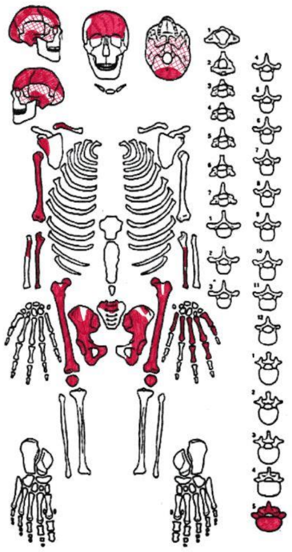
3029:

Alongside bones recorded on pro forma, vertebral, sacral and long bone fragments also present. Female (from pelvis only). L auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Non-metric trait = lateral squatting facets. MNI = 2 (additional L cuboid).



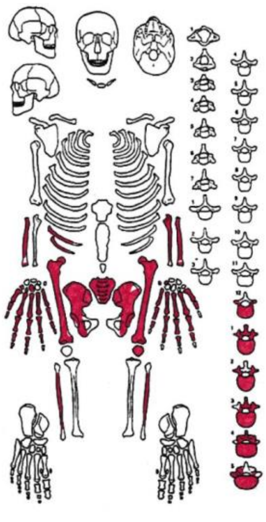
3016:

Alongside bones recorded on pro forma, rib fragments also present. Male (from skull only). Dental pathology was recorded – caries, calculus, LEH, AMTL (due to presence of periapical lesion) was identified, with periodontal disease recorded as 'mild to moderate' according to Ogden (2008). Non-metric trait = L tibia lateral squatting facet. MNI = 2 (additional 2 pelvic fragments). Using Trotter and Gleser's 1970 method stature (from L radius and R humerus) was estimated at 5 ft 6- 5 ft 7.



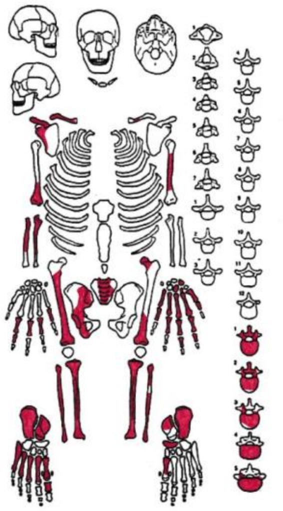
3013:

Alongside bones recorded on pro forma, skull, vertebral, sacral and rib fragments also present. Male (from pelvis). L auricular surface = aged 50-59 years, R auricular surface = 40-44 years - using Lovejoy et al 1985 method. R pubic symphysis = 27- 66 years - using Suchey Brooks 1990 method. L and R parietals = porotic hyperostosis. Non-metric trait = bilateral parietal foramina. Porosity on 1 lumbar vertebra. MNI = 2 (additional L femur fragment, R humeral fragment, 2 skull fragments. Using Trotter and Gleser's 1970 method stature (from R humerus) was estimated at 5 ft 5.



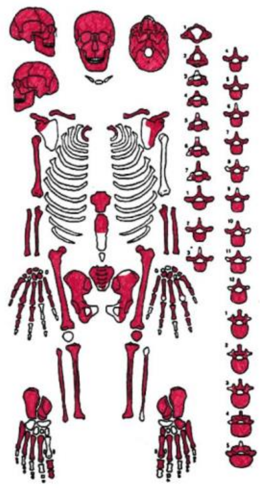
3072:

Alongside bones recorded on pro forma, rib fragments also present. Male (from pelvis only). L auricular surface = aged 35-39 years, R auricular surface = 30-34 years - using Lovejoy et al 1985 method. MNI = 2 (additional proximal hand phalanx). Eburnation present on: L and R SIJ, femora. Congenital – unilateral spondylosis of L5.



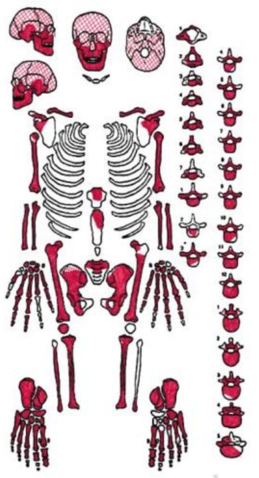
3025:

Alongside bones recorded on pro forma, rib and vertebral fragments also present. Female (from pelvis only). R auricular surface = 30-34 years - using Lovejoy et al 1985 method. Schmorls nodes present on 5 vertebral bodies. Eburnation present on: R upper and lower extremities, pelvis, L and R tarsals, metatarsals, L metacarpals. Non-metric trait = single talar and calcaneal facets. R 5^{th} metacarpal = healed fracture.



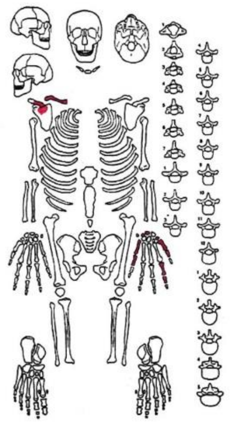
3023:

Alongside bones recorded on pro forma, rib and scapulae fragments also present. Male (from skull and pelvis). Dental pathology was recorded – caries, calculus, LEH, AMTL was identified, with periodontal disease recorded as 'mild' according to Ogden (2008). L auricular surface = aged 40-44 years, R auricular surface = 35-39 years - using Lovejoy et al 1985 method. Porotic hyperostosis on L and R parietals. Eburnation present on: L and R TMJ, upper and lower extremities, clavicles, SIJ, scapula, manubrium L and R hand bones. Non-metric trait = bilateral parietal foramina. Using Trotter and Gleser's 1970 method stature (from R humerus, R radius, L ulna, R femur) was estimated at 5 ft 3- 5 ft 4.



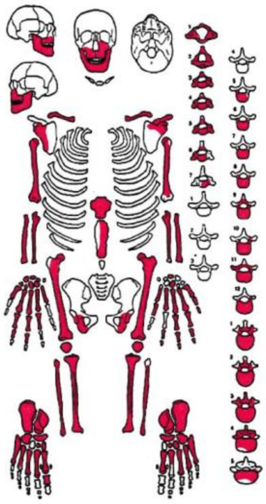
3026:

Alongside bones recorded on pro forma, rib, vertebral, sacral, skull and scapulae fragments also present. Male (from skull and pelvis). L and R auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Dental pathology was recorded – caries, calculus, LEH, AMTL was identified, with periodontal disease recorded as 'mild to moderate' according to Ogden (2008). Dental wear also present. Schmorls nodes present on 10 vertebral bodies. Eburnation present on: L and R TMJ, C1. Deep clavicular sulcus L and R. Metal marks on: L tibia, ulna, radius, humerus, SIJ, R femoral fragment, 2 skull fragments. L and R foot bones. Using Trotter and Gleser's 1970 method stature (from L humerus, L radius, R femur) was estimated at 5 ft 6.



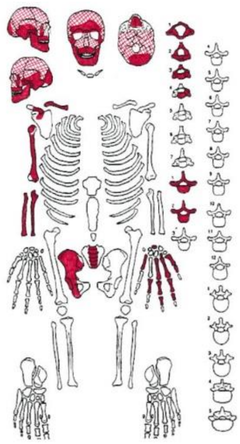
3037:

Alongside bones recorded on pro forma, rib fragments also present. No sex, age-at-death estimations were recorded due to too little skeletal material. However, R medial clavicle has fusion flake present = young adult. Eburnation present on L carpal and 5th metacarpal. Healed trauma present on R clavicle = distorted shape.



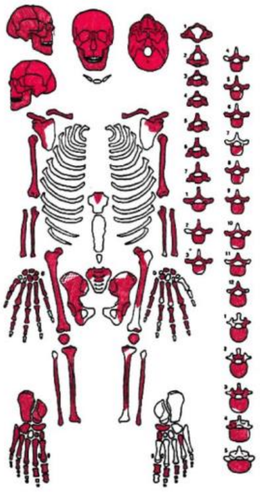
3039:

Alongside bones recorded on pro forma, rib, vertebral, pelvic and scapulae fragments also present. Male (from skull only). Dental pathology was recorded – caries, calculus, LEH was identified, with periodontal disease recorded as 'mild to moderate' according to Ogden (2008). Eburnation present on: L and R TMJ, R hand and foot bones, C1, C2, L and R femora. Metal marks on: L and R metacarpals, L scapula, clavicle, L and R upper extremities. Non-metric trait = Allen's fossa/plaque. Schmorls nodes present on 4 vertebral bodies. R tibia is distorted = residual rickets. Using Trotter and Gleser's 1970 method stature (from R humerus, R radius, R ulna) was estimated at 5 ft 4.



