

The Hospital of St John the Baptist Lichfield Staffordshire

POST-EXCAVATION ASSESSMENT



understanding heritage matters

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SUMMARY

An archaeological watching brief was undertaken during the construction of new almshouses to the rear of St John the Baptist Hospital, following the discovery of a skeleton during the excavation of a soakaway. Staffordshire County Council Planning Archaeologist Steven Dean determined that the skeleton was probably medieval. Archaeology Warwickshire were thereafter commissioned by St. John's Hospital to undertake an augmented watching brief alongside the groundworks phase of the development. A total of 46 skeletons buried in the typical Christian tradition were recovered.

The human assemblage included 17 non-adults and 29 adults. In the adult group, there were four males, six probable males, six probable females and three females. Ten adults remain unsexed due to the poor condition and/or incompleteness of the remains. Four skeletons were of African or mixed ancestry. Compared to late medieval averages, the individuals were of above average height but there was a greater prevalence of indicators of childhood stress, joint changes or disease and dental plaque concretion. The incidence of trauma, such as broken bones, developmental abnormalities, congenital or other diseases as well as dental cavities and abscesses was much lower than medieval averages which is suggestive of a relatively healthy adult population or environment. The health and demography of these individuals correspond with what one might expect from a medieval hospital skeletal assemblage as opposed to a medieval parish church, monastic assemblage, or pilgrimage.

A total of 351 sherds of largely medieval pottery were also found within or in layer immediately above the graves, and in a number of the grave fills, providing an important adjunct to the Lichfield pottery type series.

The analysis to date represents a significant adjunct to research on medieval Lichfield, medieval burial and the Hospital of St John's. The results should be published in a suitable journal and an accessible illustrated version could be produced for wider public dissemination. The site archive and finds should be deposited together in an appropriate institution to allow access for future research.

Further analysis and research could enable a greater understanding of the origin and use of the site. The potential for investigating medieval migration to the Midlands is apparently unique.

1 INTRODUCTION

- 1.1 Planning permission had been granted by Lichfield District Council for the demolition of two garage blocks, the alteration of existing access provision and the construction of 18 almshouses with associated landscaping and service works (Ref: 14/00433/FULM). The site lies just outside the defensive ditch surrounding the early medieval town of Lichfield and within land associated with St John's Hospital in the 13th-15th centuries.
- 1.2 A desk-based assessment accompanying the planning application considered the extensive history of the town and hospital site. The report raised the possibility of burials associated with the hospital to be present within the development area (Tann 2014).
- 1.3 An archaeological evaluation in March 2015 included trenches excavated in the eastern half of the site, close to the existing almshouses although site constraints at the time prevented the evaluation of the western half. Pits and ditches dating to the post-medieval period were considered to represent the constant redevelopment of the almshouses. The report concluded that there was no evidence to suggest the site was used for burial and that overall it had a negligible archaeological potential (Allen Archaeology 2015).
- 1.4 In the course of the groundworks phase of the development a single skeleton was encountered during the mechanical excavation of a soakaway. The coroner and Staffordshire Police initially removed the remains for testing and dating and the consensus is that they represented a medieval burial associated with St John's Hospital. Staffordshire County Council Principal Archaeologist then instigated an archaeological watching brief and prepared a Specification for the scope of the archaeological works. Archaeology Warwickshire were commissioned to undertake the subsequent augmented watching brief to locate, preserve remains *in situ*, record or recover burials as appropriate and in accordance with the Specification. The work was carried out in August 2015. The project archive will be stored at the Potteries Museum and Art Gallery.

2 SITE LOCATION

- 2.1 The site is located on the south side of Lichfield, southeast Staffordshire. The area of archaeological intervention was west of St John Street and to the north of the A51, centred on National Grid Reference SK 11742 09155 (Fig 1).
- 2.2 The underlying bedrock geology of the area is Bromsgrove Sandstone Formation consisting of sand and gravel (British Geological Survey 2016).

3 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

- 3.1 A comprehensive site history was included in the desk-based assessment submitted with the planning application for the development (Tann, 2014). The summary provided below is designed to inform the results of the watching brief.
- 3.2 There is only minimal evidence for prehistoric activity within Lichfield. This comprises a Mesolithic flint scatter at St Michaels Churchyard, east of Greenhill, possible Neolithic occupation activity south of the cathedral and a redeposited flint flake north of Sandford Street (MST11465). Iron Age and Bronze Age evidence have been reported in the landscape surrounding the city (MST15029).
- 3.3 Some Roman evidence, including pottery, Samian ware and flue tiles, has been found in Lichfield during investigations at the Friary, Hartshorn Inn and Sandford Street (MST048; MST17637; MST1475; MST3674). The Roman roads Watling Street and Ryknild Street are to the south of Lichfield and it is believed most Roman occupation was concentrated at the settlement of Letocetum, near Wall, 3.5km south of Lichfield.
- 3.4 Saxon occupation is indicated by a limited number of pottery finds and habitation remains found at Cross Keys and Sandford Street that date to between the 5th and 7th centuries (MST17637). From the late 7th century the town of Lichfield developed more rapidly when Bishop Chad moved the administrative centre of the bishopric there from Repton. His successor Bishop Hedda oversaw the construction of a church in AD700 which contained St Chad's remains and became a site of pilgrimage. The existing cathedral replaced an earlier stone cathedral c.1195. In the mid-12th century Lichfield experienced a second phase of growth with a deliberately planned grid of streets forming the present city centre. A large defensive ditch was

- dug into the sandstone bedrock with access across it into the city via gates (MST6443). Culstube Gate was at the entrance of the road to London, now St John Street (MST3389). The adjacent land is thought to have been marshy.
- 3.5 St John's Hospital is thought to have been founded by Bishop Clinton c.1135 and is documented in a grant of 1208. It served to provide shelter for pilgrims to the shrine of St Chad and to other visitors who could not enter the town at night. In the 13th-century the hospital comprised a prior, brethren, sisters, lay brethren, chaplains and servants in addition to the local poor. The parish church of St Michael's was the official burial ground for the hospital however following the founding of a chantry in the chapel on behalf of the deceased Canon of Lichfield Ralph de Lacok an agreement was reached to bury him at the hospital. There is documentary evidence to suggest other members of the priory were already being buried at the hospital, in a cemetery thought to be south of the chapel. The hospital seems to have maintained that it had the right to bury brethren and sisters as well as the sick and homeless that died there.
- 3.6 St John's Hospital was relatively unscathed by the 1547 Dissolution of the monasteries, perhaps because by this time it also had an active grammar school, almsmen and benevolent tradition. However in 1571, along with other confiscated lands, the property was granted to Lord Wentworth and funds specifically allocated to support 10 almsmen, a schoolmaster and usher. Despite this, by the 17th century the site is described 'ruinous' but a visit by Bishop Hacket seems to have enabled limited repairs to be arranged and the buildings maintained.
- 3.7 The earliest known depiction of the hospital is a 1737 copy of a 1721 plan labelling the various elements of the site (LRO D88/10/2). Further plans dated 1776, 1781 and 1805 represent the hospital to varying but fairly limited extents with buildings on the street frontages and gardens behind (LRO D106/4/25; SRO D615/M/3/1; LRO B/A/21/17529). Burials are known to have taken place within the hospital precinct during the 18th and early 19th century and gravestones are depicted south of the chapel in an engraving by J. Buckler dated 1833 (WS SV V.247a; WS SV V.249a).
- 3.8 In 1925 eight to ten human skeletons were found approximately 2m deep in excavations for sewer trenches, though the exact location is not recorded. It was assumed that further burials lay in the adjacent ground and that they were medieval

priors, although a letter to the Lichfield Mercury by the Revd JE Auden asserts that the burials were much more recent and associated with pottery less than 200 years old (LM4/9/1925).

- 3.9 By the 20th century the land forming the western part of the development site was let by the hospital to the Lichfield County Lawn Tennis Club and included tennis and croquet grounds. The tennis club continued on the site until the late 1980s. A new west range of accommodation was built in 1966 and the east range altered in 1967. Building works revealed a 'medieval' burial, reported by Canon GN Strong (in Greenslade, 1970, fn.10).

4 AIMS AND METHODS

- 4.1 The main aim of the fieldwork was to ensure the archaeological monitoring of all aspects of the development programme and the recording of any human skeletons and other archaeological remains encountered during the groundworks.
- 4.2 The secondary aim was to form an understanding of the remains recorded in terms of their character and date, and to place the evidence in its local and regional context.
- 4.3 The objectives of the work were:
1. To identify and record evidence for early medieval and particularly medieval development to the rear of St John the Baptist Hospital
 2. To record the presence of articulated human remains within the area of the scheme and where appropriate, to safely recover these remains for analysis and reburial.
 3. To ensure that where human remains were to be preserved in situ they were protected and clearly marked and that the relevant site management and groundworks contractors were aware of their responsibilities.
 4. To recover all disarticulated human remains from the site and undertake a Minimum Number of Individuals analysis on the assemblage before securing its reburial in an appropriate location.
 5. To prepare a developmental history of the site to include post medieval development of the site.
- 4.4 More generally, objectives of the watching brief also included identifying, recording and fully investigating previously unrecorded archaeological evidence in order to

update the HER. The objectives also required that an appropriate degree of sampling and paleoenvironmental recording and assessment was undertaken if such features were encountered and that the analysis, conservation and storage of material recovered from the site was secured.

5 RESULTS

- 5.1 The area of relevant ground reduction at the south-western end of the development area was 40m long north-west to south-east and 17m long northeast to southwest. Further, and ultimately deeper, excavations were undertaken for the soakaways and drainage trench in the central part of the reduced area. The drainage trench extended to the north-west and south-east outside of the reduced area but no additional archaeology was observed in these areas. Foundation trenches were observed (Fig 1) but there was no evidence for any significant archaeological deposits. Following the discovery of the first skeleton, all areas of ground reduction were carried out using a toothless ditching bucket under archaeological direction.
- 5.2 The geological natural, 101, was recorded as reddish-brown degraded sandstone that increased in firmness at depth.
- 5.3 The first skeleton was approximately located on the eastern end of the fourth row, counting from the north end. A further 46 graves arranged in five rows were uncovered. All were orientated SW-NE with the head at the south-west end and the majority were in a supine position.
- 5.4 Seven skeletons formed the first, most northerly, row and only one, 227, was completely within the area of ground reduction. Skeleton 212, at the eastern end, was revealed to just above the knees though only the femurs, pelvis, arm bones and part of the skull had survived. The right arm of 212 had been placed on the pelvis and the left on the stomach. Fragments of roof tile and pottery were recovered from the grave fill 211. Skeleton 215 was truncated below the pelvis but with the exception of the hands and front of the skull, the majority of the skeleton had otherwise survived. The arms had been placed down the side of the body. Only partial remains of the legs and skull survived of skeleton 218. The short length of the surviving femurs suggested this was a child. More survived of skeleton 221, though it was truncated at the knees, but the bones were in very poor condition as a result of root action. Within the grave backfill 220 fragments of pottery, mortar and slag were

found. Skeleton 224 was one of the more complete examples in this row with truncation just above the ankles and the majority of the bones visible on excavation. Only the hands and the ribs on the left side were missing. The arms of 224 slightly overlaid the sides of the pelvis. Two fragments of pottery were recovered from the grave fill (223). Skeleton 227 had not been truncated by the excavations though the arms had been visibly cut by something post-burial at the same point just below the elbow and both hands were missing. Excavators noted a green stain on the skull, possibly from a shroud pin. The most westerly skeleton on this first row, 230, was also nearly complete, with truncation occurring at the lower leg. The neck and skull of this skeleton were unusually arched backwards and the arms were down by the side of the body.

- 5.5 In the second row the most easterly burial, 209, was approximately aligned with its counterpart 212 in the first row. The second row consisted of 19 burials in two groups, the most westerly four being outside of the reduced area and separate from the others by a distance of 4.5m. The eastern end of this row had been truncated by the excavations for a manhole and drainage trench prior to the archaeological watching brief and this may have been responsible for the partial survival of some of the skeletons. Skeleton 209 consisted only of the partial remains of the legs and feet and skeletons 203 and 206 were formed only of leg bones. Immediately to the south of 209 a single long bone, 119, was found within the drainage trench and it is likely these were part of the same skeleton. In addition to pottery, a single iron nail was recovered from 208, the fill of grave 209. Skeleton 200 was west of the manhole and had fared better with the lower body surviving in a supine position as well as parts of the left shoulder and arm and crushed skull fragments. Pottery and a partial roof tile were found within the grave fill (199). The following three skeletons, 122, 125 and 128, had all been truncated by the drainage trench so that the upper chest and shoulders were not observed by the archaeologists. However, with the exception of the hands these skeletons were almost complete. Skeleton 122 was found with a small nail close to the left side of the skull and another three nails were found with 128; it is likely that these have come from coffins. Burials 131-149 only survived in the drainage trench and consisted only of the upper torso and skulls in very poor condition. Only 146 and 149 contained any pottery with 146 also including two coffin nails.

- 5.6 At the western end of row two only the lower halves of skeletons 167-176 were visible in the drainage trench, the remainder of the bones were under the baulk (Photograph 4). The femurs most commonly survived in these graves though some of the pelvis and lower leg bones were also present. In all four of these burials the bone was in very bad condition and was dry and flaky as a result of root disturbance. Skeleton 167 was found associated with one pottery fragment in the grave fill (166).
- 5.7 Row three was formed of eight burials that were relatively complete with all but 179 and 104 containing pottery in the grave fills. The most westerly three, 188, 191, 194, included coffin nails. At the eastern end of the row skeleton 197 was immediately adjacent to the edge of the reduced area to the extent that the right arm was not visible under the baulk (Photograph 1). The hands, which were visible, had been placed across the pelvis and all the bones were quite stable. In the backfill 196 of the grave, medieval pottery was recovered. The bone in burial 179, by comparison, had not survived so well, with the ribs, upper torso and feet no longer present. Skeleton 104 was located in the manhole excavations and as a result had been substantially truncated with the skull removed by machine and only the long bones surviving in poor condition in situ. Skeleton 182 was complete with the exception of the feet and the backfill 181 contained one fragment of roof tile. The north end of the grave had probably been truncated by the manhole excavations, which may explain the missing feet bones. The right arm of 182 had been placed across the pelvis and the left arm was laid down the side of the body. Skeleton 185 was also missing its feet though was to the west of the drainage excavations so truncation is unlikely to be the cause. The hands were also missing but it was observed that the right arm was across the pelvis and the left arm across the stomach. The body was supine but the head was turned to face the southeast. One fragment of slag was obtained from the backfill 184. Skeleton 188 survived in a similar state with the arms crossed over the stomach although the ribs and spine had disintegrated. Unlike all the others the upper body of skeleton 191 was twisted sideways with the head facing north-west. The arms were placed across the pelvis and there was partial survival of the finger bones. The most westerly of the group, skeleton 194 was largely complete although the bones were in poor condition.
- 5.8 Row four included three burials and probably also the first skeleton found by the builders given its approximate location east of this row. Skeleton 233 was complete with the exception of the left hand bones (Photograph 2). The arms were laid by the

sides, though some distance from the body. The grave fill (232) included five pottery fragments as well as slag and roof tile. The partial remains of skeleton 236 were placed very close to the lower limbs of skeleton 233 and aligned slightly more north-south than the others. This meant 236 was slightly out of alignment to the north of row four (Photograph 2). The few remaining bones were in poor condition but the body appears to have been laid on its left side with the legs bent at the knee and the head on its left side looking north. Skeleton 236 was also found with slag in the grave fill 235. Skeleton 239 was the most westerly in the row and was more typically in a supine position with the right arm by the side of the body and the left arm over the stomach (Photograph 2). The hands, some of the ribs and vertebrae had not survived but the bone condition was otherwise relatively good compared with others on site and roof tile and coffin nails were found in grave fill 238.

- 5.9 The most southerly row, row 5, was made up of nine burials. All but 161 contained pottery but only three, 110, 113 and 116, included coffin nails in the backfill. The most easterly skeleton, 107, was extremely fragmentary in nature with only parts of the skull, teeth, vertebrae and pelvis surviving. The adjacent skeleton, 110, largely survived in quite good condition but the feet had been truncated by the ground reduction. The grave fill, 109, contained medieval pottery and a coffin nail. Skeleton 113 lay slightly further to the south than the rest of the row and thus had not been truncated by the ground reduction. The skeleton was largely complete with the left arm by the side and the right arm resting on the pelvis. Medieval pottery and a coffin nail were found in the grave fill 112. Skeleton 116 was found in a similar position with the left arm on the stomach and right arm on the hip although the legs had been truncated just below the knee. Medieval pot and a coffin nail were also found in the grave fill 115. Skeleton 152 had also been truncated below the knee but the legs were bent and twisted over onto the left side (Photograph 3). The arms were folded onto the chest although the torso bones had not survived along with the majority of the pelvis. The skull was lying on its left side. Pottery was recovered from the grave fill 151, which was a dark brown silty sand with charcoal inclusions. The remains of skeleton 155 were very fragmentary and the baulk of the excavated area obscured the legs from a point just above the knees. The right arm was bent on to the chest whilst the left arm was alongside the body with the hand on the pelvis. Pottery was recovered whilst cleaning the skeleton. Skeleton 158 had been placed slightly to the north of the row alignment and as a result only the head, neck and clavicles were visible but well preserved in comparison to the others. The edge of excavations

obscured skeleton 161 from just above the knee downwards but the majority of the bones, although degraded, were otherwise visible. The skull was lying on its left side and the arms were by the side of the body with the right hand over the right leg. Only the upper half of the final skeleton in the row, 164, was visible with the remainder under the baulk. The left arm had been placed across the stomach but the right arm was missing below the scapula. The bones were in good condition but the front of the skull had been damaged by the machine excavating the over-burden.

- 5.10 Overlying all the burials was layer 100 a greyish-brown sandy-loam. This was dug through for each of the grave cuts and the grave fills are probably the same material re-deposited. Much of the pottery found in the graves is believed to be residual within layer 100 and backfilled into the grave.

6 OSTEOLOGICAL SUMMARY

- 6.1 Below is a summary of the osteological analysis of the skeletons recovered, the full report can be found below as Appendix C.
- 6.2 York Osteoarchaeology Ltd undertook osteological analysis of 46 skeletons likely to be 14th-century or later date. All except one burial were of typical Christian tradition, with extended, supine position and south-west north-easterly orientation – aligned towards the chapel of St Chad. One individual was buried in a twisted position with the torso prone and legs flexed but supine. Coffins may have been present, and there is evidence for shroud pins in the form of copper staining on some of the skeletons.
- 6.3 The remains varied greatly in terms of completeness, fragmentation and preservation, but were mostly in moderate to poor condition, which had an impact on the information that could be extracted. In total, the group of articulated skeletons consisted of 46 individuals from distinct burials with a minimum of 38 individuals. The assemblage included seventeen non-adults and 29 adults. In the adult group, there were four males, six probable males, six probable females and three definite females. Ten adults had to remain unsexed due to the poor condition and/or incompleteness of the remains. It was possible to determine that at least four individuals buried at St John's cemetery were of African or mixed ancestry. Stature calculations at St John's

- showed a range in heights for females and for males. The average stature at St John's was slightly above the late medieval average.
- 6.4 Four males were had congenital conditions in the spine whereby one vertebra takes on characteristics of another vertebra. Several other minor developmental anomalies were noted, as well as a potentially more serious premature suture fusion in the skull of one individual.
- 6.5 Metabolic conditions at St John's included one individual with possible Vitamin D deficiency. The prevalence of orbit lesions indicative of childhood stress was above the late medieval average, but it fitted in well with the prevalence rates recorded for other contemporary hospital sites. Dental enamel hypoplasia, which is indicative of childhood health stress, was observed in 36.03% of teeth present for analysis, and half the population, which was higher than the late medieval average. More females were affected than males, which may have been due to a higher survival rate of females when confronted with health stresses, or simply increased stress on females during childhood.
- 6.6 Fractures were recorded for two individuals, including one left shoulder and a muscle injury fracture of a left femur.
- 6.7 Chronic sinusitis affected over half of observable sinuses and adults were generally more commonly affected than non-adults. Females were also more frequently affected than men, which corresponded to the contemporary norm. Two adolescents were noted to have inflammatory rib lesions and a total of fourteen individuals at St John's had signs of well-receding inflammatory lesions on their leg long bones. One adolescent had active woven new bone affecting almost the entire elbow, which indicated inflammation active at the time of death, and two individuals had inflammation on the inner surface of the cranium. It is possible that these may have been secondary reactions to meningioma (Brothwell 1967, 327).
- 6.8 Spinal and extraspinal degenerative joint changes were recorded in at least half of the adults. Degenerative disc disease was most frequently affecting the neck, but it was also present in central and lower spine. Degenerative joint disease was most frequently present in the shoulders, hips and/or knees. More males had signs of the disease. These patterns were expected, although it was noted that the overall

prevalence of joint changes was beyond the late medieval average and may have been influenced by the fact that this was a hospital site. Spinal osteoarthritis was present in seven individuals. Extra-spinal osteoarthritis affected the mandible of one individual, and it was found in both knees and the right shoulder of Skeleton 197, an individual who also had Legg-Calve-Perthes disease, a circulatory condition (Photograph 1). Five additional adults suffered from arthritis in the knees and/or hip joints. Additionally, nine individuals at St John's had evidence of either cysts or cystic lesions in their skeleton.