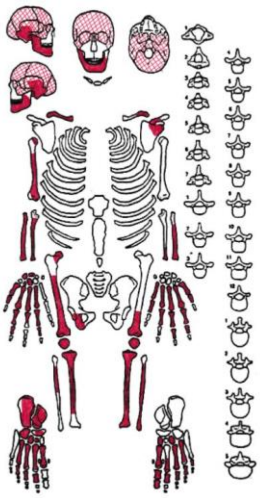
3018:

Alongside bones recorded on pro forma, rib, skull, vertebral, pelvic and scapulae fragments also present. Male (from skull and pelvis). Dental pathology was recorded – caries, calculus, AMTL (part of mandible = edentulous). Arachnoid granulation present. Congenital = fused C3 + C4 vertebrae. Eburnation present on: C1, C2, L and R TMJ, L 1st metacarpal.



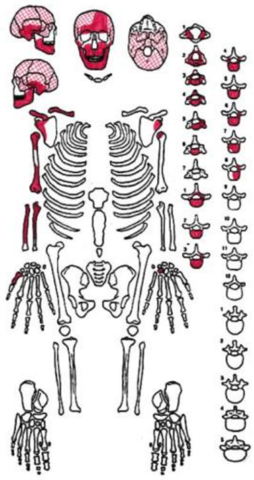
3003:

Alongside bones recorded on pro forma, rib, skull, vertebral and scapulae fragments also present. Male (from skull and pelvis). Dental pathology was recorded – caries, calculus, AMTL, LEH and a periapical lesion present, with periodontal disease recorded as 'mild to moderate' according to Ogden (2008). L and R auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Non-metric trait = Carabelli cusp. Eburnation present on: L and R TMJ, C1, C2. Schmorls nodes present on 2 vertebral bodies. Deep clavicular sulcus L and R. Consecration on skull fragment. L and R deep fovea capitas present. Osteomyelitis present on L fibula. Using Trotter and Gleser's 1970 method stature (from R and L humerus, R radius, R ulna) was estimated at 5 ft 6.



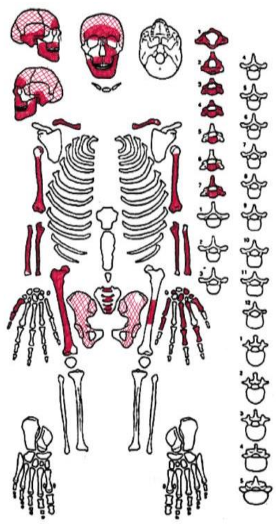
3004:

Alongside bones recorded on pro forma, rib, vertebral and scapulae fragments also present. Female (from skull only). Eburnation present on: R 4th metacarpal. DJD of spine present. Edentulous. Metal marks on 2 skull fragments. Porosity on foot bones. Trauma on R radius = Smiths fracture.



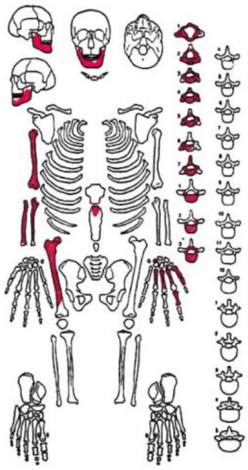
3007:

Alongside bones recorded on pro forma, rib fragments also present. Female (from skull only). Dental pathology was recorded – caries, calculus, AMTL and LEH present, with periodontal disease recorded as ‘mild to moderate’ according to Ogden (2008). Dental wear also present. 2 maxilla incisors appear to have grooves/cut marks present – could this link to activity? Porotic hyperostosis on L and R parietals. Cribra orbitalia present. Schmorls nodes present on 3 vertebral bodies. Deep sulcus on R clavicle.



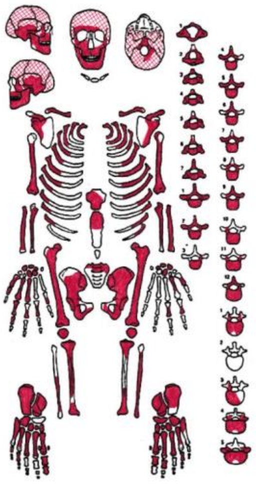
3062:

Alongside bones recorded on pro forma, rib and vertebral fragments also present. Male (from skull and pelvis). L auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Dental pathology was recorded – caries, calculus and AMTL present, with periodontal disease recorded as ‘mild’ according to Ogden (2008). 2 periapical lesions of the maxilla also present. Arachnoid granulation present. DJD of spine present.



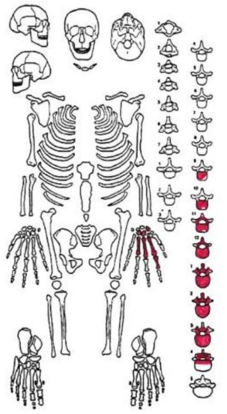
3069b:

Alongside bones recorded on pro forma, 1 clavicular fragment and numerous vertebral fragments present. Dental pathology was recorded – caries, calculus and LEH present. DJD of spine present. Eburnation present on: R humerus, ulna, radius and femur.



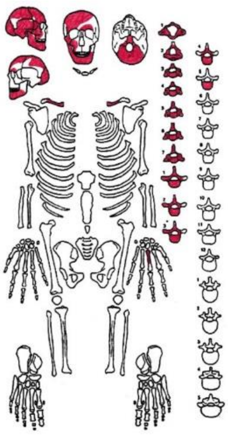
3070:

Alongside bones recorded on pro forma, rib, skull, vertebral, pelvic and sacral fragments also present. Female (from skull and pelvis). L auricular surface = aged 20-24 years - using Lovejoy et al 1985 method. Dental pathology was recorded – caries, calculus and LEH present, with periodontal disease recorded as 'mild' according to Ogden (2008). Evidence of fusion present on: R ulna, L radius, femur, fibula, R metacarpals and metatarsals, L and R unfused clavicles.



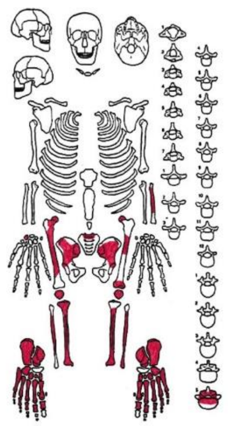
3036:

No sex, age-at-death estimations were recorded due to too little skeletal material. Slight evidence of schmorls nodes present on 7 vertebral bodies. Metal marks on l rib fragment.



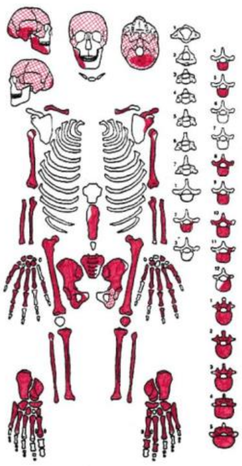
3033:

Alongside bones recorded on pro forma, 1 rib fragment and skull fragments also present. Male (from skull only). Dental pathology was recorded – caries, calculus, AMTL and LEH present, with periodontal disease recorded as 'mild' according to Ogden (2008). A periapical lesion is also present on maxilla. Dental wear also present. Arachnoid granulation present. Schmorls nodes present. Non-metric trait = extra foramina in C6 and C7, bilateral occipital mastoid ossicle.



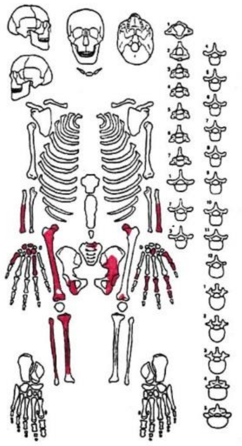
3067:

Alongside bones recorded on pro forma, pelvic and sacral fragments also present. Female (from pelvis only). L and R auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Osteochondritis dissecans present on L distal femur. Lesion present on R scaphoid.



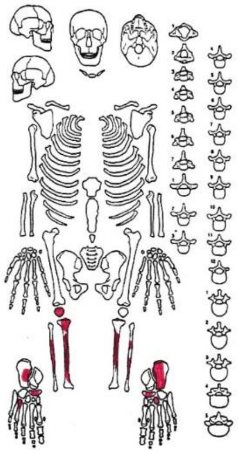
3038:

Alongside bones recorded on pro forma, rib, vertebral, skull and scapulae fragments also present. Male (from pelvis only). L and R auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Arachnoid granulation present. Eburnation present on: L and R upper and lower extremities, hands and feet. Schmorls nodes present on 6 vertebral bodies. Enlargement of fovea = activity marker. Alteration of L 4th proximal phalanx = avulsion fracture. Using Trotter and Gleser's 1970 method stature (from R ulna, R femur and L fibula) was estimated at 5 ft 2 – 5 ft 5.