- 6.9 Dental plaque concretion prevalence was very high compared with the medieval average and males were generally more frequently affected than females, which was consistent with contemporary populations. In contrast, cavities prevalence at St John's was low, suggesting that individuals buried at St John's had a less cariogenic diet than those at other late medieval sites. Abscesses were rare at St John's, with only four of 13.79% adults affected, which was lower than the British average prevalence at the time. It is likely that this was related to the low prevalence of cavities.
- 6.10 Dental anomalies included a number of impacted milk teeth, which caused part of the permanent dentition to either be moved from their normal position, or to be impacted as well. Enamel defects were recorded in two skeletons and two individuals had crowding in the anterior mandible. Possible nerve damage in one tooth was recorded for one individual and one adolescent had a likely work-related notch on the occlusal surfaces of the right maxillary and mandibular incisors.

7 POTTERY ANALYSIS by Stephanie Rátkai

- 7.1 The pottery was divided by eye into generic groups roughly along the lines of the typology used by Ford (1995). The broad groups were:

IRP	Medieval Iron-poor wares (buff/pale orange/salmon pink)	12th-14th c
IRT	Medieval Iron-rich (table wares)	12th-13th c
IRU	Medieval Iron-rich (utilitarian wares)	12th-13th c
RPWW	Medieval red-painted whiteware	?mid 13th-14th c
SHW	Medieval shelly ware	12th-13th c
STAM	Medieval Stamford ware	12th c*
WEDS	Late medieval Wednesbury ware	15th-16th c
WW	Medieval whiteware	?mid 13th-14th c

*date represents likely date of the sherd from SLA15

- 7.2 The groups were quantified by sherd count and sherd weight. The sherds were also assigned to sherd type and vessel form where possible. A total of 351 sherds were recorded including two fragments of ceramic building material (CBM). Pottery quantification is shown in (Table 1).
- 7.3 The form sherds in the assemblage and some decorated sherds were fabric-typed following the Lichfield type series (eg Rátkai 2004). In addition, some rim profiles have been illustrated and some handles and decorated sherds photographed. This approach allows closer comparison with other sites in Lichfield and augments the Lichfield pottery dataset.
- 7.4 The majority of the pottery came from the soil layer 100, with a smaller amount from the grave fills. The latter was clearly redeposited material from 100. The pottery from the soil dates primarily to the 12th and 13th centuries. It is possible that some of the whitewares date to the 14th century. The one exception is the sherd of Wednesbury ware which must represent an intrusion, as do the two fragments of CBM.

Table 1 Quantification of pottery by Fabric Group

Fabric Group	Context 100			Grave fills		
	Count	Weight	ASW	Count	Weight	ASW
IP	8	161	20.1	3	12	4.0
IRT	17	202	11.9	2	36	18.0
IRT?	0	0	0.0	2	38	19.0
IRU	114	1120	9.8	41	289	7.1
RPWW	13	428	32.9	5	49	9.8
STAM	1	4	4.0	0	0	0.0
WEDS	1	16	16.0	0	0	0.0
WW	114	1180	10.4	27	198	7.3
WW or IP?	1	10	10.0	0	0	0.0
CBM	2	136	68.0	0	0	0.0
Total	271	3257	12.0	80	622	7.8

ASW = Average Sherd Weight

- 7.5 Wear was evident on the sherds, as would be expected. However, sherd size was varied, ranging from 1-2g to over 20g. This may indicate an *in situ* build-up of material. The average sherd weight of 12g for the topsoil pottery was greater than that for the graves at a little under 7g. This might indicate that the pottery in 100 had been reworked as the graves were dug and back-filled. The comparative frequency of the fabric groups in 100 and the grave fills shows some variation (see Table 2) but clearly shows, nevertheless, that the assemblage was dominated by whitewares and iron-rich cooking pots.

Table 2 Comparison of major fabric groups in topsoil and grave fills

Fabric Gp.	Context 100		Grave fills	
	Count	Weight	Count	Weight
IP	2.95%	4.94%	3.75%	1.93%
IRT	6.27%	6.21%	5.00%	11.90%
IRU	42.07%	34.39%	51.25%	46.46%
WW	42.07%	36.23%	33.75%	31.83%
RPWW	4.80%	13.14%	6.25%	7.88%

7.6 Cooking pots/jars (cpj) were the most common form and rarer cooking vessels such as pipkins, skillets and a dripping tray were also present. Jugs were also well-represented and included early 'pitcher-type' vessels of the later 12th and early 13th century. Bowls were recorded, some of which were used for cooking. The use of internally glazed whiteware bowls for cooking is a feature of pottery assemblages from north Warwickshire and south Staffordshire. The breakdown of sherds by form is shown in Table 3.

Table 3 Percentage of sherds by form

Form	<i>Ctxt 100</i>		<i>Grave fills</i>	
	Qty	Wght	Qty	Wght
jug/pitcher	21.40%	24.01%	21.25%	28.62%
jug?	1.11%	8.69%	6.25%	12.54%
jug/jar	0.37%	0.12%		
cpj	12.92%	12.37%	57.50%	51.13%
cpj?	9.96%	8.01%	1.25%	0.80%
bowl	4.43%	6.08%	1.25%	0.32%
bowl?			1.25%	1.93%
drip tray	0.37%	1.44%		
pipkin?	0.37%	0.28%		
skillet/pipkin	0.74%	1.17%		
unknown	47.23%	33.16%	11.25%	4.66%

7.7 Thirty-four cooking pot/jar (cpj) rims were recorded (Table 4). Most of these were in Fabric CPJ8b. This fabric (and variants of this group CPJ8 and CPJ8a) is mainly reduced black but has a thin skin of orange or brown oxidation on the surfaces. The clay body is not consistently prepared and inclusion size and density vary. The principle inclusions are quartz sand and red and/or brown ferrous material. In some

respects the fabric is similar to Coventry A and D wares (Redknapp 1985) but as CPJ8a and CPJ8b are also used for pitchers (see below) which are completely different from those found in Coventry ware, it seems safe to assume that most of the cooking pots were made fairly locally. The next largest number of cooking pots were found in whiteware fabric WW2 but these represent less than a third of the number found in Fabric CPJ8b. In general, the cooking pot fabrics at St John's have all been encountered elsewhere in Lichfield (see Table 5). However, St John's is the only site where Fabric CPJ8b is the most common.

- 7.8 Some of the cooking pots could be directly paralleled by vessels from elsewhere in south Staffordshire; a squared rim with combing on its upper surface finds a match at Drayton Bassett (Ford 1995 fig. 9, 28-29) and a second rim at 15, Sandford Street - a site which backs onto the precinct wall of the Franciscan Friary. A small diameter pot (15cm) in Fabric CPJ2 stands out in this assemblage. Small diameter cooking pots are usually associated with the Late Anglo-Saxon period but the sherd from St John's is hand-formed rather than wheel-thrown and it is more likely to be post-Conquest in date. A similar small diameter jar was found at Stafford Castle (Rátkai 2007, fig.37, 129) and a better parallel also in Fabric CPJ2, at the Cross Keys site in Lichfield, where there was some Late Anglo-Saxon pottery (Stamford ware and Stafford ware).
- 7.9 Evidence of other cooking vessels was provided by two tapering handles (Fabric WW2) from pipkins or, and possibly more likely, skillets.
- 7.10 Jugs were appear less common (Table 3) when quantified by rim count and rim percentage than is the case when weight or sherd count is used (Table 4). All but one of the rims were from whiteware jugs. These rim sherds were small and offered little new information. However, body and base sherds revealed that thumbed or finger-impressed bases were present and one sherd was decorated with bands of square roller stamping (paralleled by a jug from Stafford, Ford 1995 fig. 15 106), another had an applied pinched strip. The latter two were in fabric WW2. A number of jug sherds were also decorated with red slip bands, the so called red-painted whitewares. Most of these sherds also appeared to be in fabric WW2. This fabric has the coarsest, sandiest whiteware fabric with relatively few ferrous inclusions. There were two whiteware handles. The first (Fabric WW2) had a pronounced central rib, stabbing and comb impressions. The glaze had decayed to a dull brownish colour, a common feature on some of the whitewares. Small patches of bright copper

green glaze indicated how the glaze had looked originally. This handle type is unusual but not unknown in South Staffordshire. It is, however, not found at the Chilvers Coton kilns. A similar handle was found at Stafford Castle (Rátkai 2007, fig. 36, 127). The second handle was a rod handle with central stabbing. This is a much less common form and also belongs to the South Staffordshire tradition, rather than that of the Chilvers Coton wares. The glaze was also brownish. The whiteware jugs date from the mid-13th century to the 14th century.

Table 4 Quantification of rim sherds by fabric and form type

FABRIC	cpj		bowl		bowl?		cpj/pipkin		drip tray		jug		Total MV	Total %
	MV	%	MV	%	MV	%	MV	%	MV	%	MV	%		
CPJ1	1	3											1	3
CPJ2	2	10											2	10
CPJ3	4	12											4	12
CPJ5?	2	8											2	8
CPJ8	1	5											1	5
CPJ8AG											1	1	1	1
CPJ8B	17	74											17	74
CPJ8B?	1	5											1	5
WW1					1	4					3	16	4	20
WW2	5	21	3	17	1	4	1	5			2	13	12	60
WW3									1	5			1	5
WW4											1	10	1	10
REDUCED DERITEND	1	5											1	5
Total	34	143	3	17	2	8	1	5	1	5	7	40	48	218

7.11 The paucity of jug rim sherds obscures the fact that a different, and earlier, set of jugs was being used at the St John's site. Ford (1995) has termed these 'Stafford green-glazed pitchers'. These are large, hand-formed vessels with broad strap handles decorated with crimped strips and finger-impressions or pinching. Three handles were present, one continuing up to a small section of rim. The 'crimped' handle is directly paralleled by sherds from Stafford town (Ford 1995, fig. 11, 41 and 45) and Stafford Castle (Rátkai 2007, fig. 31, 53 and 60). At St John's the crimped handle and another with finger-impressed decoration were recorded as Fabric CPJ8AG ie a glazed version of cooking pot fabric CPJ8A. A finger-impressed base with a decayed glaze was recorded in Fabric CPJ8G. The third handle was in Fabric MEDG3. One

further glazed ware was noted, Fabric CPJ5G. This is an extremely coarse, sandy ware. Typologically these large jug/pitchers belong to the second half of the 12th to early 13th century.

Table 5 Fabric occurrence on other Lichfield sites

Fabric	CKL05	CHL02	SLA15	15 SS	SS	LH-30
STAMFORD	X	X	x			
SHELLY WARE	x	x	x	x	x	
CPJ1	X	X	x	X	X	
CPJ2	X	X	x	X	X	
CPJ3	X	X	x	X	X	
CPJ4	X	X		X	X	x
CPJ5	X		x	X	X	
CPJ5G			x	X	X	
CPJ8	X	X	x	X	X	
CPJ8B	X	X	x	X		
CPJ8G	X		x			
CPJ8AG	X	X	x			
CPJ8BG	X	X				
MEDG3	X	X	x	X		
IRP1	X	X		X	X	x
WW1	X	X	x	X	X	x
WW2 (AND VARIANTS)	X	X	x	X	X	x
WW3	X	X	x	X	X	
WW4	X	X	x	X		x
DERITEND	X			X		x
DERITEND REDUCED	X		x			
RW3	X	X		X	X	x
LMT2	X	X		X		x
LMT2A				X		x

(Key: CKL05 = Cross Keys; CHL02 = Civic Hall (Nash 2003); SS = Sandford Street (Nichol and Ratkai 2004); 15 SS = 15 Sandford Street; SLA15 = St John's Lichfield; LH-30 = Lichfield Friary (Wessex Archaeology 2016))

7.12 Pottery sources were mainly local or fairly local. Most of the whitewares (and red-painted whitewares) were of a coarse gritty type that suggests a Staffordshire source, rather than a north Warwickshire one, although it is certainly possible that some

Chilvers Coton whitewares also came to Lichfield. Some cooking pot/jar sherds could be Coventry-type ware but the balance of probabilities is that they are not. The reduced Deritend ware sherd is an 'import' from Birmingham and although only one such sherd was identified at St John's, both reduced Deritend ware cooking pots and the glazed Deritend ware jugs are often found on Lichfield sites. Sherds that were not local were the Stamford ware sherd and two shelly ware sherds from 100. Shelly ware sherds have been found previously on excavations on Sandford Street but only in small numbers. A source in the east or south-east Midlands is likely for the shelly wares.

Conclusion

- 7.13 The assemblage does not date the graves as it is largely unstratified but it has value insofar as it enhances our understanding of the development of this part of Lichfield and increases our knowledge of the pottery supply and use in lieu of two larger unpublished assemblages.
- 7.14 Table 5 provides a resume of the pottery fabrics identified at St John's and the adjacent site at the Franciscan Friary, in relation to other excavated sites in Lichfield. The assemblage was similar to that recovered on the south side of the road at 15 Sandford Street where it was suggested that there was sufficient evidence to indicate 12th-century occupation. Two other sites that have early phases of activity, the Civic Hall (Nash 2003) and the Cross Keys (Marches Archaeology) are also similar and are the only two sites where Stafford green-glazed pitchers and Stamford ware were found.
- 7.15 The assemblage from St John's seems to represent a build-up of pottery during the 12th and 13th centuries predominantly, indicating that this area of Lichfield was occupied from before 1200 and pottery from the hospital may have started to accumulate in the 1140s, shortly after its founding. The graves could have been dug at any point after c 1300. The absence of pottery datable to after c.1400, apart from the one Wednesbury ware sherd, indicates that no further material was dumped in the area once grave-digging began. It does not, of course, necessarily indicate that all the graves themselves were dug before 1400.
- 7.16 The assemblage as a whole appears to be composed of normal domestic waste. It is difficult to see anything that would mark the pottery out as belonging to a religious

establishment in terms of function, apart possibly from the two skillet handles. Skillets are not especially common on West Midlands sites in the period under discussion. However, a rather striking collection of skillets was found in a single deposit at Coombe Abbey, Warwickshire. It was suggested (Palmer *et al* 2009), that these may have served as 'mess tins' for the brethren. If, however, the skillets, the possible pipkin and the dripping tray, which could be more or less contemporary, were used for a normal culinary purpose then it would suggest that the diet of those living at St John's was somewhat better than plain fare.

- 7.17 In terms of supply, most of the pottery used at St John's appears to have been fairly local with demonstrable links with Stafford and Birmingham, both about 25km distant. The exceptions to this are the shelly ware and Stamford ware sherds which have their home in the east or south-east Midlands. There is no strong evidence that the episcopal links between Lichfield and Coventry influenced the pottery supply in any considerable way, or the influx of pilgrims (who were sometimes quartered at the hospital) to the shrine of St Chad.

8 ASSESSMENT

- 8.1 The excavations are believed to have determined three sides of the extent of the cemetery. No further graves were identified to the east of 197 (Photograph 1), south of Row 5 or west of 176. However, the nature of the sandy soil 100 made it difficult to identify the grave cuts slightly above the level of the skeletons. In addition, the majority of the skeletons were found at a depth of approximately 2m but those west of centre in Row 2 were increasingly deeper than this. The combination of the possibility of graves deeper than 2m and the difficulty identifying the cut of the grave means it is still possible that graves could be outside the excavated extent. To the north the edge of excavation truncated parts of Row 1 and the area north of this was only investigated as a watching brief on one service trench. No evidence of burial was found in the trench but there was room for at least another row of burials in the area not investigated.
- 8.2 The increasing depth of the burials in Row 2 may explain the gap between burials 149 and 167. There was no evidence for any other incursion that might have obscured or destroyed burials in this area. Although it remains a possibility that the bones did not survive, this seems very unlikely given the relatively good preservation across the rest of the site. From the remains found in the drainage trench dug across

- Row 2 it seems there may be a change in alignment, with skulls in graves 131-149 and legs in 167-176 (Photograph 4). It is therefore possible that the shift occurred in the gap and that these graves are outside of the drainage trench.
- 8.3 Graves that may have made up the western ends of Rows 1 and 3 and possibly the gap in Row 2 were not identified as the building plan was modified to enable only a minimal degree of ground reduction. It is highly likely that more burials do exist in these areas but have been preserved *in situ*. It is also very probable that more graves made up Rows 2, 3 and 4 in the areas excavated for the soakaways and drainage trench adjacent to the first skeleton found by the builders and skeleton 104. These trenches were initially excavated without archaeological supervision and so evidence for burials is likely to have been lost.
- 8.4 Despite the problems identifying the location of many of the graves, the 46 graves that were located showed clear trends in layout. They were of a typical Christian burial ground with bodies laid supine and no accompanying grave goods. Christian burials are usually close to east-west in alignment but all of these were facing north-east, in the direction of Lichfield Cathedral and the relics of St Chad. With two exceptions there were no incidents of intercutting suggesting the graves were marked and each person buried individually. The first exception was 176 where the two femurs were not a pair and were likely to have come from two individuals, although there is no evidence from the excavation to explain how this might have occurred. The second exception is 236 which significantly encroaches on grave 233 (Photograph 2). Skeleton 236 is that of a child and therefore maybe related to 233. A difference in the time of death may also explain an attempt to squeeze 236 into the row.
- 8.5 Eleven of the graves contained one or more iron nails consistent with those used for coffins. There was no pattern to the distribution of the nails except that none were found in Row 1. Many of the bones also had slight copper stains suggestive of shroud pins. It is probable that the majority were buried in shrouds or coffins or both. Row 1, as the closest to the hospital of those identified, may represent the earlier of earliest phase of burials. The lack of coffin nails in Row 1 may be indicative of a later change in tradition or they may simply not have survived in this row.

- 8.6 There was one burial, 152, that was not laid supine like the others. Its torso was prone with the legs flexed to the left side but supine and the head also on its left side facing north-west (Photograph 3). There are a myriad of reasons why a person may be buried like this, from Christian piety to drawing attention or distinctions to physical attributes during life. It might never be understood why this burial occurred in this way but it is unusual in being the only one of those exposed in this cemetery. Skeleton 152 is also notable for being of African or mixed ancestry, one of four found at St John's. Although this might mark it out as unusual, the other three African or mixed race individuals were not buried in a way that would distinguish them.
- 8.7 None of the burials were notable for grave goods although nearly all had pottery within them. A high quantity of the same types of pottery was found in layer 100, a probable former topsoil through which all the graves were dug. The backfill material of the graves is therefore made up of redeposited soil from layer 100. As a result the pottery within the graves is very unlikely to have been deliberately deposited there but is instead residual, originating in the topsoil. Despite the lack of a secure context, the assemblage is useful in providing an indication of the date range and use of the site and in providing additional evidence for the use and sources of pottery in the Lichfield area. All the pottery at St John's dates to the 12th and 13th centuries with some whitewares possibly extending into the 14th century. The assemblage was largely typical of that for Lichfield; consisting of locally made cooking pots and jars of domestic types with no specific reference to the religious or pilgrimage aspects of the site. The vessels have more in common with the pottery traditions and production sites of south Staffordshire than those originating nearby in north Warwickshire and the large production centre at Chilvers Coton. Trading further afield is suggested by the presence of Deritend ware from near Birmingham and Shelly ware from the east or southeast midlands. The presence of the pottery found in the graves indicates this area was occupied before 1200, probably coinciding with the founding of the hospital. The absence of pottery dating to after 1400 suggests the dumping of pottery ceased once burials began or that the site ceased to be used entirely around that time.
- 8.8 A minimal quantity of slag and ceramic building materials, mainly roof tile, was also recovered. These show a potentially significant pattern, despite the very small assemblage. The fragments of slag were found in four graves in a NE-SW alignment; graves 221, 185, 236 and 233. These fragments are clearly suggestive of metalworking happening nearby, most likely being dumped here before the burials

- took place, like the pottery. The apparent alignment may be coincidence. The ceramic building material was similarly found on a NE-SW alignment, close to the slag, in six graves: 212, 221, 200, 182, 233 and 239, but there is no evidence to draw more detailed conclusions.
- 8.9 The skeletal assemblage is of a moderate size but large enough to establish some conclusions or comparisons with other sites. The bones were in a poor to moderate condition and there was quite a high incidence of incompleteness of the skeletons due to the degree of survival and truncation as a result of the excavation. However, it was still possible to complete a Minimum Number of Individuals analysis and the majority could be at least broadly categorised by age and sex.
- 8.10 Compared to medieval averages for the 12th to 14th centuries, the individuals interred were of above average height and there was a greater prevalence of indicators of childhood stress, joint changes or disease and dental plaque concretion. The incidence of trauma, such as broken bones, developmental abnormalities, congenital or other diseases as well as dental cavities and abscesses was much lower than medieval averages. This is suggestive of a relatively healthy adult population or environment. Given this site was a hospital, it might be expected that the dead would represent a population in poor health but there would also have been clerical staff, who probably had quite a safe and sheltered life, and pilgrims, who would still have to be quite fit to make the journey this far, even if they were seeking the healing powers of St Chad. The causes of death were not determinable from the bones though there is any number of possibilities from infection, severe dietary deficiencies to plague.
- 8.11 Although there are significant differences to medieval averages the burials from St John's compare favourably with those from other hospital sites, such as Spital Square, an Augustinian priory and hospital in north-east London. There seems to be a high correlation in the occurrence of disease and trauma but also in the population distribution. St John's has a greater number of adolescents than might be expected compared to the medieval population more generally. A similar spike in adolescents is found at Spital Square. Why there were more adolescents at these hospitals and why they died there is unknown but has potential for further research.

8.12 Also currently difficult to explain without further research is the presence of at least four individuals of African or mixed ancestry. This was determined using cranial traits so it remains possible that others are included in the assemblage that could not be determined due to the lack of or poor condition of the skulls. As a focus of pilgrimage the presence of individuals from further afield is not inconceivable. In addition, there was considerable movement of people across Europe as the various Crusades continued to be fought across the Middle East, eastern Mediterranean and Iberia throughout the period the cemetery was in use. It is unlikely to ever be known why these four or more African individuals died at Lichfield but further analysis, particularly strontium and oxygen analysis which is likely to enhance our understanding of movement and mobility and carbon and nitrogen isotope analysis may be able to shed light on their diet and therefore refine their story of origin and movement, or otherwise. Such analysis may also be informative regarding the other individuals to add information to what is known about the population and diet at the hospital.

9 RECOMMENDATIONS

- 9.1 Overall the cemetery at St John's Hospital represents an addition to the story of Lichfield and the long history of the hospital. The quantity of bones, their pathology and associated pottery and coffin nails, as well as the cemetery layout, is significant new evidence. Comparison with other hospital sites has been shown to have potential to establish trends and for further research. There remain several unanswered questions, including; the precise timeline and reasoning for a cemetery in this location, the causes of death and the unusual presence of the four African or mixed ancestry individuals. Further research into the hospital, greater comparison with other sites and testing of the bones is likely to provide additional data for interpretation.
- 9.2 Following this stage of assessment, it is recommended that a summary of the findings is published in a suitable journal and an abridged illustrated version is produced for wider public dissemination for local people, schools and visitors to St John's.
- 9.3 The site archive and finds should be deposited together in an appropriate institution to allow access for future research.

10 FUTURE RESEARCH POTENTIAL

10.1 Further analysis and research could enable a greater understanding of the origin and use of the site, the individuals buried therein, and could allow for better comparisons with other medieval and hospital sites to gain a better picture of the local and regional medieval population. The potential for investigating medieval migration to the Midlands is apparently unique.

1. Strontium and oxygen analysis and carbon and nitrogen isotope analysis on the individuals of African ancestry could help to determine their 'life history'.
2. Strontium and oxygen analysis and carbon and nitrogen isotope analysis on additional individuals, where teeth preservation allows, could provide further information on the hospital population.
3. Radiocarbon dating of selected skeletons, where preservation allows, could provide a more secure date and chronology for the cemetery than is possible just from the pottery and context of the burials and hospital.
4. Further documentary or comparative research into Lichfield and similar sites could provide a greater understanding and context for the results of the analysis.

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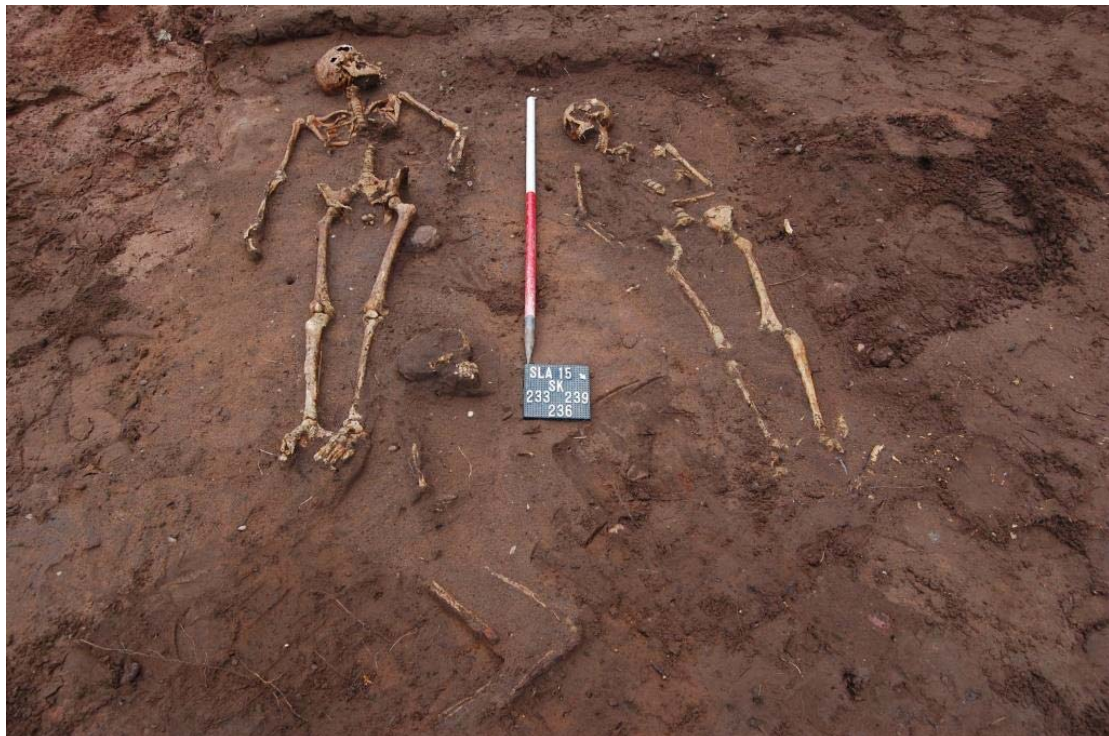
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1. Skeleton 197, a good example of the general positioning and state of preservation of the majority of skeletons at St John's



2. Skeletons 233, 239 and 236, squeezed into Row 4



3. Skeleton 152 was the only one in a twisted position and is also of African ancestry



4. The partial remains of the legs of skeleton 176, found in the drainage trench. Note also the slight variation in the grave backfill from the surroundings, and the difficulty in identifying the cuts of the other graves

APPENDICES

A List of contexts

Context	Description	Comment/details
3	Layer of tarmac overlying hardcore 4	
4	Hardcore overlying 100	
100	Layer of greyish brown sandy loam	Old topsoil/graveyard soil
101	Geological natural	Layer reddish brown sand/sandstone
102	Grave cut of 104	Faintly visible
103	Grave fill over 104 dark brown sandy loam	
104	Skeleton	
105	Grave cut for 107	Faintly visible
106	Grave fill over 107 dark brown sandy loam	
107	Skeleton fragmentary	Child
108	Grave cut for 110	
109	Grave fill over 110 dark brown sandy loam	
110	Skeleton	Adult
111	Grave cut for 113	Faintly visible
112	Grave fill over 113 dark brown sandy loam	
113	Skeleton	Adult
114	Grave cut for 116	Faintly visible
115	Grave fill over 116	
116	Skeleton	Small adult
117	Grave cut for 119	Within service trench
118	Grave fill over 119 brown sandy loam	
119	Skeleton	Single adult long bone
120	Grave cut for 122	
121	Grave fill over 122	
122	Skeleton	
123	Grave cut for 125	
124	Grave fill over 125	

125	Skeleton	Adult
126	Grave cut for 128	
127	Grave fill over 128	
128	Skeleton	Adult
129	Grave cut for 131	
130	Grave fill over 131	
131	Skeleton	Child skull only
132	Grave cut for 134	
133	Grave fill over 134	
134	Skeleton	Adult skull only
135	Grave cut for 137	
136	Grave fill over 137	
137	Skeleton	Adult very degraded
138	Grave cut for 140	
139	Grave fill over 140	
140	Skeleton	Child very degraded
141	Grave cut for 143	
142	Grave fill over 143	
143	Skeleton	Adult poor condition
144	Grave cut for 146	
145	Grave fill over 146	
146	Skeleton	Adult skull only
147	Grave cut for 149	
148	Grave fill of 149	
149	Skeleton	Adult skull only
150	Grave cut for 152	
151	Grave fill over 152 dark brown silty sand	
152	Skeleton	Adult
153	Grave cut for 155	Faintly visible
154	Grave fill over 155 dark brown silty sand	Charcoal inclusions
155	Skeleton	Adult
156	Grave cut for 158	Faintly visible
157	Grave fill over 158 dark brown silty sand	Charcoal inclusions
158	Skeleton	Adult

159	Grave cut for 161	
160	Grave fill over 161 dark brown silty sand	Charcoal inclusions
161	Skeleton	Adult
162	Grave cut for 164	Faintly visible
163	Grave fill over 164 dark brown silty sand	Charcoal inclusions
164	Skeleton	Adult
165	Grave cut for 167	
166	Grave fill over 167 brown sandy loam	
167	Skeleton	Adult poor condition
168	Grave cut for 170	
169	Grave fill over 170 brown sandy loam	
170	Skeleton	Adult poor condition
171	Grave cut for 173	
172	Grave fill over 173 brown sandy loam	
173	Skeleton	Adult
174	Grave cut for 176	
175	Grave fill over 176 brown sandy loam	
176	Skeleton	Adult Very poor condition
177	Grave cut for 179	
178	Grave fill over 179	
179	Skeleton	Adult
180	Grave cut for 182	
181	Grave fill over 182	
182	Skeleton	Adult
183	Grave cut for 185	
184	Grave fill over 185	
185	Skeleton	Adult
186	Grave cut for 188	
187	Grave fill over 188	
188	Skeleton	Adult
189	Grave cut for 191	
190	Grave fill over 191	
191	Skeleton	Adult
192	Grave cut for 194	

193	Grave fill over 194	
194	Skeleton	Adult poor condition
195	Grave cut for 197	
196	Grave fill over 197	
197	Skeleton	Adult
198	Grave cut for 200	
199	Grave fill over 200	
200	Skeleton	Adult
201	Grave cut for 203	
202	Grave fill over 203	
203	Skeleton	Adult legs only
204	Grave cut of 206	
205	Grave fill over 206	
206	Skeleton	Child legs only
207	Grave cut for 209	
208	Grave fill over 209	
209	Skeleton	Adult legs and feet only
210	Grave cut for 212	
211	Grave fill over 212	
212	Skeleton	Adult
213	Grave cut for 215	
214	Grave fill over 215	
215	Skeleton	Adult
216	Grave cut for 218	
217	Grave fill over 218	
218	Skeleton	Child very poor condition
219	Grave cut for 221	
220	Grave fill over 221	
221	Skeleton	Adult
222	Grave cut for 224	
223	Grave fill over 224	
224	Skeleton	Adult
225	Grave cut for 227	
226	Grave fill over 227	

227	Skeleton	Adult
228	Grave cut for 230	
229	Grave fill over 230	
230	Skeleton	Adult no feet
231	Grave cut for 233	
232	Grave fill over 233 dark brown silty sand	
233	Skeleton	Adult
234	Grave cut for 236	
235	Grave fill over 236	
236	Skeleton	Child
237	Grave cut for 239	
238	Grave fill over 239	
239	Skeleton	Adolescent
240	Grave cut for 242	
241	Grave fill over 242 dark brown sandy loam	
242	Skeleton	Adult feet only
243	Topsoil layer	0.3m
244	Man-made soil layer	0.5m-0.7m
245	Brown yellow sand	Geological natural
246	Concrete slab on black plastic sheeting	0.12m-0.15m
247	Brick demolition fragments of wood and cable	0.50m
248	Topsoil layer dark brown sandy loam	0.3m
249	Brown sandy loam layer	
250	Reddish yellow sand	Geological natural
251	Brick wall laid on concrete footings	9 brick courses
252	Brick wall laid on concrete footing	6 courses
253	Modern soakaway drainage	
254	Modern linear drain cut	
255	Topsoil layer brown sandy loam	0.3m
256	Subsoil layer pale brown very sandy loam	
257	Fill of loose bricks and pipe in 254	
258	Modern pit vertical sided	>1.2m
259	Fill of pit 258	

B List of Finds

Context	Material	SF	Number	Comment
100	Pottery		277	Medieval, fabrics WW1, WW2, WW3, WW4, STAM, SHW,RPWW, IRP1, 6 sherds post-medieval Manganese Mottled ware and black glazed coarseware
100	Slag		11	Iron slag
100	Iron		2	Knife blade, medieval, nail
100	Clay pipe		8	5 bowls, 3 stems one bowl stamped LS, one stamped JOHN HART
100	Roof tile		2	Hand-made fragments
100	Floor tile		1	Decorated
100	Cu alloy	1	1	Thimble with rimmed body, 19thC
100	Coin	2	1	1806 George III penny
100	Cu alloy	3	1	Belt buckle, D-shaped, 42mm x 35mm
100	Lead	4	1	2oz lead weight
103	<i>Pottery</i>		1	<i>medieval</i>
103	<i>Iron nail</i>		1	
106	Pottery		1	medieval
109	Pottery		3	medieval
109	Iron nail		1	Square-shafted, 49mm long
112	Pottery		2	medieval
112	Iron		2	Square-shafted, flat-headed nail, 54mm long and roughly rectangular, and flat rectangular object
115	Pottery		3	medieval
115	Iron nails		2	Two square-shafted nails, c.55mm long
121	Iron nail		1	Large nail, 53mm long, with T-shaped head and rectangular shaft, 9mm wide
124	Pottery		2	Medieval fabric WW1
127	Pottery		2	GF
127	Iron nails		13	Fragments of square-shafted, flat-headed nails, including one hooked nail, lengths vary between 44mm to 25mm
145	Pottery		1	Reduced Deritend
145	Iron nails		2	Two square shafted nails, 40mm long, flat headed nail
145	Tile		4	
148	Pottery		2	GF medieval

151	Pottery		4	GF medieval
154	Pottery		3	Gf medieval
157	Pottery		3	Gf MEDG3
160	Pottery		2	medieval
160	Iron		1	nail
160	Tiles		1	Small fragment of roof tile
163	Pottery		1	Gf medieval
166	Pottery		1	Gf medieval
178	Tile		3	
178	Iron nails		3	One square-shafted flat-headed nail, 26mm long, plus two thin possible shafts
181	Pottery		1	Gf medieval
181	Tile		1	
184	Pottery		3	Gf medieval
184	Slag		1	
187	Pottery		8	Gf CPJ2
187	Iron nails		5	Square shafted, flat-headed, max length 43mm
190	Pottery		5	gf
190	Iron nails		10	Square-shafted, flat-headed nails and fragments, max length 30mm
190	Roof tile		1	
193	Pottery		1	Gf, medieval fabric WW2
193	Iron nails		3	Square-shafted, flat-headed nails, max length 35mm
196	Pottery		1	medieval
199	Roof tile		1	
208	Pottery		2	Grave fill
208	Iron nail		1	Square nail shaft, no head, 43mm long
211	Pottery		6	Gf, medieval fabric WW1
211	Roof tile		2	
220	Pottery		2	Gf medieval

220	Mortar		2	
220	Slag		1	
223	Pottery		2	Grave fill, medieval fabric WW2
232	Pottery		5	Gf medieval
232	Slag		1	
232	Roof tile		2	
232	Adipocere?	6	1	
235	Pottery		6	Grave fill - medieval
235	Slag		1	
238	Pottery		4	Grave fill - medieval
238	Iron nails		11	Variety of nails (max length 60mm) and nail fragments, three of which are have their shafts bent 90 degrees (hooked nails?).
238	Roof tile		12	
238	Cu alloy	5	1	Pin – shroud pin?

Osteological Analysis
St. John's Almshouses
Lichfield
Staffordshire

Site Code: SLA 15
NGR: SK 11742 09155

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May 2016

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Summary

York Osteoarchaeology Ltd was commissioned by Warwickshire Archaeological Services to carry out the osteological analysis of 46 skeletons excavated at St. John's Almshouses, Lichfield, Staffordshire (SK 11742 09155). The skeletons are considered to be from the twelfth to fourteenth century and are associated with the hospital at St John the Baptist's, which included a chapel and later a grammar school. It was host to the sick, poor and pilgrims on their way to the shrine of St Chad.

The excavation likely uncovered three sides of the cemetery, except on the northern side. All except one burial were of typical Christian tradition, with extended, supine position and south-west north-easterly orientation – aligned towards the chapel of St Chad. One individual was buried in a twisted position with the torso prone and legs flexed but supine. Coffins may have been present, and there is evidence for shroud pins in the form of copper staining on some of the skeletons.

The remains varied greatly in terms of completeness, fragmentation and preservation, but were mostly in moderate to poor condition, which had an impact on the information that could be extracted. In total, the group of articulated skeletons consisted of 46 individuals from distinct burials with a minimum of 38 individuals. The assemblage included seventeen non-adults and 29 adults. In the adult group, there were four males, six probable males, six probable females and three definite females. Ten adults had to remain unsexed due to the poor condition and/or incompleteness of the remains. It was possible to determine that at least four individuals buried at St John's cemetery were of African or mixed ancestry. Stature calculations at St John's showed a range in heights for females and for males. The average stature at St John's was slightly above the late medieval average.

Four males were noted to congenital conditions in the spine where one vertebra takes on characteristics of another vertebra. Several other minor developmental anomalies were noted, as well as a potentially more serious premature suture fusion in the skull of one individual.

Metabolic conditions at St John's included one individual with possible Vitamin D deficiency. The prevalence of orbit lesions indicative of childhood stress was above the late medieval average, but it fitted in well with the prevalence rates recorded for other contemporary hospital sites. Dental enamel hypoplasia, which is indicative of childhood stress, was observed in 36.03% of teeth present for analysis, and half the population, which was higher than the late medieval average. More females were affected than males, which may have been due to a higher survival rate of females when confronted with health stresses, or simply increased stress on females during childhood.

Fractures were recorded for two individuals, including one left shoulder and a muscle injury fracture of a left femur.

Chronic sinusitis affected over half of observable sinuses and adults were generally more commonly affected than non-adults. Females were also more frequently affected than men, which corresponded to the contemporary norm. Two adolescents were noted to have inflammatory rib lesions and a total of fourteen individuals at St John's had signs of well receding inflammatory lesions on their leg long bones. One adolescent had active woven new bone affecting almost the entire elbow, which indicated

inflammation active at the time of death, and two individuals had inflammation on the inner surface of the cranium. It is possible that these may have been secondary reactions to meningioma (Brothwell 1967, 327).

Spinal and extraspinal degenerative joint changes were recorded in at least half of the adults. Degenerative disc disease was most frequently affecting the neck, but it was also present in central and lower spine. Degenerative joint disease was most frequently present in the shoulders, hips and/or knees. More males had signs of the disease. These patterns were expected, although it was noted that the overall prevalence of joint changes was beyond the late medieval average and may have been influenced by the fact that this was a hospital site. Spinal osteoarthritis was present in seven individuals. Extra-spinal osteoarthritis affected the mandible of one individual, and it was found in both knees and the right shoulder of Skeleton 197, an individual who also had Legg-Calve-Perthes disease, a circulatory condition. Five additional adults suffered from arthritis in the knees and/or hip joints. Additionally, nine individuals at St John's had evidence of either cysts or cystic lesions in their skeleton.

Dental plaque concretion prevalence was very high compared with the medieval average and males were generally more frequently affected than females, which was consistent with contemporary populations. In contrast, cavities prevalence at St John's was low, suggesting that individuals buried at St John's had a less cariogenic diet than those at other late medieval sites. Abscesses were rare at St John's, with only four of 13.79% adults affected, which was lower than the British average prevalence at the time. It is likely that this was related to the low prevalence of cavities.

Dental anomalies included a number of impacted milk teeth, which caused part of the permanent dentition to either be moved from their normal position, or to be impacted as well. Enamel defects were recorded in two skeletons and two individuals had crowding in the anterior mandible. Possible nerve damage in one tooth was recorded for one individual and one adolescent had a likely work-related notch on the occlusal surfaces of the right maxillary and mandibular incisors.

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1.0 INTRODUCTION

In January 2016 York Osteoarchaeology Ltd was commissioned by Archaeological Warwickshire to carry out the osteological analysis of 46 skeletons excavated at St. John's Almshouses, Lichfield, Staffordshire (SK 11742 09155) in August 2015.

The skeletons were recovered from the vicinity of the medieval hospital of St John the Baptist and are considered to be part of a larger cemetery dating from the early twelfth century. The hospital was founded in Roger de Clinton's term as bishop (1129-48 AD) and catered not only for the sick, but also a number of almsmen (Greenslade 1970). According to historic accounts, St John's hospital also took in pilgrims travelling on the shrine of St Chad (Tann 2014, 5), which may have been quite frequent considering the popularity of saints' cults during this period (*ibid*). For the first 300 years St John's was home to clerics, including a prior, brethren, sisters and lay brethren. Just before the mid 1500s it was subject to increased secularisation and admitted 'secular clerks' (*ibid*), which may have been the reason for the survival of the later dissolution (*ibid*). The cemetery contained pottery sherds exclusively from the twelfth and thirteenth centuries in the fills of the graves and the ground they were cut into, and although this may not suffice as evidence for dating the burials, it suggests that the graves were dug not much later than this period due to the continuous occupation of the site. The human remains analysed for this report thus likely date to the twelfth to early fourteenth centuries, but may exceed this timespan slightly.

Forty-seven burials were discovered during the archaeological monitoring, but only forty-six were lifted for analysis. The remains of Skeleton 242 were left *in situ* due to their incomplete nature (solely the feet were exposed). During the analysis of the assemblage, only one atlas (uppermost vertebra) was noted as disarticulated bone. It was found with the remains of Skeleton 197. The overall minimum number of individuals of the site indicated the presence of 38 individuals.