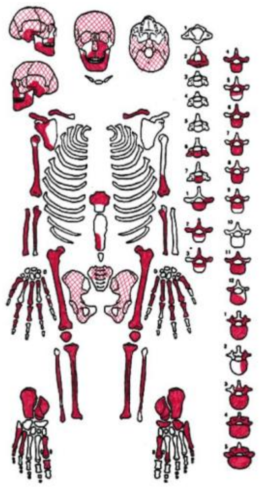
3034:

Alongside bones recorded on pro forma, rib and vertebral fragments also present. No sex, age-at-death estimations were recorded due to too little skeletal material. Eburnation on: L radius, acetabulum, L and R femora. DJD of spine present. Metal mark on 1 rib fragment. Presence of eburnation, new bone formation and lytic reaction of the L acetabulum, therefore, indicating OA alongside something else such as TB. The connecting femoral head (L) shows osteophyte growth, lytic appearance and eburnation is present.



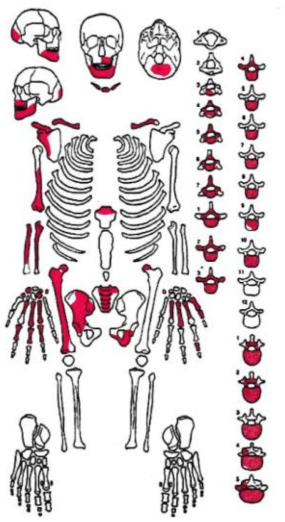
3031:

No sex, age-at-death estimations were recorded due to too little skeletal material. Only lower limbs available. Woven and sclerotic periosteal formation present on L fibula, with new bone present on L tibia = indicating osteitis. Looking through R tibia fragment gaps are apparent in trabecular bone = indicating osteoporosis (further analysis would be necessary for confirmation). Lesion present on L navicular.



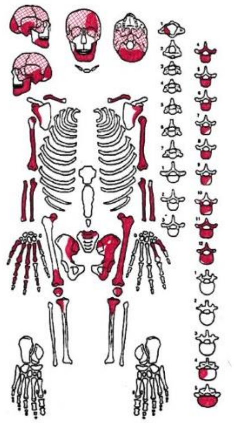
3057:

Alongside bones recorded on pro forma, rib and vertebral fragments also present. Male (from skull and pelvis). Dental pathology was recorded – caries, calculus present. L auricular surface (scored 2 on phase) years - using Lovejoy et al 1985 method. Fusion of epiphyses is evident on: L and R upper extremities, L proximal tibia = young adult. 3rd molars have also erupted.



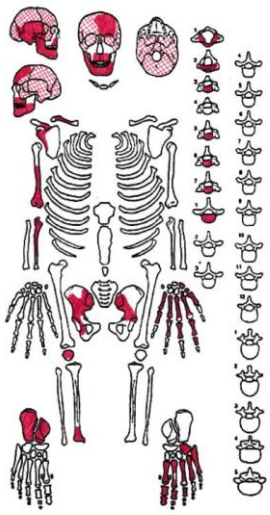
3069a:

Alongside bones recorded on pro forma, rib, pelvic, vertebral, skull and scapulae fragments also present. Male (from skull and pelvis). Dental pathology was recorded – calculus and LEH present, with periodontal disease recorded as 'mild to moderate' according to Ogden (2008). Dental wear is also present. L and R deep clavicular sulcus and fovea capitas. Eburnation present on: R humerus and ulna and 3rd metacarpal. Schmorls nodes present on 7 vertebral bodies. Fused T3 and T4 = block vertebrae.



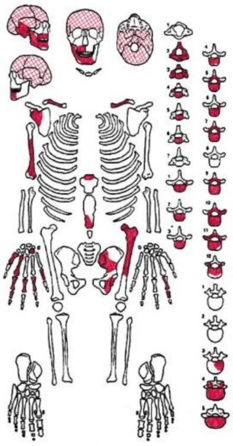
3024:

Alongside bones recorded on pro forma, rib, vertebral and skull and fragments also present. Female (from skull only). Dental pathology was recorded – caries, calculus, AMTL and LEH present, with periodontal disease recorded as ‘mild’ according to Ogden (2008). R auricular surface = aged 35-39 years - using Lovejoy et al 1985 method. Cribra orbitalia present on L and R orbits, porotic hyperostosis also present. Eburnation present on: L and R upper extremities, R scapula, L femur, TMJ, metacarpals. Using Trotter and Gleser’s 1970 method stature (from L humerus) was estimated at 5 ft 2.



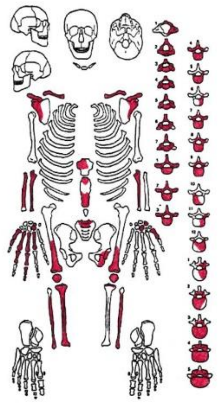
3009:

Alongside bones recorded on pro forma, rib, vertebral and skull and fragments also present. Female (from skull and pelvis). Dental pathology was recorded – caries, calculus, AMTL and LEH present, with periodontal disease recorded as ‘mild to moderate’ according to Ogden (2008). Dental wear is also present. L auricular surface = aged 40-44 years, R auricular surface = 45-49 years - using Lovejoy et al 1985 method. Cribra orbitalia present on L orbit and porotic hyperostosis too. Porosity on L humeral had too. Non-metric trait = double talar and calcaneal facets.



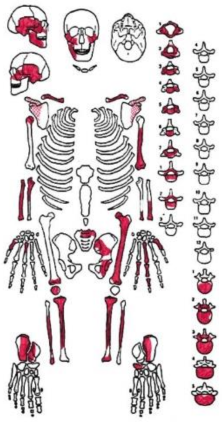
3043:

Alongside bones recorded on pro forma, rib, vertebral, scapulae and pelvic and fragments also present. Dental pathology was recorded – caries, calculus, AMTL and LEH present, with periodontal disease recorded as 'mild to moderate' according to Ogden (2008). Dental wear also present. L auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Metal mark on R mandible.



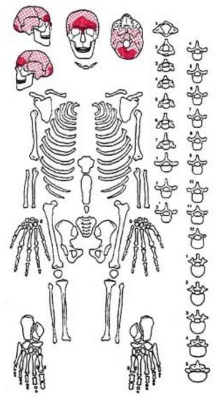
U/1:

Alongside bones recorded on pro forma, rib and vertebral fragments also present. Age-at-death estimations were not recorded due to too little skeletal material R clavicle = deep sulcus. Non-metric traits = sternal foramen, bilateral vastus notch. MNI = 3 (additional material L ulna fragment, 2 juvenile bones. DJD of spine present. Schmorls nodes present on 4 vertebral bodies. Metal mark on a vertebral body.



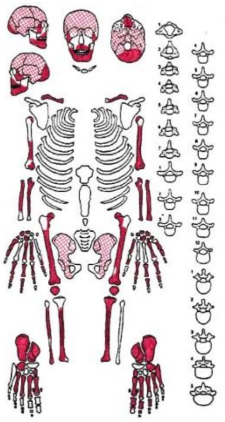
U/S:

Alongside bones recorded on pro forma, rib, skull, vertebral and scapulae fragments also present. Male (from skull and pelvis). L auricular surface = 50 - 59 years - using Lovejoy et al 1985 method. Eburnation present on: C2, L ulna and radius, R radius. Sclerotic new bone present on tibiae. Bleaching and weathering also present on skeleton. DJD of spine present. Deep l fovea capitas present.



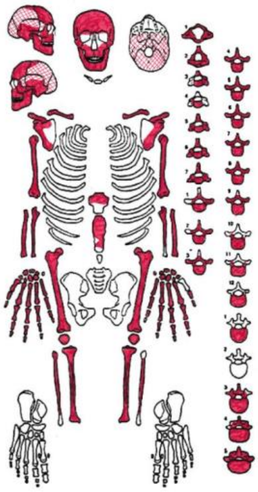
0005b:

Age-at-death estimations were not recorded due to too little skeletal material. Male (from skull only). Metopic suture present.



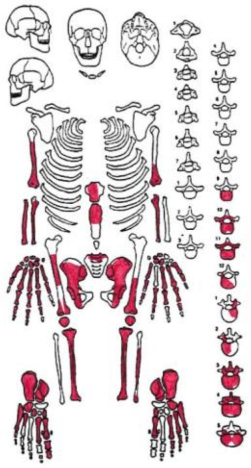
2014/21:

Alongside bones recorded on pro forma, rib, skull, vertebral, scapulae and pelvic and fragments also present. Edentulous. Male (from skull only). L auricular surface = aged 40-44 years, R auricular surface = 45-49 years - using Lovejoy et al 1985 method. MNI = 2 (additional juvenile fragments). Non-metric trait = mandibular torus. Arachnoid granulation present. Sclerotic new bone formation on L and R ulna = non=specific infection.