Although the excavation photo of Skeleton 176 (adult, unsexed) appears to show one articulated burial, the different sizes of the femora suggest that these are in fact two individuals (Plate 1). Perhaps the burials intercut each other and thus appear articulated (although it does not seem that way from the photograph). It is unlikely that these belong to the same person. Yet, it was clear from size and shape that the right pelvis belonged to the right femur and vice versa on the left side. The same is confirmed for the proximal tibiae, which belong to the respective femur. The more complete side of the skeleton was therefore treated as Skeleton 176, while the slightly less complete side was treated as disarticulated bone.



Plate 1 Skeleton 176 – Size difference of proximal femora, possibly two individuals

Throughout the report, comparisons to mainly two other sites in London were made. These were Spital-Square (Beklavac *et al* 2007) and St Mary Spital, London (Connell *et al* 2012), which were part of the same twelfth century priory and hospital, but were separate cemeteries. Spital-Square was perhaps even more relevant for comparison to St John's, because it does include more of the priory component, meaning that this cemetery contained burials of clerics as well as people who died at the hospital (*ibid*), which is thought to be the case at St John's.

1.1 AIMS AND OBJECTIVES

The aim of the skeletal analysis was to determine the age, sex and stature of the articulated skeletons, and to record any manifestations of disease and trauma. For the disarticulated bone the aim was to provide an inventory of the bone present, determine the age and sex of the individuals represented (where possible), as well as to record and diagnose any skeletal manifestations of disease and trauma.

1.2 METHODOLOGY

The articulated skeletons were analysed in detail, assessing preservation and completeness, and attempting to determine the age, sex and stature of the individuals. All pathological lesions were recorded and described.

The disarticulated bone was recorded following accepted guidelines (McKinley 2004). All bones were identified, and the part of the bone element that was present was recorded. Preservation and completeness, and any information on the age and sex of the individuals were recorded, along with pathological lesions observed.

2.0 OSTEOLOGICAL ANALYSIS

Osteological analysis is concerned with the determination of the identity of a skeleton, by estimating its age, sex and stature. Robusticity and non-metric traits can provide further information on the appearance and familial affinities of the individual studied. This information is essential in order to determine the prevalence of disease types and age-related changes. It is crucial for identifying sex dimorphism in occupation, lifestyle and diet, as well as the role of different age groups in society. A summary of the osteological and palaeopathological data for the articulated skeletons is given in Table 1, with a detailed catalogue of skeletons provided in Appendix A.

Table 1 Summary of osteological and palaeopathological data

Sk No	C (%)	SP	F	Age	Age Group	Sex	Stature (cm)	Dental Pathology	Pathology
104	65	4	Moderate	46+	MA	M?	-	AMTL, calculus, caries	Lytic lesion on right ilium; two depressions on endocranial surface of parietals; bilateral spondylolysis of L5; OA in cervical and thoracic spine and S1; Schmorl's nodes
107	15	4	Severe	7-8	OJ	-	-	Calculus, deciduous teeth with caries, DEH	None seen
110	70	3	Moderate	26-35	YMA	M?	166.4 (possible African ancestry)	AMTL, caries, DEH, PD	Slight DJC in spine; lumbarisation of T12; lamellar bone on right femur, tibiae; mandibular second premolars not present (AMTL?)
113	85	3	Moderate	26-35	YMA	M?	171.4 (possible African ancestry)	AMTL, calculus, caries, PD	Small lytic lesion on L5; OD in right distal femur including fragment; Lamellar bone on femora, tibiae; Schmorl's nodes in thoracic spine; S1 bifid; <i>cribra orbitalia</i> ; sinusitis
116	60	4	Severe	36-45	OMA	F?	150.9	AMTL, caries	OA in upper thoracic spine, slight DJC; Coxa vara; small lytic lesion in right acetabulum; lytic lesion in proximal radial articular surface; sinusitis; S1 bifid
119	<5	3	Moderate	18+	Adult	U	-	No dentition	None seen
122	75	4	Moderate	26-35	YMA	M	167.8	Calculus, caries, two teeth not present; crowding; PD	Hypervascularity on orbital rims and glabella; DJC in lower thoracic spine, acetabuli; Schmorl's nodes in thoracic and lumbar spine; small lytic lesion on of L5; DJC on right inferior facet of L5 and S1; S1 bifid; cortical defects in glenoids; lamellar bone on femora and left tibia; <i>cribra</i>

									<i>orbitalia</i> , sinusitis
125	65	4	Severe	12-15	AO	U	-	Calculus, DEH, RM ² larger than LM ²	Arachnoid granulations; abnormal maxillozygomatic joint at right orbit; OD in in distal right tibia (unfused); woven bone on femora
128	70	4	Moderate	26-35	YMA	M?	176.1	Calculus, caries, enamel defects	Slight DJC; small lytic impression on inferior left facet of T10; hypervascularity on supraorbital ridge; <i>cribra orbitalia</i> ; sinusitis
131	10	2	Moderate	4-6	YJ	U	-	Calculus, DEH	Sinusitis
134	<10	3	Moderate	18+	Adult	F?	-	AMTL	OA in cervical spine; arachnoid granulations on endocranial surface; three small, smooth depressions on endocranial surface of frontal bone of uncertain cause, <i>cribra orbitalia</i>
137	<10	4	Heavy	9-10	OJ	U	-	DEH	Sinusitis; <i>cribra orbitalia</i>
140	<10	2	Moderate	5-6	YJ	U	-	Caries, DEH	<i>Cribr</i> a orbitalia; sinusitis
143	10	2	Moderate	11-12	OJ	U	-	Calculus, DEH	Suture mendosa in occipital retained bilaterally
146	5	4	Moderate	18+	Adult	U	-	No pathology	<i>Cribr</i> a orbitalia, sinusitis
149	5	3	Moderate	18+	Adult	U	-	AMTL, DEH	Several endocranial, foci, possibly a meningioma; woven bone on ectocranial surface – possible ossified haematoma
152	40	4	Moderate	18+	Adult	F?	150.1 (possible African ancestry)	AMTL, calculus, DEH, three teeth not present, abscesses, PD	None seen
155	50	3	Moderate	14-15	AO	U	-	DEH, caries	Slight lamellar bone on left and right ribs; porotic woven bone on iliae
158	25	2	Slight	18-25	YA	U	-	DEH, calculus, three teeth not present; PD	Sinusitis; <i>cribra orbitalia</i>
161	60	4	Slight	15-16	AO	U	-	Calculus; possible damage to nerve of first mandibular premolar – root has turns black	Left mid shaft rib fragment with woven bone on visceral surface; S1 bifid; <i>cribra orbitalia</i>
164	55	2	Moderate	18-25	YA	M	175.2	AMTL, Calculus, DEH, two teeth not present; PD	Schmorl's nodes in most of thoracic and lumbar spine; cranial shift of thoracic-lumbar border; lytic lesion on right glenoid; small, healed cystic lesion in right

									mandibular condyle
167	30	2	Slight	8.5-9.5	OJ	U	-	No dentition	None seen
170	20	3	Moderate	14-16	AO	U	-	No dentition	Lamellar bone on left tibia
173	10	3	Moderate	18-25	YA	U	-	No dentition	Lamellar bone on femora
176	10	3	Moderate	18+	Adult	U	-	No dentition	Relative size of femora suggests two individuals, though photo suggests otherwise; lamellar bone on left proximal femur
179	20	3	Moderate	13-18	AO	U	161.3	No dentition	Arachnoid granulations; sinusitis
182	85	2	Moderate	45+	MA	F?	161.7 (possible African ancestry)	AMTL, Calculus, caries, DEH, three teeth not present	Enlarged incisive foramen; possible healed fracture of lateral right clavicle; OA in the upper thoracic, lower thoracic and lumbar spine; Schmorl's nodes in lower thoracic and lumbar spine; smooth porous bone along superior lateral margins of sphenoid and occipital bodies; HFI; arachnoid granulations
185	85	3	Moderate	15-16	AO	U	-	Calculus, RC ¹ impacted; caries, DEH	Woven bone on left proximal ulna; left radial notch possibly fused to left radial head; arachnoid granulations; possible lytic lesion on the endocranial surface of frontal; circular lytic lesion in floor of right nasal concha; hypervascularity on distal femora and prox tibiae – possibly growth related; sinusitis; <i>cribra orbitalia</i>
188	60	3	Moderate	46+	MA	U	-	No dentition	Small lytic lesion on superior aspect of acetabulum; lamellar bone femora and left tibia; conflicting sexually dimorphic traits
191	85	3	Slight	18-25	YA	F	169.1	Calculus, dental crowding	Lamellar bone on femora and right tibia; <i>cribra orbitalia</i>
194	90	3	Moderate	36-45	OMA	M	172	Calculus, DEH, LC ₁ impacted and root of deciduous Lc ₁ is still present	Hypervascularity on orbital rims; lytic lesions on anterior margin of inferior facets of C1; cranial shift of thoracic-lumbar border; non-fusion rift of posterior spine of

									sacrum; lytic lesion in left manubrium; bilateral OD in distal femora; lamellar bone on right tibia; <i>cribra orbitalia</i>
197	90	3	Moderate	36-45	OMA	M	177.6	Calculus, caries, DEH, abscesses	Avulsion fracture of left lesser trochanter; Legg-Calve-Perthes disease in left prox femur / acetabulum; more robust left posterior sides of neural arches in L1-L5 – related to avulsion and/or Legg-Calve-Perthes; Schmorl's nodes in mid-lower thoracic spine; <i>cribra orbitalia</i> ; OA in right prox humerus and distal femora
200	60	2	Heavy	18+	Adult	F?	155.4	Calculus, caries, AMTL	Torsion in left femur; <i>cribra orbitalia</i>
203	10	3	Heavy	18+	Adult	U	-	No dentition	Lamellar bone on right tibia
206	<5	4	Moderate	2.5-7.5	YJ	U	-	No dentition	None seen
209	15	2	Slight	18+	Adult	U	-	No dentition	Lamellar bone on left tibia
212	40	3	Moderate	36-45	OMA	F?	-	Calculus, caries	OA in proximal right femur
215	40	4	Heavy	15-16	AO	U	-	Calculus, DEH, maxillary left canine is impacted; notch on occlusal surface of right maxillary / mandibular first incisors – occupation-related?	Sinusitis
218	5	4	Severe	3-4	YJ	U	-	Calculus	Lamellar bone on right tibia; woven bone on right femur
221	50	3	Heavy	16-17	AO	U	-	Calculus, DEH	Sagittal suture obliterated; sinusitis; <i>cribra orbitalia</i>
224	80	2	Moderate	46+	MA	M?	169.9	AMTL, calculus, caries, two teeth not present	Large cystic lesion on right anterior inferior iliac spine; cranial shift of thoracic-lumbar border; L5 bifid; Schmorl's nodes in lower thoracic and upper lumbar spine; sinusitis; <i>cribra orbitalia</i>
227	60	3	Heavy	18+	Adult	F?	-	DEH	Arachnoid granulations; small area of irregular bone nodules on left distal femur

230	85	2	Moderate	36-45	OMA	M	180.6	No dentition	Arachnoid granulations; slight OA in T8; Schmorl's nodes in mid-thoracic and upper lumbar spine
233	80	3	Moderate	18+	Adult	F	164.7	AMTL, calculus, caries, DEH, one tooth not present; PD	Possible OD on talus; lumbarisation of S1; Schmorl's node on inferior body of T5; slight OA in distal right femur
236	5	4	Severe	7-8	OJ	U	-	DEH	None seen
239	70	3	Moderate	15.5-17.5	AO	U	-	Calculus, caries	Lamellar bone in left tibia; individual is likely female, but age demands caution

Key:

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

Non-adult age categories: f (foetus, <38weeks *in utero*), p (perinate, c. birth), n (neonate, 0-1m), i (infant, 1-12m), yj (young juvenile, 1-5 years), oj (older juvenile, 6-11 years), j (juvenile, 1-11y), ad (adolescent 12-17y)

Adult age categories: ya (young adult, 18-25y), yma (young middle adult, 26-35y), oma (old middle adult, 36-45y), ma (mature adult, 46+y), a (adult, 18+y)

Dental pathology: AMTL – ante-mortem tooth loss; DEH – dental enamel hypoplasia; PD – periodontal disease

Pathology: C- cervical; T – thoracic; L – lumbar; S – sacral; OA – osteoarthritis; DJC – degenerative joint changes; OD – osteochondritis dissecans

Osteological analysis of disarticulated bone is concerned with cataloguing the bones present, determining the minimum number of individuals represented, and estimating the age and sex of the individuals represented where possible. A detailed catalogue of the disarticulated bone is provided in Appendices B and C. Each bone was given a unique identification number in the table which has been used to refer to specific bones throughout the report.

2.1 PRESERVATION

Skeletal preservation depends upon a number of factors, including the age and sex of the individual as well as the size, shape and robusticity of the bone. Burial environment, post-depositional disturbance and treatment following excavation can also have a considerable impact on bone condition (Henderson 1987, Garland and Janaway 1989, Janaway 1996, Spriggs 1989). Preservation of human skeletal remains is assessed subjectively, depending upon the severity of bone surface erosion and post-mortem breaks, but disregarding completeness. Preservation is important, as it can have a large impact on the quantity and quality of information that it is possible to obtain from the skeletal remains.

Surface preservation, concerning the condition of the bone cortex, was assessed using the seven-category grading system defined by McKinley (2004), ranging from 0 (excellent) to 5+ (extremely poor). Excellent preservation implied no bone surface erosion and a clear surface morphology, whereas extremely poor preservation indicated heavy and penetrating erosion of the bone surface resulting in complete loss of surface morphology and modification of the bone profile. Surface preservation could be variable throughout an individual skeleton, so the condition of the majority of bones in the skeleton was taken as the preservation grade for the whole skeleton.

Completeness of the skeletons varied significantly recorded using categories ranging from 'minimal' (little or no fragmentation of bones) to 'extreme' (extensive fragmentation with bones in multiple small

fragments). The completeness of the skeletons was assessed and expressed as a percentage: the higher the percentage, the more complete the skeleton (Table 2). Nine of the 46 skeletons (19.6%) were almost complete, ranging from 76-100%. A slightly larger number of skeletons (n=12, 26.1%) was fairly complete with 51-75% of the remains present, and six skeletons (13%) were only 26-50% complete. The largest number of individuals was incomplete, with less than 25% of remains present (Figure 1). This had an impact on the amount of information that could be extracted for this analysis.

Table 2 Completeness of skeletal remains

Completeness	n	%
0-25%	19	41.3
26-50%	6	13.0
51-75%	12	26.1
76-100%	9	19.6
Total	46	

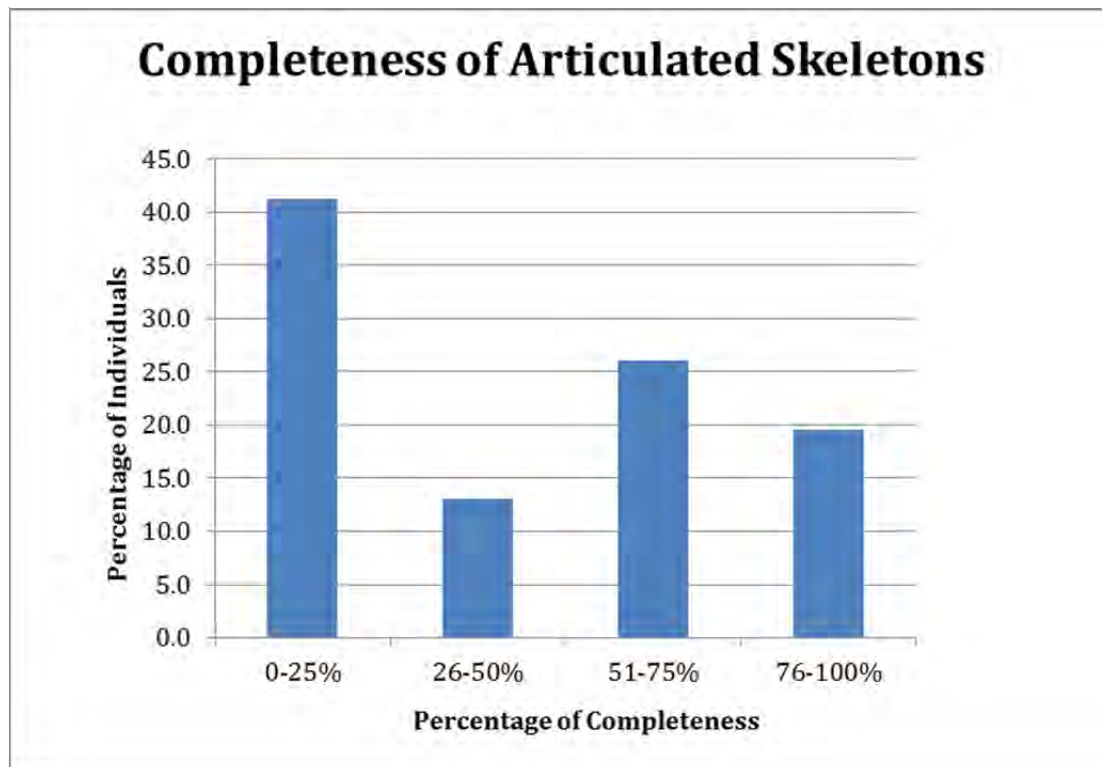


Figure 1 Chart illustrating the completeness of the skeletal remains

The general surface preservation of the skeletal remains was poor (Figure 2). There were few skeletons with preservation that could be classed as good and most of the remains were found to be Grade 3 (n= 21, 45.7%). Ten skeletons were better preserved (Grade 2; 21.7%). By far the most severe erosion was present in fifteen skeletons who made up 32.6% of the overall remains. It should be noted here that in a single skeleton preservation could vary greatly. The data for this analysis is summarised in Table 3 below.

Table 3 Preservation of the skeletal remains

Preservation	n	%
0	0	0
1	0	0
2	10	21.7
3	21	45.7
4	15	32.6
5	0	0.0
5+	0	0
Total	46	

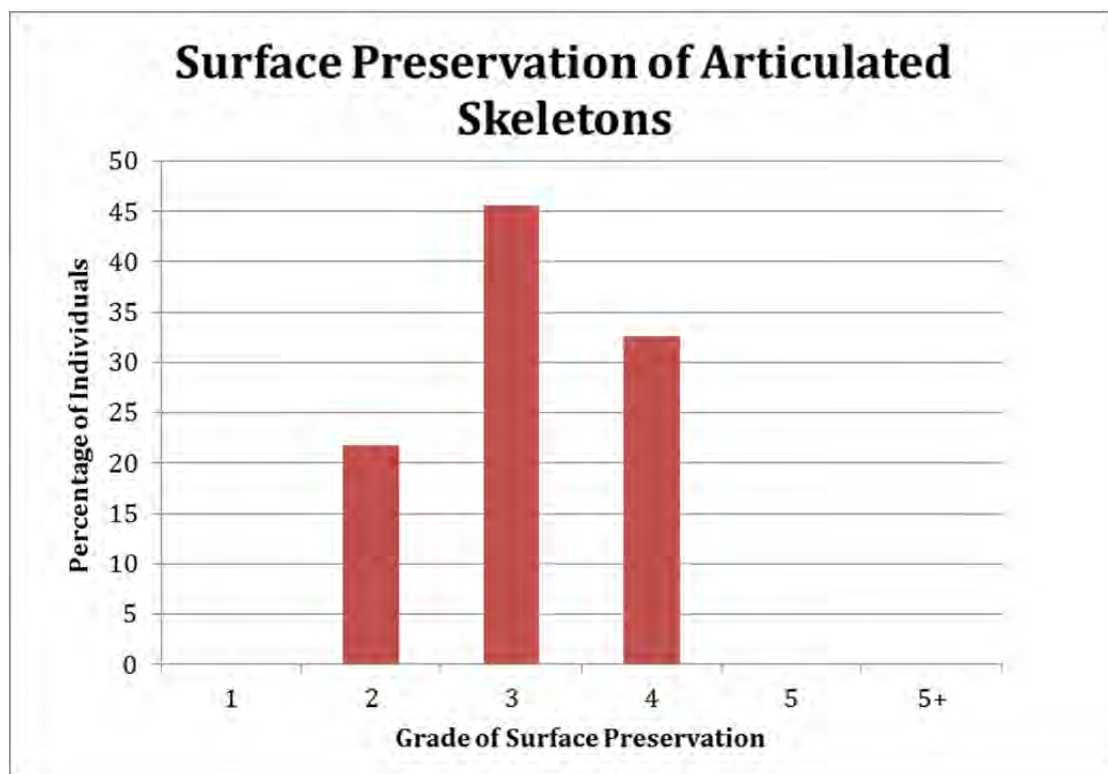


Figure 2 Chart illustrating the surface preservation of the skeletal remains

The majority of skeletons was moderately fragmented, with 30 skeletons (65.2%) falling into this category. As Table 4 below highlights, there were five skeletons each who suffered slight or severe fragmentation. Both of these groups made up 10.9% of the overall number of skeletons. Six skeletons (13%) were affected by heavy fragmentation. Overall it can be stated that fragmentation was moderate for St John's almshouses, with most skeletons present in slight to moderate categories (Figure 3).

Table 4 Fragmentation of skeletal remains

Fragmentation	n	%
Minimal	0	0
Slight	5	10.9
Moderate	30	65.2
Heavy	6	13.0
Severe	5	10.9

Extreme	0	0.0
Total	46	

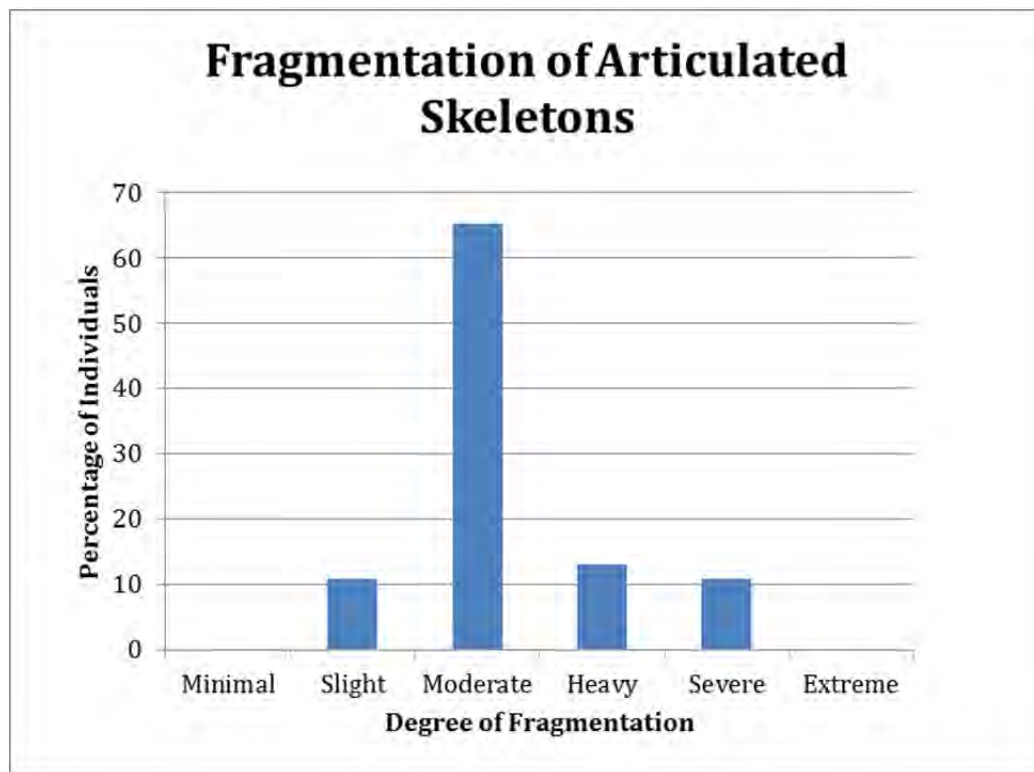


Figure 3 Chart illustrating the fragmentation of the skeletal remains

2.2 MINIMUM NUMBER OF INDIVIDUALS

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

The MNI for the site of St John's hospital was calculated considering the presence of fourteen non-adult right and left temporal bones. These included three young juveniles, four older juveniles and seven adolescents. 24 adult occipital bones demonstrated that 24 adults were present. This added up to a total of at least 38 individuals.

2.3 ASSESSMENT OF AGE

Age was determined using standard ageing techniques, as specified in Scheuer and Black (2000a; 2000b) and Cox (2000). For non-adults age was estimated using the stage of dental development (Moorrees *et al.* 1963a; 1963b), dental eruption (Ubelaker 1989), measurements of long bones and other appropriate

elements, and the development and fusion of bones (Scheuer and Black 2000b). In adults, age was estimated from stages of bone development and degeneration in the pelvis (Brooks and Suchey 1990, Lovejoy *et al.* 1985) and ribs (modified version of methods developed by İşcan *et al.* 1984; 1985 and İşcan and Loth 1986 provided in Ubelaker 1989), supplemented through examination of patterns of dental wear (Brothwell 1981, Miles 1962).

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

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

Seventeen (37%) of the individuals buried in St John the Baptist's cemetery were non-adults, 29 (63%) were adults (Table 5, Figure 4). The non-adult group was represented by four young juveniles (8.7%), five older juveniles (10.9%) and a total of eight adolescents (17.4%). The adult group included five young adults (10.9%), four young middle adults aged 26-35 (8.7%), and five old middle adults who make up 10.9% of the overall population. Mature adults are represented by four individuals (8.7%) and eleven skeletons could only be aged as eighteen years old or older (23.9%). The largest group by far were the unaged adults, most of whom were less than 40% complete. No perinates or infants were present amongst the excavated individuals.

Table 5 Age ranges of the skeletons

Age Range	n	%
Perinatal	0	0
1-6 months	0	0
7-11 months	0	0
1-6	4	8.7
7-12	5	10.9
13-17	8	17.4
18-25	5	10.9
26-35	4	8.7
36-45	5	10.9
46+	4	8.7
18+	11	23.9
Total	46	

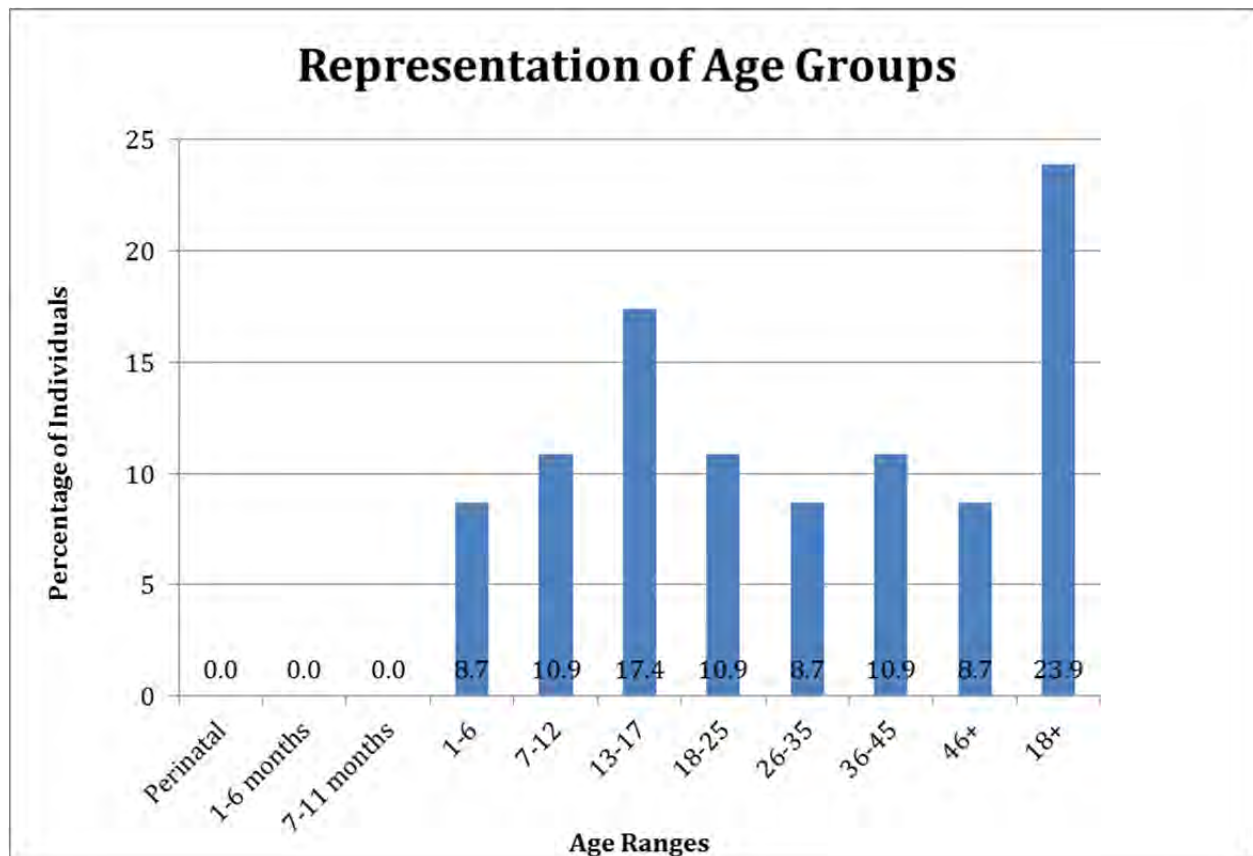


Figure 4 Chart illustrating the age distribution in St John's hospital cemetery

The ages of three younger juveniles (1-6 years) (Skeleton 131, 140 and 218) were based on the stages of development of the dentition, as there was no possibility to measure long bone lengths due to fragmentation and incompleteness. The other younger juvenile (Skeleton 206) had to be placed into a broad age category (2.5-7.5 years) due to the fact that the only fragments present were incomplete cortical bone fragments of tibiae and femora. Overall, Skeleton 218 was the youngest individual excavated from the site with approximately three to four years of age.

The older juveniles (7-12 years) were aged using dentition, skeletal fusion stages and where possible long bone measurements. Two of the skeletons in this group (Skeletons 107 and 236) were around seven and a half years old. Care must be taken when considering the age of Skeleton 236, because only fragmentary dentition was present and not much else to support this assessment. The age estimation for Skeleton 167 is also tentative (8.5-9.5 years) because this is only based on a femoral measurement – no dentition was available for this individual. Catch-up growth or environmental factors may have influenced the rate of growth and the individual may be older than the long bones suggest (Lewis 2007, 38). Skeleton 137 was around nine to ten years old, based on dentition and skeletal fusion, and Skeleton 143 was between eleven to twelve years old.

In the adolescent (13-17 years) group, there were six individuals (Skeletons 161, 170, 185, 215, 221 and 239) who fell into the upper half of their age category. The other two individuals (Skeletons 125 and 155) were marginally younger, with Skeleton 125 possibly straddling the upper older juvenile range and thus representing the youngest adolescent. While most of the age ranges were calculated under consideration of skeletal fusion and dental development, long bone measurements could only be taken in the case of

Skeleton 125. The length of the right tibia suggested an age of eleven and a half to twelve and a half, while the dental age was closer to fifteen years. This may have to do with environmental factors can influence growth, but, as mentioned above, are much less likely to affect dentition. With Skeleton 239 it was not possible to consider dentition, so the age estimation is largely based on the measurement of the left femur, which may of course also be affected by environmental factors. It is important to point out, however, that the spike in adolescents present in the cemetery is unusual compared to other medieval cemetery sites (with the exception of some hospital sites such as St Mary Spital, or 'Spital Square', in north-east London; discussed below) (Connell 2012; Bekvalac et al 2007).

As can be seen in Table 5 above, many of the adults (eleven skeletons, 37.9% of adults) had to be placed into a general adult (18+) age category. This was unfortunate but it was mostly due to relevant parts missing from the skeletal remains and/or advanced erosion. Ageing was difficult on occasion, as the ages suggested by different methods often yielded contradicting results. For example in Skeleton 194, an older middle adult, the auricular surface highlighted an age of 35-39, while dental attrition was more like that of a young adult. This may be due to the consumption of soft or non-grainy foods.

Young adults (YA) were represented in the adult group in equal measure as old middle adults (OMA; 17.2% of adults), with five individuals respectively. Both the young middle adults (YMA) and mature adults (MA) were represented by four individuals (14.7% of adults).

2.4 SEX DETERMINATION

Sex determination was carried out using standard osteological techniques, such as those described by Mays and Cox (2000). Assessment of sex involves examination of the shape of the skull and the pelvis and can only be carried out once sexual characteristics have developed, during late puberty and early adulthood. Evidence from the pelvis was favoured as its shape is directly linked to biological sex (the requirements of childbirth in females) whereas the shape of the skull can be influenced by factors such as age (Walker 1995). Measurements of certain bones were used to supplement the morphological assessment (Bass 1987). As with estimation of age, sex estimation in disarticulated remains could only be carried out where appropriate bones were preserved (i.e. pelvis and skull). Metrics alone are an unreliable method for estimating age.

Ten of all adults present were males or possible males, and nine were females or possible females (Figure 5). Ten of the adults had to remain unsexed. One of the adolescents, Skeleton 239, had strong female traits in cranium and pelvis, and was likely to be female. This assessment is based on premature dimorphic traits, however, and is thus not completely reliable. Table 6 summarises the distribution of sex at St John's.

Table 6 Sex distribution

Sex	n	%
M	4	10.3
M?	6	20.7
U	10	34.5
F?	6	20.7

F	3	13.8
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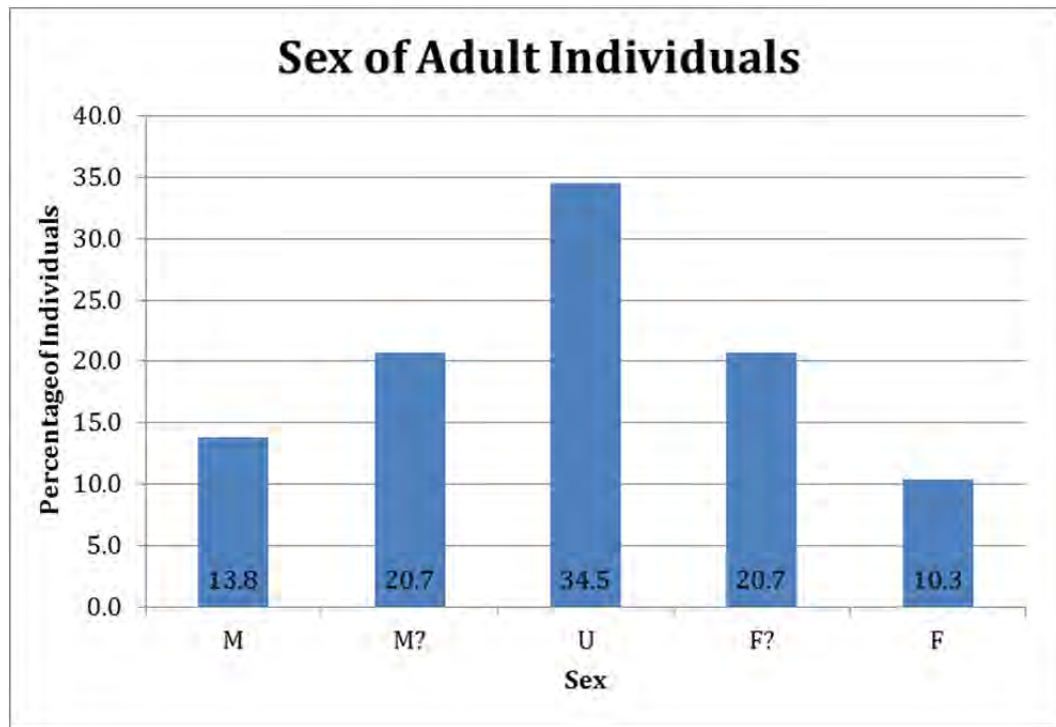


Figure 5 Chart illustrating sex distribution at St John's

In terms of age considered in the context of sex, it was noted that in the young adult group, a higher proportion of females (6.9%) was represented in the burial population (Table 7). This indicated that more women than men died at this age, although it has to be considered that a true prevalence is not possible due to the incomplete excavation of the cemetery. This higher number may be explained when the dangers of childbirth are considered, or perhaps these were sisters who had joined St John and died young. While the percentage of men in the young adult age group is relatively low (3.4%), it was much higher in the young middle adult age group (13.8). This was especially notable because no women were present between the ages of 26 and 35.

Table 7 Sex and age distribution (%)

Age Range	M	M?	U	F?	F	Total
18-25	3.4	0.0	6.9	0.0	6.9	17.2
26-35	0.0	13.8	0.0	0.0	0.0	13.8
36-45	10.3	0.0	0.0	6.9	0.0	17.2
46+	0.0	6.9	3.4	3.4	0.0	13.8
18+	0.0	0.0	24.1	10.3	3.4	37.9
Total	13.8	20.7	34.5	20.7	10.3	100.0

The same pattern emerged in the old middle adult age group, where more men were represented (10.3%) once again and only 6.9% were women (Figure 6). This high presence of men could mean several things. One function of the hospital was to take in pilgrims waiting to enter Lichfield. Perhaps men were more likely to go on pilgrimage, as the dangers of travelling in the medieval period likely discouraged women from making the journey. On the other hand St John's was home to a host of brethren and almsmen. Many

of these individuals may have not survived into mature adulthood because of stresses on health in early life, and even at the hospital subsistence seems to have been scarce on occasion. It was mentioned in the historic records that in the seventeenth century, one individual 'had recently died "*in want of necessaries for his body and . . . spiritual advice and assistance in the tune of his sickness*"' (in Greenslade 1970). Although this had happened several centuries after the period in question, it is possible that mismanagement and poverty were present even earlier at St John's. At Spital-Square, an Augustinian priory and hospital, the cemetery population had double as many men present as women, which was likely due to the nature of the site (Bekvalac et al 2007). Even though the numbers of males and females were almost equal at St John's, it should be considered that there were a high number of unsexed individuals present without whom definite statements are difficult to make.

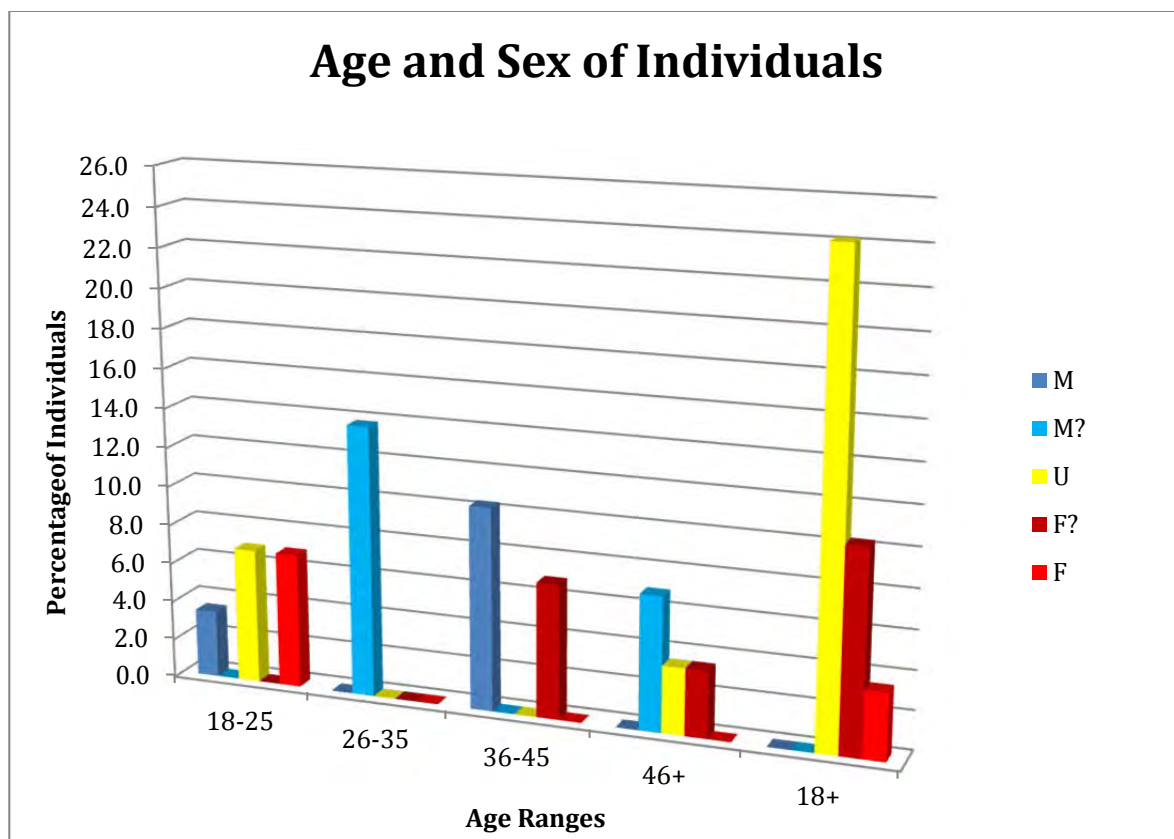


Figure 6 Chart illustrating age and sex distribution

It should be considered that perhaps more men were admitted to St John's as brethren and in clerical functions than women. There are also more men in the mature age category, which would support this argument. Unfortunately, a high number of adults (34.1%) could not be sexed due to the incompleteness and/or condition of the remains and most of these could not be aged more precisely than 18+ either (24.1%), likely for the same reasons. More women (13.7%) could not be aged than men.

2.5 ANCESTRY

It was possible to determine that at least four individuals buried at St John's cemetery were of African or mixed ancestry. This was based on cranial traits, which included most noticeably guttering of the nasal anterior border (Plate 2), which is sharp and more defined in Caucasians. Additionally, a broad, squarish

palate (roof of mouth) as opposed to a more anteriorly pointed one, a broad nasal bridge, are indicators for African ancestry (Byers 2011) and were noted in these individuals. At least some of these traits were found in Skeletons 110 and Skeleton 113, both young middle adult probable males, in Skeleton 152 (adult probable female), and in Skeleton 182 (mature adult probable female). It is possible that more individuals of African or mixed ancestry were present in the cemetery, but that these were not detected due to the poor condition or lack of skulls.