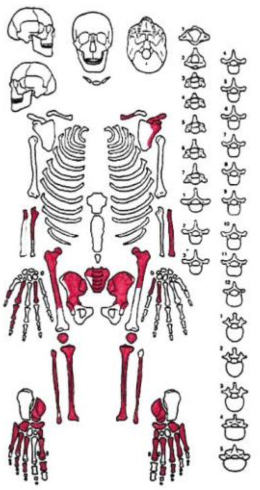
1511.2:

Alongside bones recorded on pro forma, rib, skull and scapulae fragments also present. Male (from skull only). Dental pathology was recorded – caries, calculus and LEH present, with periodontal disease recorded as ‘mild’ according to Ogden (2008). Dental wear is also present. Using Trotter and Gleser’s 1970 method stature (from L and R humerii, radius, R ulna, L and R femora) was estimated at 5 ft 5. Non-metric trait = metopic suture.



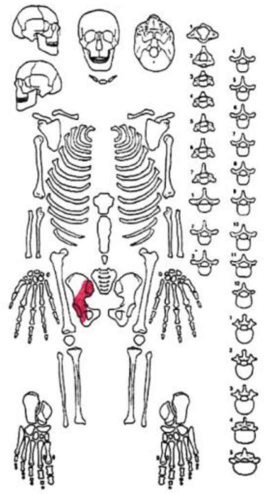
2014/23:

Alongside bones recorded on pro forma, rib, vertebral and pelvic fragments also present. MNI = 3 (additional 3 R auricular surfaces, 2 L tibiae, 2 R femora, 3 L humeral fragments2 R radial fragments. DJD of spine present. Schmorls nodes present on 2 vertebral bodies. Significant OA changes on R elbow joint.



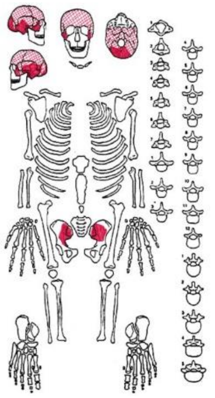
2014/22:

Alongside bones recorded on pro forma, rib and skull fragments also present. Male (from pelvis only). L and R auricular surface = aged 40-44 years - using Lovejoy et al 1985 method. Strong muscle attachments L and R femora. MNI = 2 (additional 2 L fibulae, 2 R radii, 5th metatarsal. Metal marks present on L 5th metatarsal, R tibia fragment. L and R 5th metatarsals (distal ends) appears lytic = could indicate gout/necrosis. Lesion also present on 1st metatarsal too = indicating gout. Using Trotter and Gleser's 1970 method stature (from L radius) was estimated at 5 ft 7.



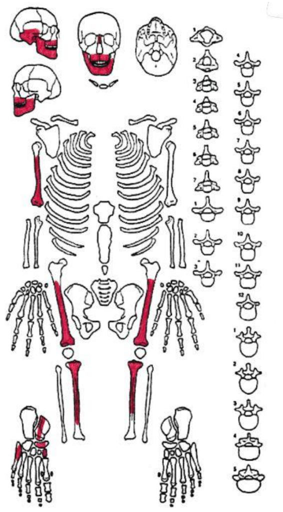
6:

PF? Pathology was not recorded due to too little skeletal material. R auricular surface = aged 45-49 years - using Lovejoy et al 1985 method.



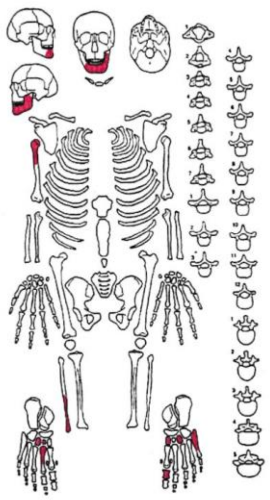
0005a:

Male (from skull only). L and R auricular surface = aged 30-34 years - using Lovejoy et al 1985 method. Arachnoid granulation present. Metal mark present on a skull fragment.



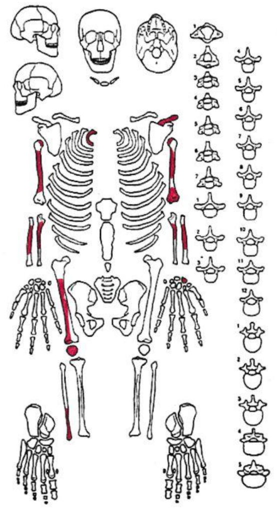
0003 (individual 1):

Female (from skull only). Dental pathology was recorded – caries, calculus and LEH present. Dental wear also present. Taphonomy present = bleaching. 3rd molar eruption = 17.5 – 23.5 years according to Al Qahtani (2010).



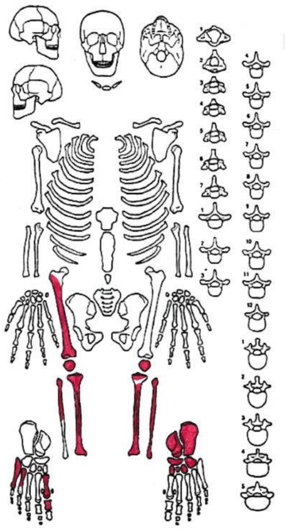
0003 (individual 2):

Age-at-death estimations were not recorded due to too little skeletal material. Undetermined sex. Eburnation and porosity present on L tarsal.



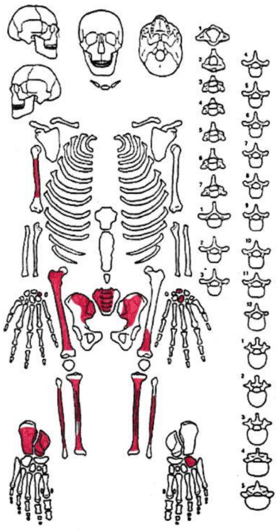
0004:

No sex, age-at-death estimations or pathology were recorded due to too little skeletal material.



Grave 27:

No sex, age-at-death estimations or pathology were recorded due to too little skeletal material. Only lower extremities present. MNI = 3 (additional = juvenile bones, R tibia fragment, skull fragments. Some animal bones and teeth also present.



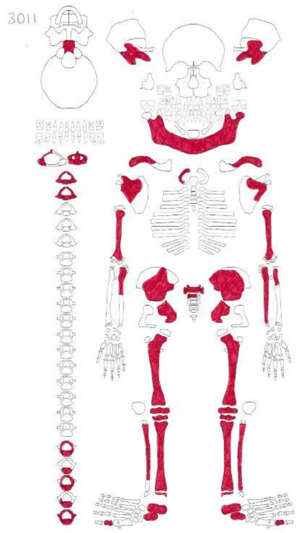
2014/21 (individual 2):

Alongside bones recorded on pro forma, pelvic fragments also present. No pathology to report. L and R auricular surface = aged 20-24 years - using Lovejoy et al 1985 method. Using epiphyseal union times, age-at-death estimated = before 14-20 years of age. Indicating this individual as a young adult.

3044:

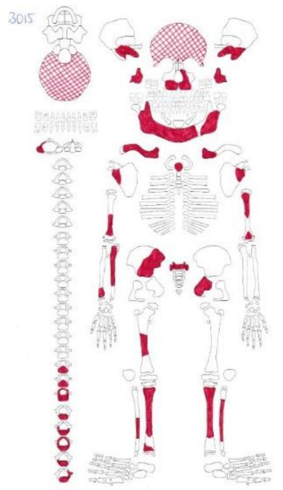
Male (from skull only). Alveolar resorption present on mandible. Schmorls nodes present on 4 vertebral bodies. Little skeletal material present (upper half of skeleton only). Prolific and lytic bone across the skeleton (skull, ribs, sternum, scapulae, clavicles, vertebrae = indicating metastatic carcinoma.

NON-ADULT



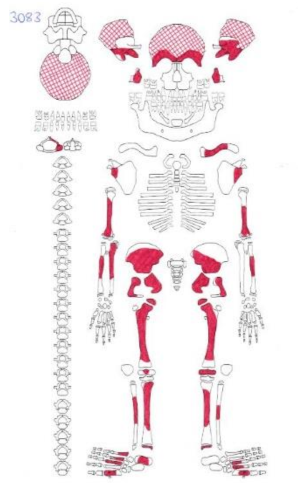
3011:

Using Al Qahtani's 2010 method of dental development and eruption, age-at-death estimation = 6-7 years. Sex not determined. No pathology to report.



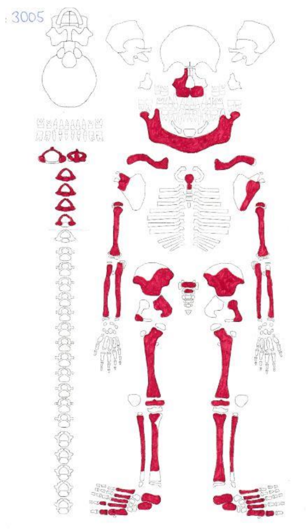
3015:

Alongside bones recorded on pro forma, rib and skull fragments also present. Using Al Qahtani's 2010 method of dental development and eruption, age-at-death estimation = before age 7.5 years. Periosteal new bone formation recorded on lower extremities and right ilium.