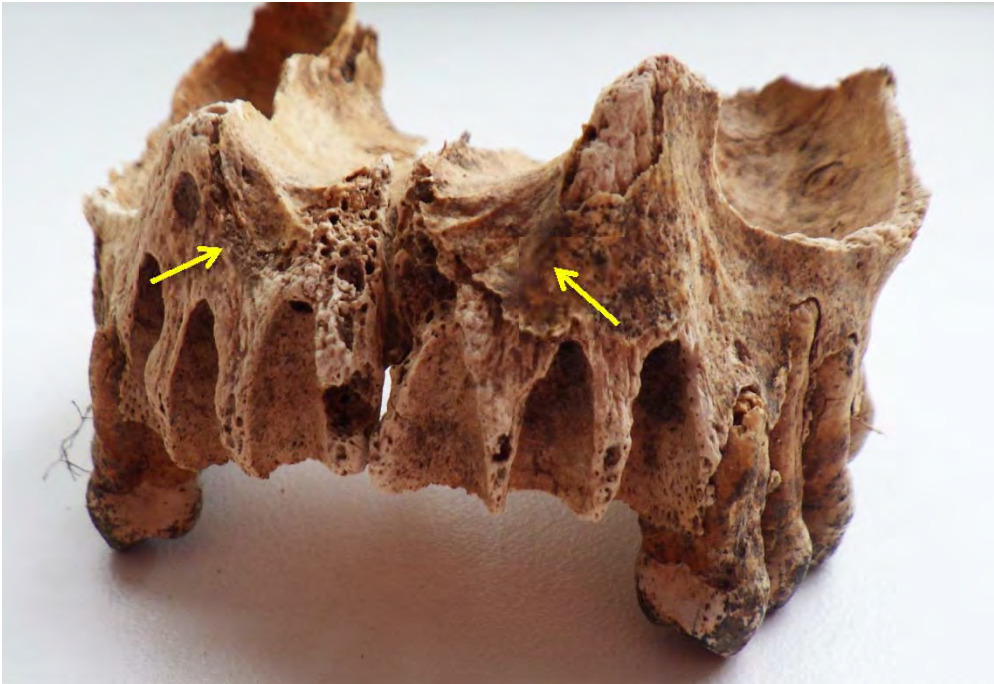


Plate 2 Skeleton 110 – Nasal guttering

2.6 METRIC ANALYSIS

2.6.1 Stature

Stature depends on two main factors, heredity and environment; it can also fluctuate between chronological periods. Stature can only be established in skeletons if at least one complete and fully fused long bone is present, but preferably using the combined femur and tibia. Knowing the sex of the individual is also necessary, which is an issue with disarticulated long bones where sex cannot be determined. The bone is measured on an osteometric board, and stature is then calculated using a regression formula developed upon individuals of known stature (Trotter 1970). Where possible, bones from the legs were used in preference to those of the upper limb as these carry the lowest error margin (*ibid*).

Stature was calculated for nine males, and six females, including four individuals of African ancestry (Table 8). Male statures ranged from 166.4 cm to 180.6 cm. The mean for this range was 173.0 cm, which is slightly taller than the male average mean of 171 cm calculated for the late medieval period by Roberts and Cox (2003, 248). It should be considered that at least four individuals (Skeletons 110, 113, 152 and 182) from this cemetery were identified to be of African or mixed ancestry, which has an effect on the

calculations. If these individuals are removed from the overall sample, however, the average stature for males at St John's hospital is still 3 cm above the late medieval mean, and Skeleton 230 is c 9cm taller than this (Table 9).

Table 8 Male statures

Skeleton	Sex	Stature (cm)
110	M?	166.4 possible African
122	M?	167.8
224	M?	169.9
113	M?	171.4 possible African
194	M	172
164	M	175.2
128	M?	176.1
197	M	177.6
230	M	180.6

Table 9 Female statures

Skeleton	Sex	Stature (cm)
152	F?	150.1 possible African
116	F?	150.9
200	F?	155.4
182	F?	161.7 possible African
233	F	164.7
191	F	169.1

For the females, the calculations have similar results. The average stature for this period is 159 cm (Roberts and Cox 2003, 248). At Lichfield, the overall average stature for females is 158.7 cm (160.3 cm, excluding two African individuals) and the range is 150.1 – 169.1 cm (150.9 – 169.1 cm, excluding African individuals) (Tables 10 and 11). The overall average calculated by Roberts and Cox (*ibid*) is thus slightly shorter than the mean from St John's cemetery and the range is much narrower compared to the wide variation noticeable in Lichfield.

Skeleton 116 (old middle adult female) is remarkably similar in size to Skeleton 152 (Adult female of African ancestry) and buried in between her and Skeleton 113 (young middle adult male of African ancestry). It should be considered that this individual may also be of African origin (although residual rickets or osteomalacia appears to be present which could have affected stature).

Table 10 Stature

Sex	M/M?	F/F?
Min	166.4	150.1
Max	180.6	169.1
Average	173.0	158.7
Median	172	158.6
SD	4.7	7.7
N	9	6

Table 11 Stature (excluding Individuals of African ancestry)

Sex	M/M?	F/F?
Min	167.8	150.9

Max	180.6	169.1
Average	174.2	160.3
Median	175.2	161.3
SD	4.5	7.2
N	9	6

2.6.2 Platymeric and Platycnemic Indices

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

A total of eleven right and ten left femora were available for analysis (Table 12). The *meric* index showed that more than half the femora fell into the *platymeric range* (broad and flat), with the majority of the remainder being *eurymeric* (rounded). This was consistently the case for females and males alike, except in the right male femora, where half the femora were *platymeric*, and half were *eurymeric*.

Table 12 *Platymeric and platycnemic indices*

	Male		Female		Unsexed		Total									
	Right	Left	Right	Left	Right	Left	Right	Left								
<i>Platymeric</i>	3	50.00%	3	60.00%	2	66.67%	3	100.00%	2	100.00%	2	66.67%	7	63.64%	8	80.00%
<i>Eurymeric</i>	3	50.00%	2	40.00%	1	33.33%	0	0%	0	0%	1	33.33%	4	36.36%	2	20.00%
<i>Stenomic</i>	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
	6		5		3		3		2		3		11		10	

For the calculation of the *cnemic* index, only six tibiae were in good enough shape to be measured. This revealed that two right male tibiae were *eurycnemic* (broad), while one female tibia fell into the *platycnemic* range (flattened). Two left male tibiae were *eurycnemic* (broad) and one left tibia belonging to an adult of undetermined sex also fell into this range.

2.6.3 Cranial Indices

The cranial index describes the shape of the cranium. It was possible to calculate this for five adult crania (17.24%) (5/29), of which three were sexed as female and two male. All individuals had skulls that were *dolichocranic* (long headed).

The cranial breadth-height index expresses the relationship between the breadth and height of a skull as a percentage. It was possible to calculate the index for nine individuals (31.03% of adults) of which three were female, five were male, and one belonged to an unsexed individual. The index revealed that five individuals fell into the *metriocranic* range (average or medium skulls), three of these were male, one was female and one was the unsexed adult. Three individuals had low skulls (*tapeinocranic*). This included one male and two females. Finally, one female skull had a high skull (*acrocranic*).

The fronto-parietal index expresses the relationship between the minimum breadth of the frontal bone and the maximum cranial breadth and this could be calculated for a total of six individuals (20.68%). It

revealed that three individuals were *metriometopic* (of average shape), and three were *eurymetopic* (broad). The *metriometopic* group consisted of two males and one female, which was repeated in the *eurymetopic* group. It should be noted here, that all individuals falling into the *metriometopic* range were determined to be of African ancestry (Skeletons 110, 113 and 152).

The nasal index which describes the shape of the nasal aperture indicated that two males had *mesorrhinic* (average) noses. Another two individuals, a female and a male, had noses which fell into the *leptorrhinic* (narrow) range, and one other female, Skeleton 152, who was of African or mixed ancestry, had a *platyrrhine* (broad or wide) nasal aperture.

The orbital index was calculated for six individuals. Four of these fell into the *hypsicnchic* (narrow) range; two of these individuals were females and two were males. Two other males had orbits which were wide (*chamaeoconchic*). Five individuals could be measured for the maxilloalveolar index, which pertains to the shape of the maxilla. This included three males, two females and one unsexed adult. All five of these had fairly broad palates (*brachystaphyline*).

2.7 NON-METRIC TRAITS

Non-metric traits are additional sutures, facets, bony processes, canals and foramina, which occur in a minority of skeletons and are believed to suggest hereditary affiliation between skeletons (Saunders 1989). The origins of non-metric traits have been extensively discussed in the osteological literature and it is now thought that while most non-metric traits have genetic origins, some can be produced by factors such as mechanical stress (Kennedy 1989) or environment (Trinkhaus 1978). A total of thirty cranial (skull) and thirty post-cranial (bones of the body and limbs) non-metric traits were selected from the osteological literature (Buikstra and Ubelaker 1994; Finnegan 1978; Berry and Berry 1967) and recorded.

2.7.1 Cranial Non-Metric Traits

Most notable at St John's cemetery was the occurrence of the accessory lesser palatine foramen. This trait is present in six of seven (right, 85.7%) and six of eight (left, 75%) individuals with observable palates (Table 13). Also common were *extrasutural mastoid foramen* (variation in the position of a small hole behind the ear), which were present in thirteen of eighteen individuals on the right side (72.2%), and in eight of seventeen in the left (47.1%) (Table 14). *Parietal foramen* (small holes near the back of the head) occurred often, especially in the right side, where sixteen of 24 individuals with observable parietal bones had the trait (66.7%). Only thirteen of 24 individuals had this trait present in the left side (54.2%).

Table 13 Cranial non-metric midline traits

Midline Traits	Trait Present	Bone Present	%
Ossicle at Lambda	3	23	13.04%
Ossicle at Bregma	1	19	5.26%
Metopic Suture	3	19	15.79%

Precondylar Tubercle	1	19	5.26%
Palatine Torus	0	13	0.00%

Table 14 Cranial non-metric traits

Paired Traits	Right			Left		
	Trait Present	Bone Present	%	Trait Present	Bone Present	%
Highest Nuchal Line	0	23	0.00%	0	23	0.00%
Ossicle in Lambdoid	10	23	43.48%	6	22	27.27%
Parietal Foramen	16	24	66.67%	13	24	54.17%
Ossicle in Coronal	1	19	5.26%	0	17	0.00%
Ossicle at Pterion	3	11	27.27%	5	13	38.46%
Ossicle at Parietal Notch	3	16	18.75%	1	18	5.56%
Ossicle at Asterion	0	16	0.00%	0	19	0.00%
Auditory Torus	0	21	0.00%	0	20	0.00%
Foramen of Huschke	1	20	5.00%	2	20	10.00%
Mastoid Foramen Extrasutural	13	18	72.22%	8	17	47.06%
Sutural Mastoid Foramen	0	12	0.00%	2	16	12.50%
Posterior Condylar Canal Open	6	18	33.33%	4	17	23.53%
Double Condylar Facet	0	16	0.00%	0	16	0.00%
Double Anterior Condylar Canal	4	18	22.22%	3	17	17.65%
Incomplete Foramen Ovale	1	15	6.67%	1	14	7.14%
Open Foramen Spinosum	3	11	27.27%	2	12	16.67%
Accessory Lesser Palatine Foramen	6	7	85.71%	6	8	75.00%
Maxillary Torus	2	14	14.29%	1	13	7.69%
Mandibular Torus	1	20	5.00%	1	21	4.76%
Absent Zygomaticofacial Foramen	2	6	33.33%	0	12	0.00%
Bridging of Supraorbital Notch	1	6	16.67%	0	8	0.00%
Accessory Infraorbital Foramen	1	6	16.67%	2	6	33.33%
Accessory Supraorbital Foramen	4	7	57.14%	1	8	12.50%
Anterior Ethmoid Foramen Extrasutural	2	4	50.00%	3	4	75.00%
Posterior Ethmoid Foramen Extrasutural	2	4	50.00%	2	4	50.00%
Stafne's Defect	0	0	0.00%	0	0	0.00%

In the non-adult group, eight of ten individuals had *parietal foramen* in the right (44.4%) and four of nine (12.5%) in the left side of the cranium. A larger number of individuals had *ossicles* (7/10 right, 8/10 left) present in the *lambdoid suture* (additional small bones in the sutures of the cranium). The third most common trait was *the accessory lesser palatine foramen*, which was also common in the adults.

It is notable that Skeleton 116 (mature old middle adult female) is remarkably similar to Skeleton 110 (young middle adult male of African origin) in terms of her non-metric traits and the skeletons were interred beside one another. Both individuals have bilateral *ossicles in the lambdoid*, bilateral *ossicles at the pterion* (extra bone at the side of the cranium), and bilateral *extrasutural mastoid foramen*.

Considering that the ossicles at the pterion are not as common as some other traits, and the proximity of the burials, Skeleton 116 may have a genetic relationship with Skeleton 110, although not too much emphasis should be put on non-metric traits in this respect.

2.7.2 Post-Cranial Non-Metric Traits

Most notable in the postcranial non-metric traits is the presence of medial tibial squatting facets (small extension to joint surface in the ankle), which may suggest habitual squatting of the individuals affected (4/8 right, 3/7 left) (Table 15). A few individuals had exostoses in the trochanteric fossa (small spicules of bone present in the femur) (3/16 right, 2/14 left) and double inferior talar facets (double facet on the dorsal side of the talus) (2/8 right, 1/7 left). Other traits do not appear with any frequency in the adult group.

Table 15 Post-cranial non-metric traits

Paired Traits	Right			Left		
	Trait Present	Bone Present	%	Trait Present	Bone Present	%
Lateral Atlas Bridging	0	16	0.0%	0	17	0.0%
Double Atlas Facet	2	16	12.5%	1	17	5.9%
Posterior Atlas Bridging	0	14	0.0%	0	16	0.0%
Transverse Foramen Bipartite	0	12	0.0%	0	8	0.0%
Suprascapular Foramen	0	7	0.0%	0	8	0.0%
Accessory Acromial Facet	0	4	0.0%	0	3	0.0%
Circumflex Sulcus	0	5	0.0%	0	6	0.0%
Supracondyloid Process	0	17	0.0%	0	18	0.0%
Septal Aperture	2	14	14.3%	1	13	7.7%
Accessory Sacral Facet	0	13	0.0%	0	13	0.0%
Acetabular Crease	2	18	11.1%	1	16	6.3%
Allen's Fossa	0	12	0.0%	0	9	0.0%
Poirier's Facet	1	13	7.7%	1	10	10.0%
Plaque	0	12	0.0%	0	10	0.0%
Hypotrochanteric Fossa	0	17	0.0%	0	15	0.0%
Exostosis in Trochanteric Fossa	3	16	18.8%	2	14	14.3%
Third Trochanter	0	18	0.0%	0	15	0.0%
Emarginate Patella	0	8	0.0%	0	9	0.0%
Vastus Notch	1	7	14.3%	0	7	0.0%
Vastus Fossa	0	7	0.0%	0	7	0.0%
Medial Tibial Squatting Facet	4	8	50.0%	3	7	42.9%
Lateral Tibial Squatting Facet	1	7	14.3%	0	5	0.0%

Peroneal Tubercle	0	5	0.0%	0	6	0.0%
Double Anterior Calcaneal Facet	1	7	14.3%	1	7	14.3%
Absent Anterior Calcaneal Facet	0	7	0.0%	0	8	0.0%
Double Inferior Talar Facet	2	8	25.0%	1	7	14.3%
Medial Talar Facet	0	8	0.0%	0	8	0.0%
Os Trigonum	0	6	0.0%	0	5	0.0%
Lateral Talar Extension	0	6	0.0%	0	5	0.0%
Other	0	0	0.0%	0	0	0.0%

In the non-adult group, one of two individuals with a right calcaneus had a double anterior calcaneal facet and one of two individuals with a right femur had an Allen's fossa (area of porous bone near femoral head).

2.8 CONCLUSION

The 46 articulated skeletons varied greatly in completeness, from <5% to 90% present and almost half the skeletons were less than a quarter complete, which affected the ability to determine age and sex in the remains. Fragmentation varied as well, with slight to severe degrees present, but most of the skeletons (65.2%) were affected by moderate fragmentation. The surface preservation of the remains analysed was generally poor. All this contributed to the large number of adults aged 18+, most of whom could not be sexed.

Seventeen (37%) of the individuals buried in St John the Baptist's cemetery were non-adults and 29 (63%) were adults, including five young adults, four young middle adults, five older middle adults, four mature adults and eleven individuals aged over eighteen. The non-adult group included four younger juveniles, with the youngest one three to four years of age. Five older juveniles and eight adolescents were also recorded. The adult group consisted of ten males/probable males and nine females/probable females. The remainder of individuals had to remain unsexed (n=10).

The cranial morphology suggested that four individuals were of African or mixed ancestry, which was unexpected. The statures calculated for St John's were varied and males were slightly taller than the late medieval mean, while females were of average female stature. Non-metric traits were especially common in the cranium and some similarities were observed between some of the skeletons. The overall MNI for this site was 38.

3.0 PATHOLOGICAL ANALYSIS

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

macroscopically for evidence of pathological changes. In articulated burials the distribution of the lesions observed across the skeleton is one of the features used for differential diagnosis. Obviously, with disarticulated bone this is not possible, and this has an impact on identifying the pathological conditions concerned.

3.1 CONGENITAL CONDITIONS

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

3.1.1 Transitional Vertebrae

The vertebrae are divided into different groups by 'borders', and during development each group receives instructions governing the type of vertebrae into which they will develop. If these borders move up or down the spine then a vertebra becomes incorporated into an adjacent group, receives the wrong instructions, and takes on the characteristics of the new vertebra type (Barnes 1994, 79). The resulting vertebrae are termed 'transitional vertebrae'. Border-shifts have the effect of increasing the number of vertebrae in a particular group, but do so by reducing the number present in the adjacent group. The overall number of vertebrae remains the same, which is not the case with genuine additional segments or reductions in the number of segments (*ibid.*).

Several spinal border shifts were observable in the adult skeletons from St. John's. These were found in two males and two probable males. In Skeleton 110 (young middle adult probable male of African/mixed ancestry), the twelfth vertebra was lumbarised, meaning that the two inferior apophyseal joints were of lumbar appearance and that there were six lumbar vertebrae and eleven thoracic vertebrae in total.

In Skeleton 164 (young adult male), the same cranial border shift of the thoracic-lumbar border occurred as in Skeleton 110, with the twelfth vertebra taking on the appearance of a lumbar vertebra and the eleventh thoracic vertebra becoming the twelfth. Another of these cranial shifts was present in Skeleton 194 (old middle adult probable male). The fourth individual to have a cranial border shift of this border is Skeleton 224 (mature adult male). In Skeleton 194 and Skeleton 224, the fifth lumbar vertebrae are both bifid.

In Skeleton 233, an adult female, the first sacral vertebra was lumbarised and thus was of more lumbar appearance, indicating a cranial shift of the lumbar-sacral border. It had thus not fused to the second sacral vertebra along the spinous process. All of these cranial border shifts are unlikely to have caused symptoms.

3.1.2 Cortical Defects

Occasionally small depressions or folds occur in the joint surfaces, often with rounded edges and usually with no other signs of joint degeneration (such as osteophyte formation or other porosity). Roberts and Manchester (2005, 121) stress the importance of not confusing these with osteochondritis dissecans (where a fragment of the joint surface becomes detached leaving behind a usually circular and porous depression). These joint lesions are probably developmental. Skeleton 122, a young middle adult male had such depressions in both of his glenoid joints (Plate 3). These were smooth, circular and did not expose any trabecular bone and considering they were bilateral, the case that these are developmental rather than infectious is supported. Skeleton 154 (young adult male) likely had a small developmental depression on the right joint surface of the mandibular condyle.



Plate 3 Skeleton 122 - Bilateral cortical defect mid glenoid

3.1.3 Craniosynostosis/ Sutural Agenesis

The bones in the cranial vault meet at joints named sutures. Failure of a suture to develop is known as sutural agenesis, whereas premature fusion of a suture is known as craniosynostosis (Barnes 1994). Since the presence of sutures allows the cranium to expand in size during childhood to accommodate the growing brain, if a suture is absent or fuses too early it can prevent the cranium from growing in a certain direction. If other sutures are present and open then the brain and cranium will grow in that direction instead and the end result will be a deformed cranium. Sutural agenesis can be hereditary and runs in families. Craniosynostosis can be caused by a variety of factors, including foetal cranial position *in utero*, birth trauma, infection whilst in the womb, endocrine dysfunction and metabolic disorders (such as rickets) (Jimenez *et al* 1994). In general, craniosynostosis affects males more often than females (Aufderheide and Rodríguez-Martín 1998), although certain sutures (notably the coronal) are more

commonly involved in females (Kimonis *et al* 2007, Barnes 1994). Premature fusion of the sutures can occur as part of a congenital syndrome (Barnes 1994) and over 180 such syndromes associated with craniosynostosis have been recorded (Kimonis *et al* 2007). Despite Skeleton 221 being an adolescent (c. 16-17 years), the sagittal suture has completely fused, which should only occur in mature adulthood. The suture was no longer visible and there was a longitudinal sulcus along the suture line. Several large foramina were also visible along the suture endocranially. It is unclear whether this had any effect on the shape of the skull and/or the brain, as the cranium was very fragmented. Conversely, this individual had retention of at least part of the metopic suture (20 mm), which usually fuses at the age of two to four years (Schaefer *et al* 2009).

An older juvenile, Skeleton 143, retained the *suture mendosa* bilaterally in the occipital bone. This usually fuses within the first year and is closed by the third to fourth year (*ibid*). A further adult (Skeleton 146) had retained the metopic suture. These retentions are usually asymptomatic and the presence of the metopic suture is considered a cranial non-metric trait.

3.1.4 *Coxa Vara*

Coxa vara is a condition where the neck of the femur is short and horizontal, so that the collo-diaphyseal angle (angle between the femoral head and the femoral shaft) is below 125 degrees. This causes the head of the femur to lie below the greater trochanter. The condition is not present at birth, but develops slowly due to a congenital ossification defect of the femoral neck (Salter 1999). Because of the defect, the muscles of the hip cannot hold the pelvis level during walking and the individual will have a lurching (although painless) type of limp (*ibid*). This condition was seen in Skeleton 116 (old middle adult probable female), who had *coxa vara* in both femora. There is also some slightly greater than usual anterior bowing of the femoral shafts, especially distally.

3.1.5 Other Congenital Anomalies

The first sacral vertebral spinous process in Skeleton 113 (young middle adult probable male) was bifid and thus had not fused. This was also the case in Skeleton 116 (old middle adult probable female), who was buried very close to Skeleton 113.

A bifid first sacral vertebra was also observed in Skeleton 122 (young middle adult male), and Skeleton 194 (old middle adult male). In Skeleton 194 (old middle adult male), the fifth lumbar vertebra was bifid, additionally to the sacral vertebra. While in the lumbar vertebra the sides of the arches did not touch, they did touch in the sacral vertebra. A similar occurrence was observed in the spine of Skeleton 224 (mature adult probable male), whose fifth lumbar vertebra was complete and the spinous process appeared intact, but the arches had not fused. Both of these individuals with bifid lumbar vertebrae also had cranial spinal border shifts at the thoracic/lumbar border.

In the sacrum of Skeleton 194 (old middle adult male), there was a non-fusion rift running vertically through the middle of the posterior spines of the sacrum (S2-S4 at least). This appeared to be *spina bifida occulta*, but the rift was almost closed with rounded edges that almost looked folded into each other

(Plate 4). This may have extended to the fifth sacral vertebra, but post-mortem damage prevented observation of the true extent.



Plate 4 Skeleton 194 - Non-fusion rift in posterior sacrum

3.2 METABOLIC CONDITIONS

3.2.1 Rickets (Vitamin D deficiency)

Lack of Vitamin D leads to the development of rickets and osteomalacia in children, and osteomalacia in adults (Lewis 2007, 119). The poorly mineralised bone resulting from Vitamin D deficiency is incapable of supporting normal loads, and as a result it bends under weight-bearing. As children are growing, the long bones are affected; in adults the bones of the torso are more commonly involved (Ortner 2003, 393-401; Brickley and Ives 2008, 75-150). Although Vitamin D can be obtained from food sources (primarily eggs and oily fish), most Vitamin D is synthesised by the body during exposure to sunlight (Brickley and Ives 2008, 82-84). Therefore, the development of rickets and osteomalacia are usually associated with post-medieval urban populations (Lewis 2007, 121; Ortner 2003, 393).

Skeleton 200 (adult probable female), appeared to have suffered from osteomalacia or residual rickets

affecting both femora, although the left side was more notably affected. The posterior condyles turned laterally and there is also an anterior curvature which seems slightly beyond normal variation.

This accounts for a total of 2.2% of the population affected by residual rickets or osteomalacia. This is higher than the late medieval mean (0.73% for 9 medieval sites; Roberts and Cox 2003, 247) and the prevalence of residual rickets at most late medieval sites ranges between 0.19% at St Helen's-on-the-Walls (2/1037) and 3.63% at the Dominican Priory at Chelmsford (5/138) (Roberts and Cox 2003, 247-248).

3.2.2 Anaemia and *Cribra Orbitalia*

Cribra orbitalia is a term used to describe fine pitting in the orbital roof which develops during childhood and often recedes during adolescence or early adulthood. Until recently, iron deficiency anaemia was the accepted cause of these lesions (Stuart-Macadam 1992), but a strong case has been made by Walker *et al.* (2009) for different types of anaemia as the causative factor. These include megaloblastic anaemia in the New World, suggesting a diet deficient in Vitamin B₁₂ (i.e. plant-based and lacking in animal products) and/or folic acid. Such dietary deficiency could have been exacerbated through poor sanitation leading to infection and infestation with gut parasites (*ibid*). In malarious areas of the Old World, haemolytic anaemia (e.g. sickle cell anaemia and thalassemia) may be important in the development of *cribra orbitalia* (*ibid*). However, for areas such as northern Europe they have proposed that *cribra orbitalia* may be more likely related to conditions such as scurvy (Vitamin C deficiency) or chronic infections (*ibid*). *Cribra orbitalia* is often used as an indicator of general stress (Lewis 2000, Roberts and Manchester 2005) and is often found associated with agricultural economies (Roberts and Cox 2003).

In total, 80.0% observable adult orbits were affected by *cribra orbitalia*, which accounts for 80% of orbits (Table 16). In all of these individuals, the lesions were fairly slight in expression and were present with either small pin-prick sized foramina or slight vascular impressions. In the non-adults, seven of eleven observable orbits were affected (63.6%).

Table 16 Prevalence and distribution of *cribra orbitalia*

CO		Right Orbit				Left Orbit				Total Orbits			
		P	A	Total	%	P	A	Total	%	P	A	Total	%
YJ	1-6	0	0	0	0.00%	1	0	1	100.00%	1	0	1	100.00%
OJ	7-12	0	0	0	0.00%	1	1	2	50.00%	1	1	2	50.00%
AO	13-17	2	2	4	50.00%	3	1	4	75.00%	5	3	8	62.50%
Non-Adult Total		2	2	4	50.00%	5	2	7	71.43%	7	4	11	63.64%
YA	18-25	1	0	1	100.00%	1	0	1	100.00%	2	0	2	100.00%
YMA	26-35	3	1	4	75.00%	2	1	3	66.67%	5	2	7	71.43%
OMA	36-45	1	0	1	100.00%	1	0	1	100.00%	2	0	2	100.00%
MA	46+	2	0	2	100.00%	1	0	1	100.00%	3	0	3	100.00%
Adult	18+	0	1	1	0.00%	4	1	5	80.00%	4	2	6	66.67%
Adult Total		7	2	9	77.78%	9	2	11	81.82%	1	4	20	80.00%
										6			

Combined Total	9	4	13	69.23%	1	4	18	77.78%	2	8	31	74.19%
					4				3			

When all individuals were considered together, a total of 74.9% of the observable orbits were affected by *cribra orbitalia* and there is a crude prevalence rate of 33.7% for St John's, which is higher than that from other late medieval sites. Roberts and Cox have calculated a crude mean prevalence for 33 sites of 10.8% (2003, 234), which is considerably lower. However, Roberts and Cox (2003, 234) have also calculated the crude prevalence rate of *cribra orbitalia* solely for hospital sites, which is 25.6% and thus more comparable to St John's hospital. At St Giles Hospital, Brough, the crude prevalence rate of *cribra orbitalia* is even higher at 51.4% (*ibid*).

3.3 TRAUMA

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

3.3.1 Fractured Bones

At St John's cemetery, there were two instances of possible fractures. One of these occurred in Skeleton 182, a mature adult female of African or mixed ancestry, at the lateral end of the right clavicle (Plate 5). This was considered to be a possible fracture, due to the fact that it had healed and only the very sharp angle of the lateral end of the clavicle and some thickening of the cortical bone suggest that this is abnormal. A radiograph would possibly allow for a more certain diagnosis to be made. The articulating acromion was also involved and the articular surface seems to have adapted to a moved clavicle. Unfortunately, post-mortem damage compromised the view of the fracture site.



Plate 5 Skeleton 182 – Possible healed fracture of right lateral clavicle

It has been suggested that this type of fracture occurs during a fall on the outstretched arm. However, clinical literature now suggests that it is more likely to result from a fall onto the shoulder or direct impact (Koval and Zuckermann 2002, 63). Some interesting studies have managed to show that cyclists, other types of athletes, and alcoholics are especially prone to clavicular breaks, most of all lateral fractures (Nordqvist and Petersson 1996). Men are generally more commonly affected than women, even today (*ibid*; Allmann 1967; Kendrew and Wallace 2008). For the late medieval period, the crude prevalence rate for clavicle fractures was 0.56% (Roberts and Cox 2003, 238).

An old middle adult male (Skeleton 197) suffered an avulsion fracture of the left lesser trochanter. This individual also had possible Legg-Calve-Perthes disease (discussed in section 3.6.1), which affects the femoral head and this may be related to the avulsion of the trochanter. A relational link can also be made between this fracture and a more robust left apophyseal side of the first to fifth lumbar vertebrae. It is noticeable that in the left side the vertebral pedicles of the apophyseal joints were thicker and larger than those in the right side. This may be due to the connection that this area of the spine has with the left lesser trochanter via the *Psoas Major* muscle. Strain must have been severe, likely due to the Legg-Calve-Perthes, which also inhibits mobility. Sudden straining movement may have caused the avulsion.

The prevalence for fractures at St John is relatively low with two of 46 individuals affected (4.35%).

3.3.2 Osteochondritis Dissecans

Trauma can damage the blood supply to part of a joint surface leading to localised death of the tissue, and this small piece can then become detached from the rest of the joint surface (Roberts and Manchester 2005, 121). In skeletal remains, the lesion manifests as a roughly circular, porous hollow in the joint surface.

Four individuals had osteochondritis dissecans. Skeleton 113 (young middle adult male of African or

mixed ancestry) was affected by a large circular lesion on the medial condyle of the right distal femur (knee). This particular lesion was interesting, because the small, broken-off piece of bone was recovered with the remains (Plate 6). Skeleton 125, an adolescent of twelve to fifteen years of age, had a small lesion on the distal epiphysis of his right tibia (ankle).



Plate 6 Skeleton 113 - Distal femur with OD lesion and piece of joint

An old middle adult male (Skeleton 194) had osteochondritis dissecans in both distal femora (knees) on the medial condyles. The lesions were approximately the same size and shape (Plate 7). Bilateral osteochondritis dissecans is rare and it is possible that the lesions occurred in one single traumatic incident. Skeleton 233 had osteochondritis dissecans on the inferior calcaneal facet of the right talus (in the ankle/foot). This is slightly unusual, because most osteochondritis dissecans lesions appear on convex joint surfaces, while that of the inferior talus is slightly concave.



Plate 7 Skeleton 194 – Bilateral OD in distal femora

3.3.3 Spondylolysis

When the neural arch of a vertebra separates from the body at the *pars interarticularis* this is termed 'spondylolysis'. It occurs in 4-8% of modern populations, most commonly in the fifth lumbar vertebra and affects both halves of the arch (Aufderheide and Rodríguez-Martín 1998). The condition has been associated with hyperextension of the spine in young individuals (particularly athletes) and may result from a stress fracture or direct trauma (Dandy and Edwards 2003). However, some individuals may have an underlying genetic predisposition to developing the condition (Aufderheide and Rodríguez-Martín 1998). Although many individuals with spondylolysis will be unaware of their condition (Salter 1999) some will suffer lower-back pain as a result (Dandy and Edwards 2003). Pain may worsen as the individual ages and loses muscle tone (Sture 2001).

Spondylolysis was observed in the fifth lumbar vertebra of Skeleton 104, a mature adult male. This involved the posterior arch and both inferior apophyseal facets of the vertebra, which were recovered with the skeletal remains.

3.4 INFECTIOUS DISEASE

Infectious disease can involve the skeleton, but since bone cannot respond quickly only evidence for chronic, longstanding infections can be observed in archaeological skeletal remains (Roberts and Manchester 2005, 167). Acute conditions, where the patient either recovers or dies within a short space of time will not be seen. Initial bone formation in response to infection is disorganised (woven bone), but with time, as healing takes place, woven bone is remodelled and transformed into lamellar bone. Consequently, woven bone presence indicates an infection that was active at the time the person died, whilst lamellar bone indicates an infection that had healed; a combination of both suggests a recurring or longstanding infection (*ibid*). Although specific diseases may cause new bone to be deposited on the skeleton, it is almost always impossible to diagnose these from the bones alone. Hence, evidence for

infection is discussed as 'non-specific' infection.

3.4.1 Maxillary Sinusitis

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

In 22 of 35 observable adult sinuses (62.86%), slight porosity and/or spicules of new bone were present, which may indicate the presence of chronic sinusitis (Table 17). In most of the individuals, it is likely that the changes of the bone were primary rather than secondary complications, due to impacted teeth or abscesses. The overall crude prevalence rate from other late medieval sites calculated by Roberts and Cox (2003, 233) suggested a mean of 13%, while the crude prevalence rate at St John's was considerably, higher, at 30.4%.

Table 17 Distribution and prevalence of sinusitis

Sinusitis		Right				Left				Total			
		P	A	Total	%	P	A	Total	%	P	A	Total	%
YJ	1-12	1	1	2	50.00%	0	1	1	0.00%	1	2	3	33.33%
OJ	12-18	1	1	2	50.00%	1	1	2	50.00%	2	2	4	50.00%
AO	12+	2	2	4	50.00%	3	2	5	60.00%	5	4	9	55.56%
Non-Adult Total		4	4	8	50.00%	4	4	8	50.00%	8	8	16	50.00%
YA	18-25	1	0	1	100.00%	2	0	2	100.00%	3	0	3	100.00%
YMA	26-35	2	1	3	66.67%	2	1	3	66.67%	4	2	6	66.67%
OMA	36-45	1	0	1	100.00%	0	1	1	0.00%	1	1	2	50.00%
MA	46+	1	0	1	100.00%	3	0	3	100.00%	4	0	4	100.00%
Adult	18+	1	1	2	50.00%	1	1	2	50.00%	2	2	4	50.00%
Adult Total		6	2	8	75.00%	8	3	11	72.73%	14	5	19	73.68%
Combined Total		10	6	16	62.50%	12	7	19	63.16%	22	13	35	62.86%

Non-adults at St John's were less affected by sinusitis, with eight of sixteen observable sinuses affected. This is a prevalence of 50%, which is less than the 73.68% of sinuses affected in the adult group.

Skeleton 182 (mature adult female of African or mixed ancestry), had an abscess at the site of the lower second premolar, which has protruded into the left maxillary sinus and is likely to have caused the sinusitis observed in this individual.

3.4.2 Rib Lesions

Deposits of new bone on the visceral surfaces of the ribs have been associated with lung infections, particularly tuberculosis (Santos and Roberts 2006; Matos and Santos 2006; Mays *et al.* 2002; Santos and Roberts 2001). However, other respiratory conditions such as bronchitis and pneumonia, exposure to

polluted atmospheres and inhalation of fungal spores (Roberts and Cox 2003, 60, 112; Ortner 2003, 326) can also provoke a similar response.

The ribs recovered from St John's cemetery were generally in poor condition and quite fragmented, which made it difficult to extract information from them. However, there were two adolescents with rib fragments with new bone formation.

Skeleton 155 had central rib shaft fragments with healed lamellar bone striations on the outer surfaces of both sides of the body. It is likely that they belonged to the mid-section. The lamellar bone was fine and not immediately noticeable, suggesting that it may have been in a late stage of healing.

In Skeleton 161, another adolescent, a patch of active greyish woven bone was found on the visceral surface of a left mid-shaft rib fragment (Plate 8). It is unclear how far this would have extended due to heavy erosion of the fragment.



Plate 8 Skeleton 161 – Left rib fragment with new bone on visceral surface

At St John's, the prevalence of rib lesions in individuals who had ribs available for observation was 8% (2/25).

3.4.3 Periosteal Reaction

Fourteen skeletons had evidence of inflammation of long bone shafts in the form of well-healed lamellar bone on the legs (Skeletons 110, 113, 122, 125, 170, 173, 176, 188, 191, 194, 203, 209, 218 and 239). In almost all instances, this was well integrated into the cortical bone, indicating that inflammation had taken place some time before death. However, Skeleton 218 also had slight woven bone present on a femoral shaft fragment, which may have been active at the time of death. Considering that Skeleton 218 was three to four years old, however, this may also have been growth related.

Skeleton 185, an adolescent, had new bone formation on and around the elbow. Although the left

proximal ulna was eroded post-mortem, it showed signs of new bone formation inside the olecranon fossa. Irregular spicules of smooth new bone and woven bone were present, covering an area from the fossa to the articular surface. The coronoid fossa appeared to be equally affected. The lateral surface of the ulna also showed signs of inflammation, as it was covered with irregular patches of woven new bone. This was most visible on the medial aspect of the proximal shaft and the coronoid process. The olecranon process itself had been damaged post-mortem, but it was possible to discern reactive bone on the coronoid process. The radial notch appeared to either have fused to the radial head or ossification of the annular ligament had taken place. Dense new bone protruded laterally towards the radius, but the true extent is unclear due to erosion and the absence of the radius.

Hypervascularity was present on the orbital rims and the glabella of Skeleton 122 (young middle adult male), in Skeleton 128 (young middle adult probable male), porosity was visible on the right supraorbital ridge and Skeleton 194 (old middle adult male) also had this porosity present on his orbital rims. It is possible that this was caused by pubic lice, which can affect the eye brows and are very irritation, which can cause scratching and secondary inflammatory lesions (Kate Kingston *pers. comm.* 2013).

3.4.4 Endocranial Lesions

Skeleton 149 (unsexed adult) had several slightly porotic foci on the endocranial surface of the cranium (Plate 9). The larger one of two visible foci was located in the centre of the left parietal. The edges were smooth and sloping, and smooth trabecular bone of the diploe was exposed on inside the lesion. Both of the lesions were shallow and only affected the inner table of the skull. A smaller focus was located more inferiorly towards the temporal suture. Although both lesions were roughly circular in shape, the edges were irregular.



Plate 9 Skeleton 149 – lesions on endocranial surface of left parietal

A third lesion was located on the endocranial surface of the occipital planum, within the superior sulcus of the occipital crest. The edges of this lesion were difficult to discern due to taphonomic damage, but it was concentrated on the superior sulcus. These lesions may represent secondary reaction to meningioma (neoplasm; Brothwell 1967, 327) or localised periosteal reaction.

3.5 JOINT DISEASE

The term joint disease encompasses a large number of conditions with different causes, which all affect the articular joints of the skeleton. Factors influencing joint disease include physical activity, occupation, workload and advancing age, which manifest as degenerative joint disease and osteoarthritis. Alternatively, joint changes may have inflammatory causes in the *spondyloarthropathies*, such as septic or rheumatoid arthritis. Different joint diseases affect the articular joints in a different way, and it is the type of lesion, together with the distribution of skeletal manifestations, which determines the diagnosis (Rogers 2000; Roberts and Manchester 2005, 133, 136).

3.5.1 Degenerative Disc Disease (DDD)

Degenerative changes to the vertebral bodies were recorded when osteophytes (bony outgrowths) were present around the margins or on the body surfaces, coupled with porosity of the body surfaces (Rogers 2000).

Degenerative disc disease (DDD) was present in the cervical spine of 58.62% (17/29) of adult individuals. Five of these were old middle adults, and three were mature adults. Additionally, there were five of the general adult age group affected by DDD of the cervical vertebrae.

In the thoracic spine, a total of 51.72% (15/29) individuals were affected. This included one young adult, four young middle adults, four old middle adults, and four mature adults. Only two individuals from the adult group were affected, although it is likely that this is related to the fact that most of these individuals were fairly incomplete.

55.17% (16/29) of adults were affected by DDD. This included one young adult, four young middle adults, five older middle adults and four mature adults. The condition was less prevalent in the adult group, with only two individuals showing signs of DDD. The sacral area showed signs of degeneration in 41.38% of adults with this vertebra present. None of the young adults were affected.

The pattern of DDD in the spine of the various age groups suggested that the cervical spine was more commonly affected than any other part. It is possible that there was a slight bias in how well the cervical spine survived as opposed to the rest. The least affected area was the sacral region, while the lumbar and thoracic vertebrae had DDD present in approximately equal measure.

3.5.1.1 Extraspinal Degenerative Joint Changes (DJC)

Extraspinal degenerative joint changes (DJC) were found to affect especially adult shoulder, hip and knee areas. While 25% (5/20) right proximal humeri showed signs of DJC, it was 21.05% (4/20) in the left.

In the hip joints, nineteen proximal femora were present for observation, although many of these were only partially preserved. DJC was present in four of these, although the total number is likely to be higher.

DJC affected 21.05% of adults, 20% (4/20) in the left side, 30% of available right acetabuli were affected (6/20), and 20% (4/20) of left acetabuli.

The area most affected by DJC was the knee, which was not unexpected. The hips and knees, being the weight bearing joints of the lower limb, frequently degenerate in modern populations (Roberts and Manchester 2005), with Aufderheide and Rodríguez-Martín (1998) suggesting that over 50% of those over 60 years of age may suffer from degeneration of the hips. This was also true for St John's, where most of the affected individuals were of the young middle adult age group and older, and males were more frequently affected than females. Ten of 22 right, and nine of 22 left proximal tibiae showed signs of DJC, which amounted to a 45% prevalence in the right and 40.91% in the left side. This was by far the highest prevalence of DJC in any of the joints.

The prevalence of DJC in the ankle was not as high, although this may be connected to the fact that preservation of ankles was poor. 28.57% (4/19) of left distal tibiae were affected and this was the ankle joint surface with the highest prevalence of DJC. The right distal tibia yielded a prevalence of 20% (4/20).