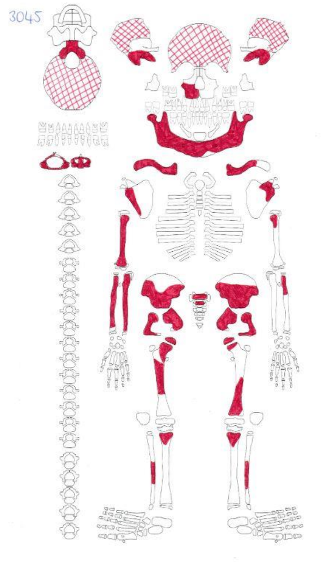
3083:

Alongside bones recorded on pro forma, rib, skull and vertebral fragments also present. Using Al Qahtani's 2010 method of dental development and eruption, age-at-death estimation = before 10.5 years of age. Dental pathology was recorded – caries, calculus and LEH present, with periodontal disease recorded as 'mild' according to Ogden (2008). Cribra orbitalia present on L and R orbits.



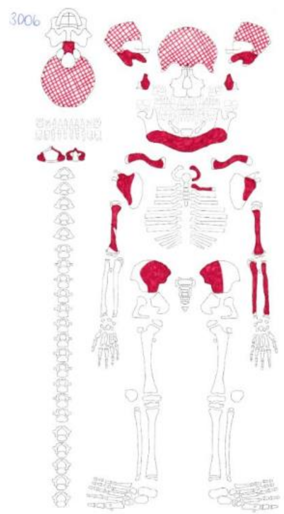
3005:

Alongside bones recorded on pro forma, rib, sacral, scapulae and vertebral fragments also present. Using Al Qahtani's 2010 method of dental development and eruption, age-at-death estimation = before 6.5 years of age. Dental pathology was recorded – caries and LEH present.



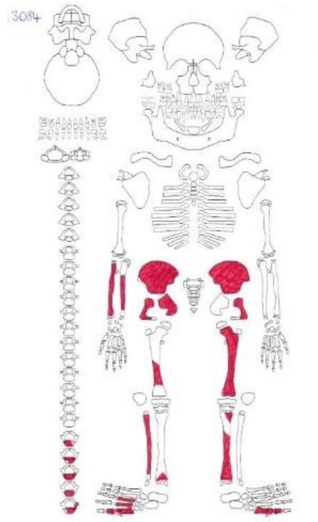
3045:

Alongside bones recorded on pro forma, rib, skull, sacral, scapulae and vertebral fragments also present. Using Al Qahtani’s 2010 method of dental development and eruption, age-at-death estimation = 4.5-6.5 years. Congenital = C7 sagittal cleft vertebrae (butterfly vertebrae). Porosity present on L orbit.



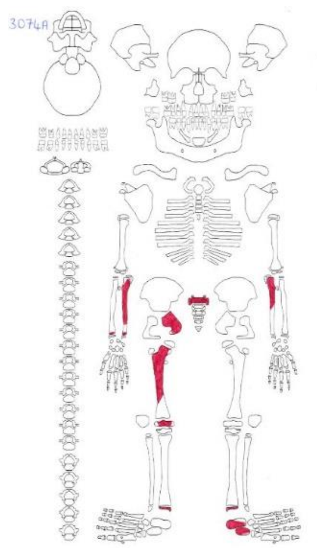
3006:

Alongside bones recorded on pro forma, rib, skull, pelvic, hand and vertebral fragments also present. MNI = 2 (additional rib and vertebral fragments from an older individual). L and R orbits and zygomatics extremely porous (almost lytic effect), with extreme porosity also evident on several skull fragments. Sclerotic and woven new bone also present across the skeleton: skull, scapulae, pelvic region, L upper extremities, L and R clavicles = indicating scurvy. Using epiphyseal union times, age-at-death estimated = 6 months – 3 years of age.



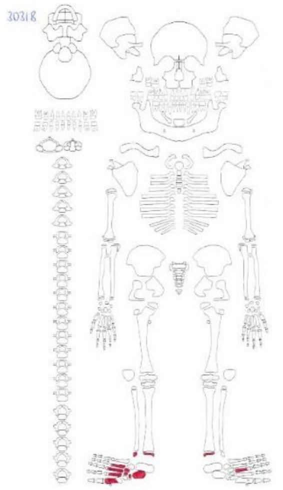
3084:

Alongside bones recorded on pro forma, rib, hand, long bone and vertebral fragments also present. Periosteal new bone formation (woven and sclerotic) present on L and R femora, R ulna and radius, L tibia. Using epiphyseal union times, age-at-death estimated = before 13/14 years of age.



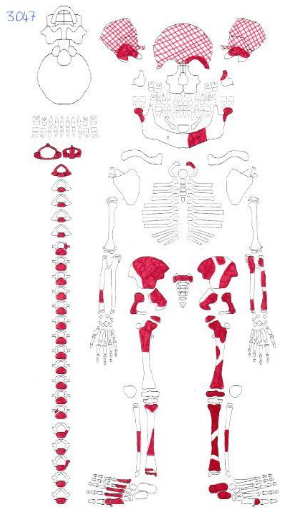
3074a:

Alongside bones recorded on pro forma, rib, hand, foot, long bone and vertebral fragments also present. No pathology to report on as small amount of skeletal material. Using epiphyseal union times, age-at-death estimated = between 2 and 8 years.



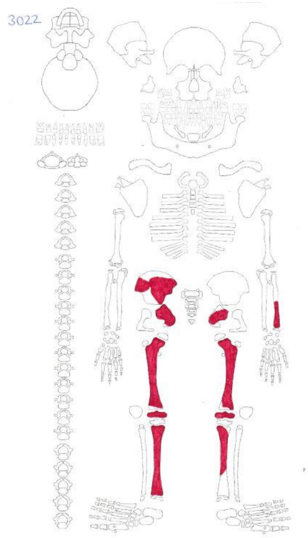
3031b:

Small amount of lower limb bones present. Too little skeletal material to record pathology. Using epiphyseal union times, age-at-death estimated = between 5 and 12 years.



3047:

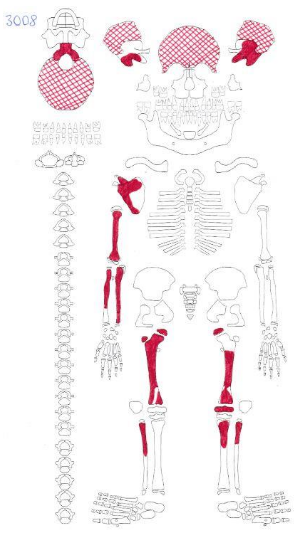
Alongside bones recorded on pro forma, humeral, scapulae and vertebral fragments also present. Periosteal new bone formation present on pelvic region and lower limbs. Using epiphyseal union times, age-at-death estimated = 4-6 years.



3022:

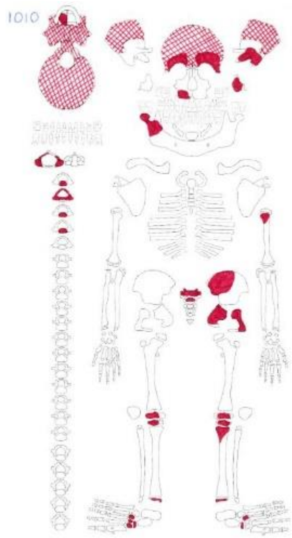
Alongside bones recorded on pro forma, upper limb fragments also present.

MNI = 2 (additional adult skeletal material). Periosteal bone formation (woven and sclerotic) present on L and R femora, tibiae, L radius. Using epiphyseal union times, age-at-death estimated = 7-12 years.



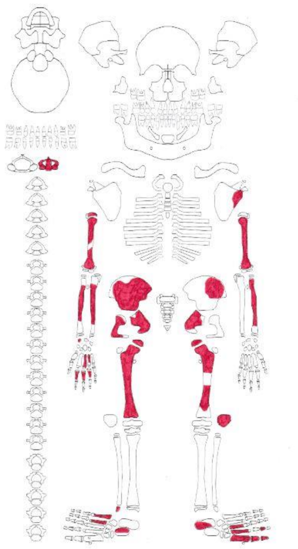
3008:

Cribra orbitalia present on R orbit. Periosteal new bone (woven and sclerotic) on R humerus and ulna, L and R femora, fibulae, and L tibia. Using epiphyseal union times, age-at-death estimated = 3-8 years.



1010:

Alongside bones recorded on pro forma, rib, pelvic, scapulae, skull and vertebral fragments also present. Porosity also present on skull fragments. Cribra orbitalia present on L and R orbits. Periosteal new bone present on L temporal bone. Non-metric trait = foramina of C1. Using epiphyseal union times, age-at-death estimated = 3-13 years.



Unknown context:

Alongside bones recorded on pro forma, long bone and vertebral fragments also present. No pathology to report. Using epiphyseal union times, age-at-death estimated = 6-12 years.

Appendix B – Osteological data collection

This table displays the data collection from the PSA assemblage in terms of sk number, biological sex, raw bone measurement and the bone measured. This data was used to measure stature using Trotter's (1970) formulae for both 'whites' and 'blacks' equations.

Sk number	Sex	Bone length (cm)	Bone
3049	Male	45.2	L Femur
3056	Female	29 20.9	R Humerus R Radius
3020	Female	31.7	R Humerus
3040	Female	30.7 21.4 22.8	R Humerus R Radius R Ulna
3042	Male	32.4 26.9 33	L Humerus R Humerus L Ulna
3068	Male	26.4	R Ulna
3041	Female	29.8	L Humerus
3016	Male	23.6 34.8	R Humerus L Radius
3013	Male	32.2	R Humerus
3023	Male	23.8 30.6 22.4 44.4	L Ulna R Humerus R Radius R Femur
3026	Male	34 24.2 46.6	L Humerus L Radius R Femur
3039	Male	32 22.6 24.7	R Humerus R Radius R Ulna
3003	Male	33.1 33.4 24.6 25.6	L Humerus R Humerus R Radius R Ulna
3038	Male	33.2 25.6 43.6	L Fibula R Ulna R Femur
3024	Female	30.5 41	L Humerus L Femur
1511.2	Male	31.7 23.7 44.6 33.2 23.6 25.5 44	L Humerus L Radius L Femur R Humerus R Radius R Ulna R Femur
2014/22	Male	25.6	L Radius

Appendix C – Pro forma

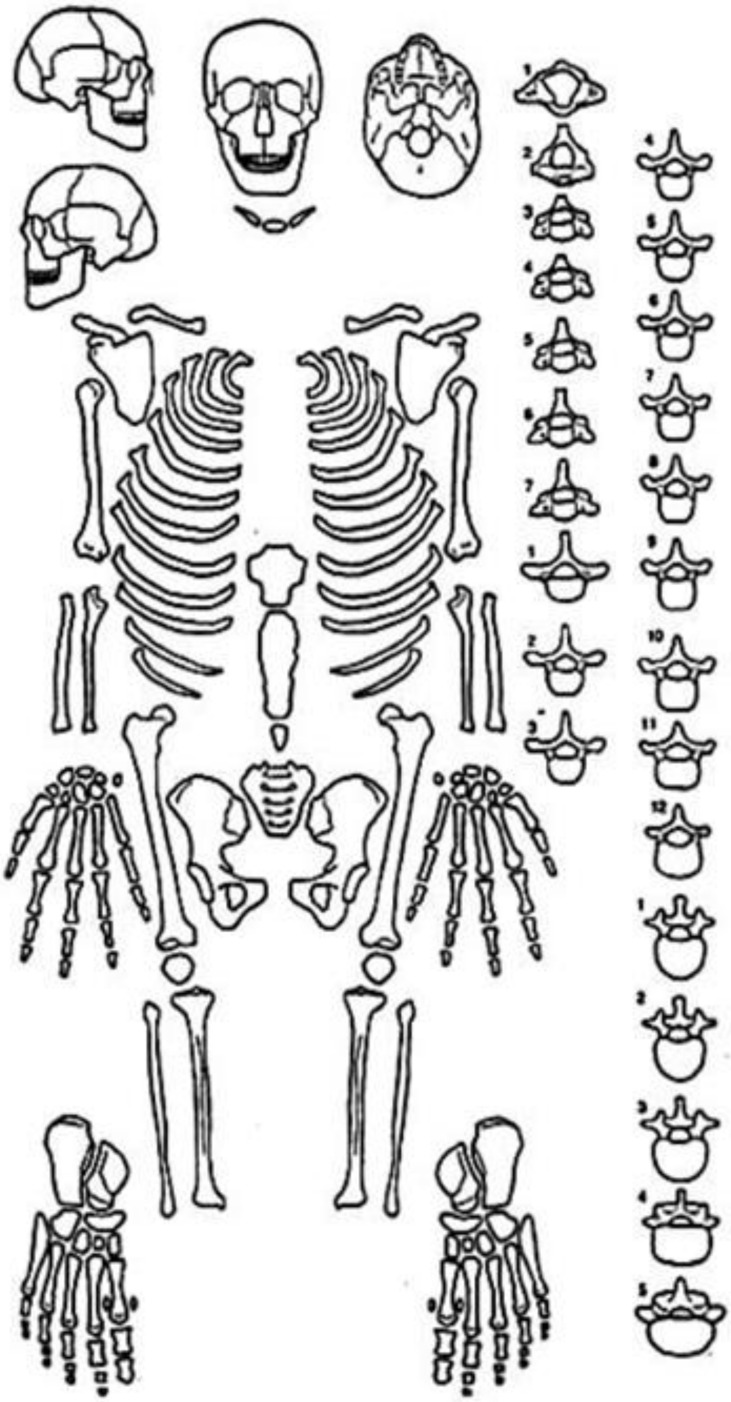
Site code:

Analyst:

Skeleton number:

Bone presence on skeleton

Right **Left**



Key

☐ Presence

☐ Fragmented

Site code:

Analyst:

Skeleton number:

Adult Skeletal Inventory

Cranial vault	
Frontal	
Occipital	
Vomer	
Sphenoid	
Ethmoid	
Hyoid	
Cartilage	

Skull	Left	Right
Parietal		
Temporal		
Orbit		
Lacrimal		
Nasal		
Zygomatic		
Maxilla		
Palatine		
Mandible		

Scapula	Left	Right
Body		
Glenoid		
Acromion		

Clavicle	Left	Right
Medial		
Diaphysis		
Lateral		

Left Long bones	PJS	P 1/3	M 1/3	D 1/3	DJS
Humerus					
Radius					
Ulna					
Femur					
Tibia					
Fibula					

Right Long bones	PJS	P 1/3	M 1/3	D 1/3	DJS
Humerus					
Radius					
Ulna					
Femur					
Tibia					
Fibula					

Vertebrae (C)	Body	Neural arch
C1		
C2		
C3		
C4		
C5		
C6		
C7		

Vertebrae (T)	Body	Neural arch
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		

Vertebrae (L)	Body	Neural arch
L1		
L2		
L3		
L4		
L5		

Metacarpals	Left	Right
1		
2		
3		
4		
5		

Carpals	Left	Right
Scaphoid		
Lunate		
Triquetral		
Pisiform		
Trapezium		
Trapezoid		
Capitate		
Hamate		

Unassigned CV	

Unassigned LV	

Unassigned TV	

Metatarsals	Left	Right
1		
2		
3		
4		
5		

Site code:

Analyst:

Skeleton number:

Mandible	Left	Right
Body		
Ramus		

Manubrium	
Sternum	
Xyphoid	

Pelvis	Left	Right
Ilium		
Ischium		
Pubis		

Hand phalanges (L & R specify)	P	M	D
1			
2			
3			
4			
5			

Ribs	Left	Right
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Foot phalanges (L & R specify)	P	M	D
1			
2			
3			
4			
5			

Ribs	#
Supernumerary	

	Left	Right
Patella		

Sacrum 1	
Sacrum 2	
Sacrum 3	
Sacrum 4	
Sacrum 5	
Coccyx	

Tarsals	Left	Right
Talus		
Calcaneus		
Navicular		
Cuboid		
Lateral c'form		
Middle c'form		
Medial c'form		

Sesamoids	Left (#)	Right (#)
Hand		
Foot		

Sesamoids	#
Unknown	

MNI	

Scoring for preservation

	Yes	No
Commingled		

Score	Preservation of bone
P	Present (95% & over)
I	Incomplete (50-94%)
F	Fragment (1-49%)
A	Absent

Site code:

Analyst:

Skeleton number:

Sex determination methods

Feature	L	R
Supra orbital margin		
Mastoid process		
Gonial angle		

Feature	
Glabella	
Ext' occipital eminence	
Mental eminence	
Mandibular angle	

Feature	L	R
Subpubic concavity		
Subpubic angle		
Ventral arc		
Pre-auricular sulcus		
Greater sciatic notch		
Ischio-pubic ramus		

Sex of individual:

Notes

Key:

Gonial angle	**R** - 90°	**W** - 120°	U – uncertain
Mandibular angle	**V** – triangle	**D** – trapezoid	U – uncertain
Subpubic concavity	**A** – absent	**P** - present	U – uncertain
Subpubic angle	**V** – less than 90°	**W** – more than 90°	U – uncertain
Ventral arc	**A** - absent	**P** – present	U – uncertain
IPR	**B** - blunt	**S** – sharp	U – uncertain

Feature	Scoring
Glabella	1 - 5
Supra orbital margin	1 – 5
Ext' occipital eminence	1 – 5
Mental eminence	1 – 5
Mastoid process	1 – 5
Pre-auricular sulcus	1 - 4
Greater sciatic notch	1 - 5

Site code:

Analyst:

Skeleton number:

Age estimation methods

Transitional analysis:

Pubic symphysis	L	R
Symphyseal relief		
Dorsal symphyseal texture		
Superior protuberance		
Ventral symphyseal margin		
Dorsal symphyseal margin		
Auricular surface		
Superior demiface topography		
Inferior demiface topography		
Superior surface characteristic		
Middle surface characteristic		
Inferior surface characteristic		
Inferior surface texture		
Superior posterior exostosis		
Inferior posterior exostosis		
Posterior exostoses		
Cranial sutures		
Coronal pterica		
Sagittal obelica		
Lambdoidal asterica		
Zygomaticmaxillary		
Interpalatine		

Ribs	L	R
1st		
2nd		
3rd		
4th		
5th		
6th		
7th		
8th		
9th		
10th		

Acetabulum	L	R
Rim		
Supra rim portion		
Groove		
Fossa		
Apex		

Method	L			R		
PS (phase)						
PS (component)						

Estimated age range of individual:

Method	L					R				
AS (phase)										
AS (component)										

Site code:
Analyst:
Skeleton number:

Cranial measurements

1	GOL	
2	XCB	
3	ZYB	
4	BBH	
5	BNL	
6	BPL	
7	MAB	
8	MAL	
9	AUB	
10	NPH	
11	WFB	
12	FMB	
13	NLH	
14	NLB	
15	OBB	
16	OBH	
17	EKB	
18	DKB	
19	FRC	
20	PAC	
21	OCC	
22	FOL	
23	FOB	
24	MDH	
25	GNI	
26	HML	
27	TML	
28	GOG	
29	CDL	
30	WRL	
31	MRL	
32	XRL	
33	MLT	
34	MLX	

Additional notes:

Postcranial measurements

		Left	Right
35	CL: Max length		
36	A-P diameter midshaft		
37	S-I diameter midshaft		
38	SC: Height		
39	SC: Breadth		
40	H: Max length		
41	Epicondylar breadth		
42	Vertical diameter head		
43	Maximum diameter midshaft		
44	Minimum diameter midshaft		
45	R: Max length		
46	A-P diameter		
47	M-L diameter		
48	U: Maximum length		
49	A-P diameter		
50	M-L diameter		
51	Physiological length		
52	Minimum circumference		
53	Sa: Anterior length		
54	A-S breadth		
55	Max' Trans' diameter base		
56	Pel: Height		
57	Iliac breadth		
58	Pubis length		
59	Ischium length		
60	F: Max length		
61	Bicondylar length		
62	Epicondylar breadth		
63	Maximum diameter length		
64	A-P Subtrochan' diameter		
65	M-L Subtrochan' diameter		
66	A-P Midshaft diameter		
67	M-L Midshaft diameter		
68	Midshaft circumference		
69	Ti: Maximum length		
70	Max' Prox' Epi' breadth		
71	Max' Dis' Epi' breadth		
72	Max' diameter Nutr' For'		
73	M-L diameter Nutr' For'		
74	Circ' nutrient foramen		
75	Fi: Maximum length		
76	Max' diameter midshaft		
77	Ca: Maximum length		
78	Middle breadth		

All measurements recorded in millimetres

'0' = bone or fragment missing

Site code:

Stature estimations

Analyst:

Skeleton number:

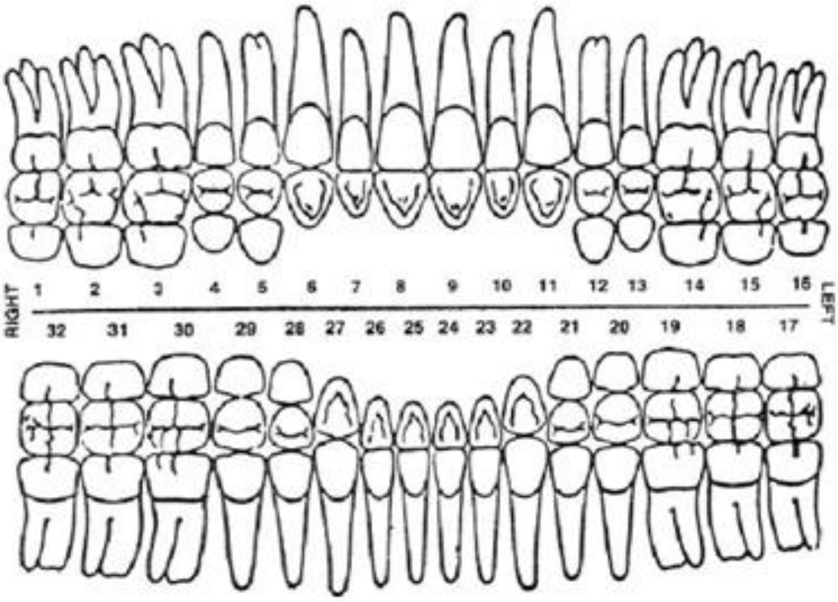
Estimated height of individual:

Site code:

Analyst:

Skeleton number:

Teeth



1		17	
2		18	
3		19	
4		20	
5		21	
6		22	
7		23	
8		24	
9		25	
10		26	
11		27	
12		28	
13		29	
14		30	
15		31	
16		32	

Key	Dental pathology
	Caries
	Calculus
	Hypoplasia
	Periodontal disease
	Abscess

Key	Definiton
P	Present
NP	Not present
AML	Ante mortem loss
PML	Post mortem loss
E	Tooth erupting
U	Tooth unerupted
B	Broken tooth

Notes ______________________________

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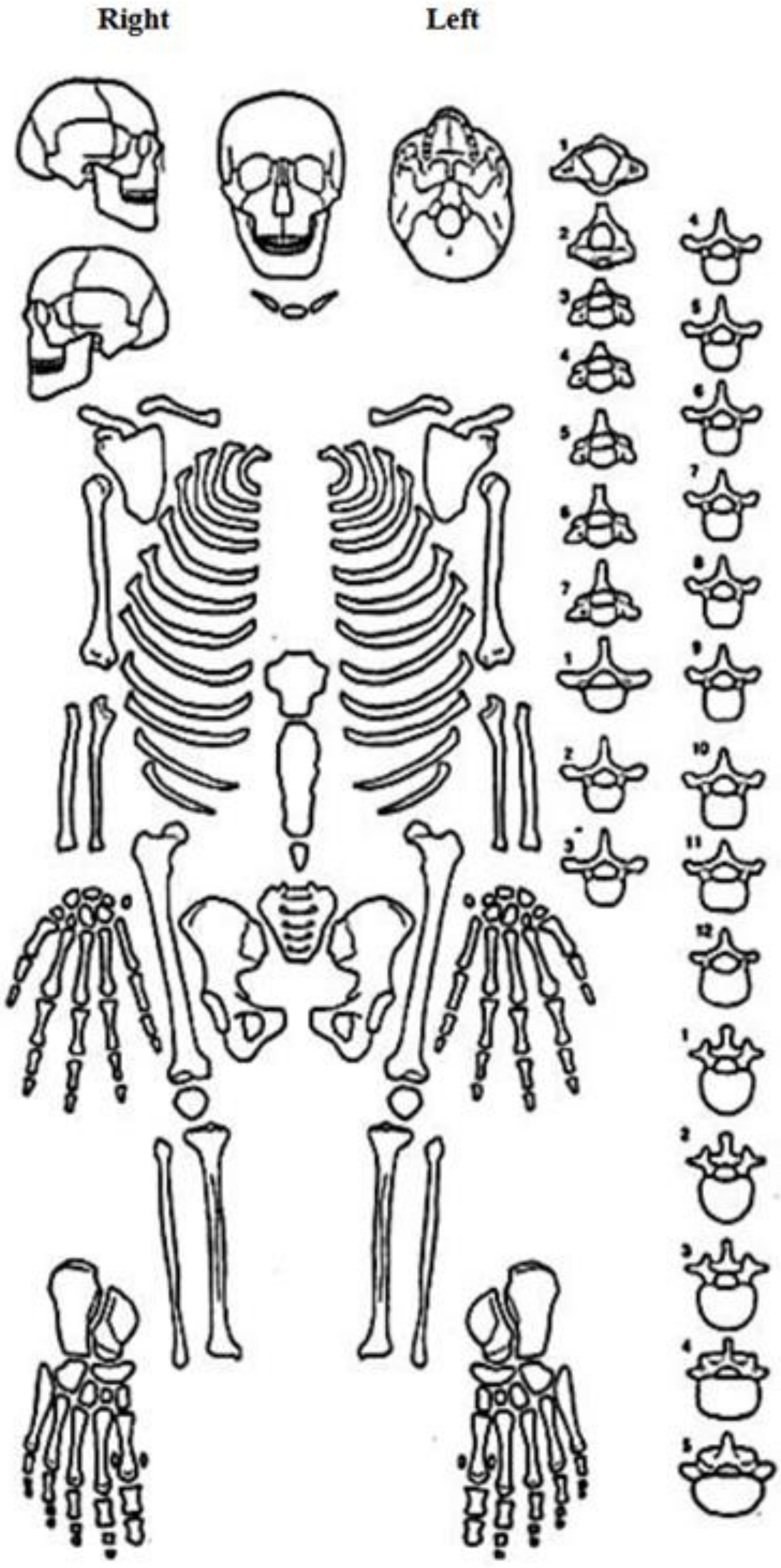
Site code:

Analyst:

Skeleton number:

Pathology



Key

Site code:
Analyst:
Skeleton number:

Pathology continued

Pathology

Ante mortem trauma

Site code:
Analyst:
Skeleton number:

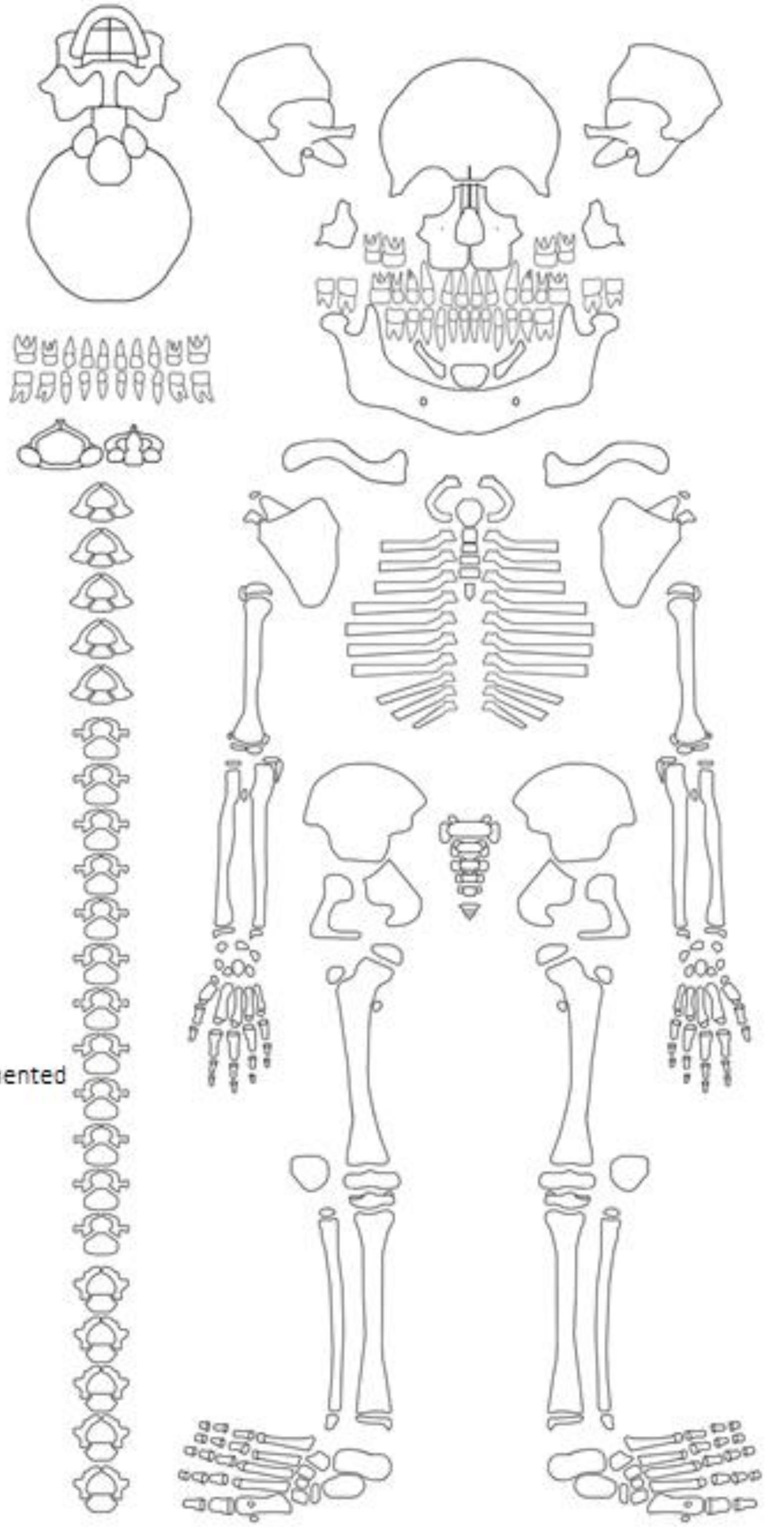
Pathology continued

Additional notes

Site code:

Analyst:
Skeleton number:

Bone presence on skeleton (child)



Key

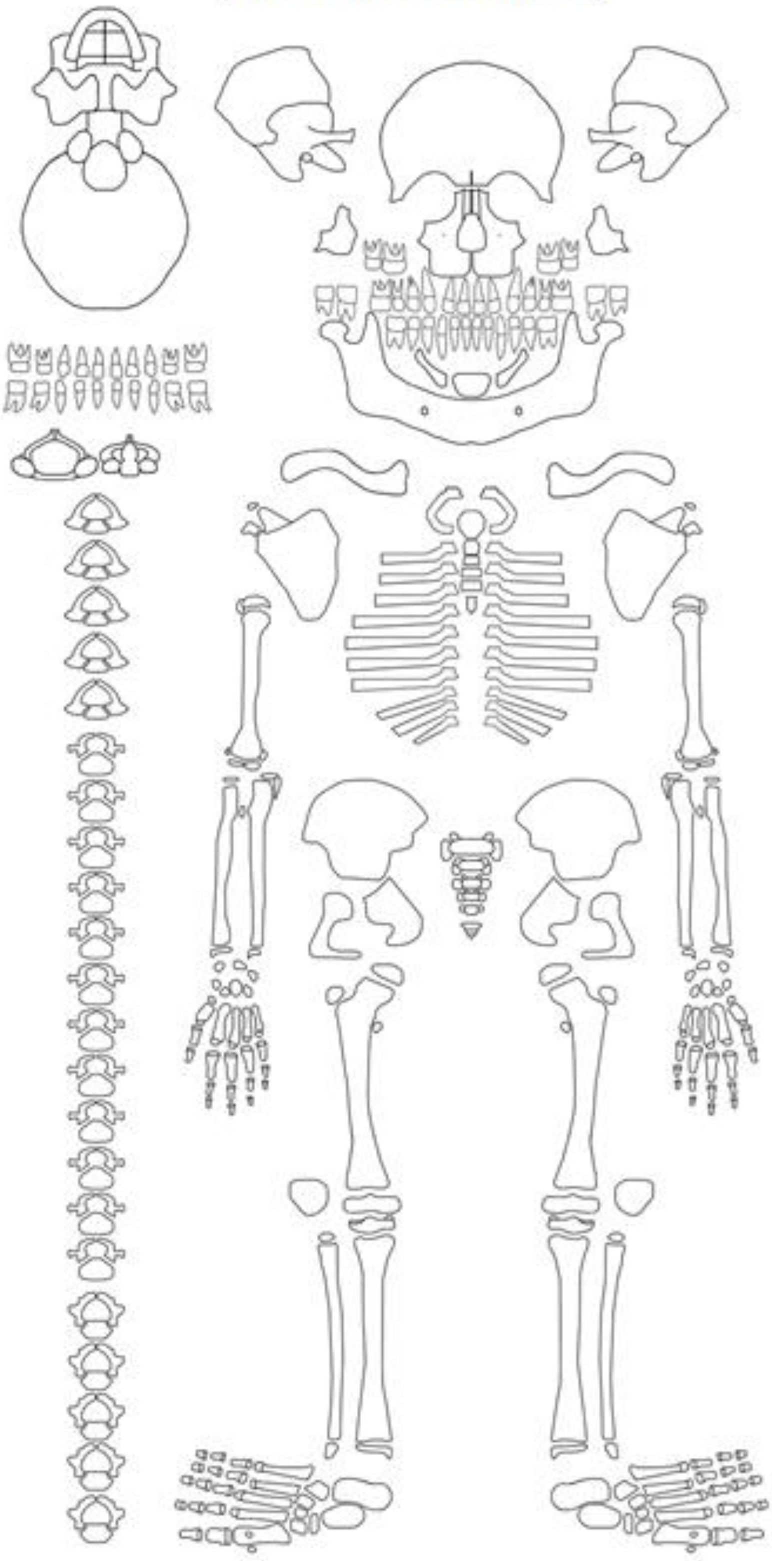
Presence

Fragmented

Site code:

Analyst:
Skeleton number:

Pathology on skeleton (child)



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