Overall, just over half (55.1%) of all adults had DJC present in a part of their skeleton. All young middle adults, old middle adults and mature adults were affected in at least one of their joints, and 27.27% (3/11) of the unaged adult category had DJC. This lower number may have been due to the incomplete nature of many of these skeletons. In total, four of nine adult females were affected (44.44%) and nine of ten adult males (90%). This may be due to larger numbers of males in the older adult groups. The results indicate that individuals at St John's were more affected by joint degeneration than the late medieval average, which was 13.75% (Roberts and Cox 2003, 282).

3.5.2 Osteoarthritis

Osteoarthritis (OA) is a degenerative joint disease of synovial joints characterised by the deterioration of the joint cartilage, leading to exposure of the underlying bony joint surface. The resulting bone-to-bone contact can produce polishing of the bone termed 'eburnation', which is the most apparent expression of OA. Other features associated with degeneration of the joint include osteophytes (bone formation) on the surface or around the margins, porosity on the surface, and the development of cysts (Rogers 2000; Roberts and Manchester 2005, 135-138). OA is frequently associated with increasing age, but can be the result of mechanical stress and other factors, including lifestyle, food acquisition and preparation, social status, sex and general health and body weight (Larsen 1997; Roberts and Manchester 2005, 138). OA was recorded as present when at least two of the features associated with OA were present (e.g. osteophytes and porosity); eburnation, even if occurring alone, was always considered to be indicative of OA (Roberts and Manchester 2005, 136-138).

3.5.2.1 Osteoarthritis of the Spine

The vertebrae articulate with each other via pairs of apophyseal joints on the posterior side of the spine. Being synovial joints, they are vulnerable to developing osteoarthritis (OA).

OA of the apophyseal faces was present in the cervical spine of two individuals, Skeleton 104 (mature adult probable male) and Skeleton 134 (adult probable female). The thoracic spine was affected by OA in five adults. This included Skeleton 104, the old middle adults Skeleton 116 (probable female) and Skeleton 230 (male) and a further mature adult probable female – Skeleton 182 of possible African ancestry.

The lumbar spine of only two individuals yielded signs of OA, that of Skeleton 182, and of Skeleton 122, a young middle adult probable male. Both of these individuals and Skeleton 104 (whose entire spine was apparently affected) show signs of OA also in the sacral area, including on the body of the first sacral vertebra.

3.5.2.2 Extra-Spinal Osteoarthritis

Skeleton 224 (mature adult probable male) had developed OA in the right mandibular condyle. Further evidence for post-cranial OA was found in Skeleton 197 (old middle adult male), in the left acetabulum and left proximal and distal femur, which is likely secondary to the Legg-Calve-Perthes disease. The eburnation present in the right distal femur indicates that perhaps, this side too was compensating for the lack of mobility in the left side.

Extra-spinal OA was noted in Skeleton 182 (mature adult probable female), who also suffered from spinal OA (see above). This individual had OA of the left proximal and distal left femur. Both hip joints (proximal femora) of Skeleton 194 (old middle adult male) were affected by eburnation and thus OA.

The proximal right femur of Skeleton 212 (old middle adult femur) had eburnation and the condition was also observed in the left distal femur of Skeleton 230 (old middle adult male). The same individual also suffered from spinal OA. Skeleton 233, an adult female, was affected in the right distal femur.

The hip and knee are the major weight-bearing joints of the lower limb, and so frequently develop OA, particularly with advancing age (Roberts and Manchester 2005, 138; Aufderheide and Rodríguez-Martín 1998, 94).

3.5.3 Schmorl's Nodes

Schmorl's nodes are another condition that can affect the spine. They manifest as indentations in the upper and lower surfaces of the vertebral bodies caused by the pressure of herniated vertebral discs (Aufderheide and Rodríguez-Martín 1998). Discs may rupture due to trauma, but vertebrae weakened by infection, osteoporosis or neoplastic disease may be more vulnerable (Roberts and Manchester 2005). Schmorl's nodes are often associated with degenerative changes to the vertebral bodies (Aufderheide and Rodríguez-Martín 1998, Hilton *et al.* 1976) and are most commonly seen in the lower thoracic vertebrae (Hilton *et al.* 1976).

Schmorl's nodes affected 44.1% (52/118) of the vertebral bodies of the thoracic spine observable for analysis. This meant that a total of twelve adults (12/29, 41.4% of adults) were affected by Schmorl's

nodes in the thoracic spine. These were found mostly in the mid to lower thoracic region and ranged from mild to severe in expression.

In the lumbar spine, five individuals had Schmorl's nodes present, which accounts for 17.2% of adults (Plate 10). In total, sixteen of 73 available vertebrae were affected (21.9%) but there was no sign that any of the seventeen present first sacral vertebrae featured Schmorl's nodes.



Plate 10 Skeleton 164 – Severe expression of Schmorl's nodes in T11 and T12

Overall, thirteen adults had Schmorl's nodes present in their spines and this is described by a percentage of 44.8% overall. None of the non-adults were affected.

3.6 MISCELLANEOUS CONDITIONS

3.6.1 Possible Legg-Calve-Perthes Disease

Skeleton 194 (old middle adult male) had a deformed proximal femur, which was possibly affected by what is known as Legg-Calve-Perthes disease (Plate 11), which is a circulatory disorder in which the blood supply to the femoral head is interrupted resulting in necrosis (bone death) Ortner (2003). This condition results in deformation and 'mushroom-shaped' appearance of the proximal femur, involving the head and neck of the bone. The neck of the femur was wide and measured c 52.7 mm at its minimum width superior-inferiorly. The minimum width anterior-posteriorly is 37.4 mm, and was severely shortened. The head itself was of an irregular shape and measured 67.4 mm superior-inferiorly, and 56.4 mm anterior-posteriorly. The superior facing aspect of the femoral head had a necrotic, roughly circular area of macroporous, irregular bone, which featured eburnation on the edges. This area was slightly depressed while the surrounding 'mushroom-cap' shaped head has a smoother appearance. At the tip of the head, it was slightly pointy and this part showed a smooth-edged rift running in antero-proximal to posterior-distal direction. It was c 20.9 mm long and 10.8 mm deep. It is possible that an avulsion fracture of the lesser trochanter was associated with the condition.



Plate 11 Skeleton 194 – Legg-Calve-Perthes disease of left femur (note avulsion fracture of the lesser trochanter)

The changes to the femur also affected the left acetabulum (hip socket). It was noticeably widened and the rim extended 11.4 mm beyond the normal rim edge to accommodate the larger, deformed femoral head. Macroporous necrotic bone was visible in the acetabulum as well, especially on the superior surface and the acetabular notch area, which was filled partially with osteophytes (especially on the inferior edge of the superior demiface of the lunate surface) and macroporosity. Eburnation was visible especially on the superior acetabular surface. The surface of the acetabulum was irregular and the general shape has adapted to the shape of the femoral head. Movement in the joint was highly restricted, which is likely to have contributed to the avulsion fracture of the left lesser trochanter.

3.6.2 Cysts

Skeleton 224 (mature adult probable male) had a large cystic hollow just inferior of the right anterior inferior iliac spine of the pelvis, superior of the acetabular superior rim (Plate 12). The opening measured c.14.6 mm superior-inferiorly and 13.9 mm medio-laterally. The walls inside the hollow were smooth, but the shape was generally irregularly rounded with smooth porosity visible.



Plate 12 Skeleton 224 – cystic hollow on right anterior inferior iliac spine

Skeleton 104 (mature adult probable male) was afflicted with a small, longitudinal lytic lesion, or cyst, at the posterior lateral margin of the acetabulum. It measured 13.8 mm superior-inferiorly and 8.3 mm anterior-posteriorly and it was at least 5 mm deep.

Skeleton 113 (young middle adult probable male) had a small lytic lesion on the posterior superior margin of his fifth lumbar vertebra. This was circular in shape and had hollowed out a small area immediately inferior to the rim of the body. It measured 3 mm superior-inferiorly and 5.6 mm medio-laterally. This was remarkably similar to the one in Skeleton 122 (described below).

Skeleton 116 (old middle adult female) had a cystic lesion in the centre of the proximal radial articular head, which articulates with the capitulum of the distal humerus. This lesion was circular and had a diameter of 4.3 mm. This may have been a subchondral cyst. The same individual also had a small lytic lesion on the superior demiface of the lunate surface in the right acetabulum (pelvis). Immediately inferior of the iliac crest, the cystic lesion showed macroporosity with smooth edges, which look lytic. The area measured 16.2 mm anterior-posteriorly at its longest extent and is 6.9 mm medio-laterally wide.

Skeleton 122 (young middle adult male), had a cystic lesion on the superior margin of the posterior body of the fifth lumbar vertebra. This looked like a Schmorl's node, but instead of being located on the vertebral body, it was situated at the rim. It had destroyed part of the margin of the body and measured 13.4 mm medio-laterally and 3.1 mm superior-inferiorly.

On the inferior posterior margin of Skeleton 164's (young adult male) right scapula glenoid it was possible to observe a lytic lesion (possibly a cyst) along the margin of the articular surface. This showed three larger hollows and one very shallow hollow on the superior aspect. The hollows were closely linked and thus appeared to be one longitudinal lesion measuring 19.2mm superior-inferiorly and 2.3mm medio-laterally.

Skeleton 188 (mature adult) had a very small circular lytic lesion which may have been a cyst in the superior aspect of the left acetabulum. This measured c 3.1 mm in diameter and was quite shallow. The

underlying trabecular bone was visible, smoothly porous and smooth-edged.

In the manubrium of Skeleton 194 (old middle adult male), on the left anterior margin of the articular facet with the medial clavicle, was evidence for a small cystic hollow. It was circular, with smooth spicules of porous bone exposed and measured 6.2 mm in diameter.

3.6.3 Other

Skeleton 122 has extreme DJC on the right inferior facet of the fifth lumbar vertebra, which is mirrored in its severity in the articulating right superior facet of the first sacral vertebra. Heavy new bone formation surrounds the facet which appears larger and less curved laterally than its left counterpart – which is completely unaffected by change. Mid-facet, there is a large area of porosity/exposure of trabecular bone, and eburnation. This porous area measures 16.5 mm superior-inferiorly and 7.4 mm medio-laterally and is located in the centre of the enlarged facet. In the first sacral vertebra, the right superior facet is also less curved and almost flat. Almost the entire enlarged surface is porous, and affected by eburnation. It is possible that the facet was fractured, or a developmental issue such as spondylolysis was underlying the heavy bone deformation.

Spicules of porous new bone were covering the superior lateral margins of the fused occipital and sphenoid bodies of Skeleton 182 (mature adult female of African ancestry). This was smooth and was located most prominently at the aspects closest to the temporal petrous portion. It followed the entire length of the bodies (more noticeable on right side) and measured 2.6 mm superior-inferiorly and 21.9 mm anterior-posteriorly. The aetiology of these lesions is not clear.

3.7 CONCLUSION

A number of pathological conditions were identified in the skeletons from St John's cemetery. Several adults were affected by developmental conditions, which expressed themselves as anomalies in the spine, where vertebrae of one spinal segment take on the appearance of an adjacent segment. The first sacral or fifth lumbar vertebrae of five individuals were affected by congenital anomalies, such as bifid spines. One adult had minor cortical defects in his shoulder articulations and two non-adults and one adult had retention or premature fusion of cranial sutures.

Residual childhood rickets or adult *osteomalacia* affected one individual in this population. *Cribra orbitalia*, a childhood stress indicator probably related to a type of anaemia affected at least seven non-adults and sixteen adults, albeit in slight form. While the prevalence rate of this condition was much higher than the late medieval mean, it was comparable to other contemporary hospital sites.

An unexpectedly small number of individuals had fractures, with a prevalence of 4.35% at St John's hospital. One of these was a clavicle fracture while the other was a muscle injury on the thigh, possibly associated with an underlying circulatory condition, Legg-Calve-Perthes disease, which causes necrosis (death) of the femoral head and led to secondary severe osteoarthritis of the hip in this individual.

Three adults and one adolescent were found to exhibit signs of *osteochondritis dissecans*, a condition that is related to trauma in adolescence. This was most prevalent in the knee, while one individual had the condition in the ankle. Spondylolysis, a condition that can be both developmental and traumatic and causes the spinous process of the fifth lumbar vertebra to separate from the vertebral body, was found in one adult individual.

Infectious diseases such as sinusitis affected half of the observable non-adult and 73.68% of the adult sinuses and a third of the population, which is almost three times the late medieval mean. Inflammatory rib lesions were present in two adolescents from St John's, one of which appeared to have been due to external trauma or infection, while the other was affected by a pulmonary infection such as pneumonia or tuberculosis. Fourteen skeletons, most of whom were adults, showed signs of receding inflammatory lesions on the legs, while one adolescent appears to have had inflammation in the left elbow. Inflammatory lesions in the eyebrow region were present in three adult males. There is a possibility that this may have been related to lice infestations. Inflammatory lesions on the inner surface of the skull were present in at least two adult individuals. Cysts and small infectious lesions were quite frequent and affected eight adults, seven males and one female.

Degenerative disc disease of the spine affected 55.17% of adults and five individuals had osteoarthritis in the spinal column. Osteoarthritis in other joints was observed in seven individuals, and mostly affected the knee and hip, including the individual with Legg-Calve-Perthes disease. The spines of thirteen adults showed signs of Schmorl's nodes, likely due to spinal stress.

4.0 DENTAL HEALTH

Analysis of the teeth from archaeological populations provides vital clues about health, diet and oral hygiene, as well as information about environmental and congenital conditions (Roberts and Manchester 2005). All teeth and jaws were examined macroscopically for evidence of pathological changes.

For the analysis of dental pathology, 36 dentitions were available, for 78.26% (36/46) of the skeletons from St John's hospital cemetery. This included fourteen non-adult dentitions, of which seven still had some deciduous teeth present.

The percentage of non-adult dentitions present for this analysis of all non-adults was thus 82.35% (14/17). The percentage of adult dentitions present for analysis of all adults present was 75.86% (22/29).

4.1 CALCULUS

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

periods, although poor preservation or damage caused during cleaning can result in the loss of these deposits from the teeth (Roberts and Manchester 2005, 64).

Plaque was present on 36.34% of all teeth (258/710) (Table 18). As expected, non-adult teeth were less frequently affected by calculus, as only 66 of a total observable 310 teeth showed signs of plaque (21.9%). Most non-adults were only had slight deposits.

Table 18 Calculus prevalence - Age

Calculus				
		Teeth Present	Teeth with Calculus	%
YJ	1-6	44	2	4.55%
OJ	6-12	69	4	5.80%
AO	13-17	197	60	30.46%
Non-Adult Total		310	66	21.29%
YA	18-25	111	43	38.74%
YMA	26-35	105	56	53.33%
OMA	36-45	73	52	71.23%
MA	46+	30	16	53.33%
A	18+	81	25	30.86%
Adult Total		400	192	48.00%
Combined Total		710	258	36.34%

In the adult group, a total of 48% of observable teeth showed evidence for calculus, and this increased with age, as is the norm. The reduced percentage of affected teeth in the mature adult category may be related to the fact that ante-mortem tooth loss also increased with age (31.82% of teeth lost per position, see section on AMTL).

Males were likely affected with 66.67% (48/72) of teeth involved, and 57.5% (69/120) in the possible male group. Calculus was not observed on any of the deciduous teeth (Table 19).

Table 19 Calculus prevalence - Sex

Calculus			
	Teeth Present	Teeth with Calculus	%
Male	72	48	66.67%
Possible Male	120	69	57.50%
Female	86	25	29.07%
Possible Female	63	25	39.68%
Unassigned	30	0	0.00%
Total	371	167	45.01%

Roberts and Cox (2003, 263) report that 19.44% of teeth in the late medieval period - and 36.42% of

dentitions - had deposits of calculus. This value is much below the value from St John's and may indicate that dental hygiene was extremely poor and/or that diet was very high in protein. Compared with St Mary Spital, however, which had calculus a prevalence ranging from 81% to 84% in teeth for the period of 1120-1400 AD (Connell 2012, 40-43), the St John's skeletons were less severely affected.

4.2 PERIODONTAL DISEASE

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

Periodontal disease was only recorded for seven adult individuals whose maxilla and mandible was in a condition which allowed observations to be made. Unfortunately, most dentitions were eroded to a degree, which meant it was not possible to record periodontitis. Periodontal disease occurred at St John's with slightly higher numbers in males/possible males than in females/probable females. However, it must be considered that these numbers are very small.

Periodontal disease prevalence for the late medieval period was 37.53% (Roberts and Cox 2003, 261). The prevalence for St John's was 100%, but only because the disease was present in the seven observable dentitions, which were in good enough, condition to be scored. It is more than likely that true prevalence was lower than this. However, a similar prevalence for periodontal disease was reported for the late medieval hospital cemetery at Spital Square, North-East London. 90% of males from this site were affected with periodontal disease, 87.5% of females, and overall the prevalence was 87.5% (42/48) (Bekvalac *et al* 2007).

4.3 DENTAL CARIES

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

Table 20 highlights the prevalence of caries at the cemetery of St John's hospital. Dental caries prevalence was low, with overall only 4.21% (31/737) of the teeth affected. The younger juveniles did not have any carious lesions present, while the older juveniles had a rate of 4.21% (4/95). The teeth of adolescents were marginally less affected and had a prevalence of 2.54% (5/197). The non-adult total thus added up

to 2.68% (9/336).

Table 20 Caries prevalence - Age

Dental Caries				
		Teeth Present	Teeth with Caries	%
YJ	1-6	44	0	0.00%
OJ	7-12	95	4	4.21%
AO	13-17	197	5	2.54%
Non-Adult Total		336	9	2.68%
YA	18-25	111	1	0.90%
YMA	26-35	106	6	5.66%
OMA	36-45	73	3	4.11%
MA	46+	30	7	23.33%
A	18+	81	5	6.17%
Adult Total		401	22	5.49%
Combined Total		737	31	4.21%

For the adult groups, caries again seemed to increase with age, although there was a slight decrease from young middle adults to older middle adults. The mature adults were most frequently affected by caries, with a prevalence of 23.33% (7/30), which highlighted the expected increased prevalence with age.

Caries prevalence was higher in females, with 15.87% (10/63) teeth of probable females affected, and 1.16% (1/86) of definite females. This was opposed to the 1.39% (1/72) of teeth with caries of males, and a slightly higher 7.44% (9/121) in probable males (Table 21).

Table 21 Caries prevalence - Sex

Dental Caries			
	Teeth Present	Teeth with Caries	%
Male	72	1	1.39%
Possible Male	121	9	7.44%
Female	86	1	1.16%
Possible Female	63	10	15.87%
Unassigned	395	10	2.53%
Total	737	31	4.21%

Compared with other late medieval sites, St John was comparable in terms of caries prevalence. According to Roberts and Cox (2003, 259) the rate of caries per tooth position examined was 5.6% for the period, which clearly corresponds to St John's. At St Mary Spital, slightly higher values were calculated for the period in question. At St Mary Spital, the prevalence for individuals from the period of 1120-1200 AD was 8.6% (558/6515), for 1200-1250 AD the prevalence of caries rose to 9.3% (1601/17,196) and in the period covering 1250-1400 AD, a prevalence of 10.3% (4047/39,143) was calculated (Connell et al 2012,

48). Perhaps this heavier presence of caries in London suggests that diet was more cariogenic.

4.4 ABSCESSSES

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

None of the non-adult dentitions showed signs of abscesses, but in the adult category, four dentitions were affected (13.79% or 4/29; Table 22). Prevalence increased with age with males and females affected equally.

Table 22 Abscess prevalence

Abscesses				
		Individuals with Abscesses	No. of Individuals	%
YA	18-25	0	5	0.00%
YMA	26-35	0	4	0.00%
OMA	36-45	1	5	20.00%
MA	46+	2	4	50.00%
A	18+	1	11	9.09%
Total		4	29	13.79%

The frequency of dental abscesses at St John's was lower than that of the late medieval average calculated by Roberts and Cox (2003, 261). While St John's prevalence was at 13.79%, the mean prevalence was 26.27% (506/1926) of dentitions affected (*ibid*).

4.5 ANTE-MORTEM TOOTH LOSS

Ante-mortem tooth loss (AMTL), or the loss of teeth during life, can occur as a result of a variety of factors, including dental caries, pulp-exposure from heavy tooth wear, or periodontal disease (occurring when inflammation of the gums, gingivitis, spreads to the underlying bone). Gingivitis can result when deposits of calculus on the teeth aggravate the gums. Once the tooth has been lost, the empty socket is filled in with bone (Roberts and Manchester 2005, 73-74).

AMTL was not observed in any of the non-adult dentitions. As would be expected, it is noticeable that the rates of ante-mortem tooth loss increased with age. While young adults had a very low prevalence of 0.89% (1/112), the young middle adults at St John's have a prevalence of 2.38% (3/126). This increase is likely due to the increased caries with age. The old middle adult group was afflicted with 11.11% of tooth loss per position, which accounted for nine lost teeth of a total observable, and 31.82% (14/44) was the prevalence for mature adults at St John's.

Table 23 AMTL prevalence - Age

AMTL		Position Present	AM Loss	%
YA	18-25			
YA	18-25	112	1	0.89%
YMA	26-35	126	3	2.38%
OMA	36-45	81	9	11.11%
MA	46+	44	14	31.82%
A	18+	100	14	14.00%
Total Tooth Positions		463	41	8.86%

Interestingly, females seemed more predisposed to be affected by AMTL which may have to do with the higher prevalence of caries in females at this site. While 2.78% (2/72) of male teeth were lost ante-mortem, it was 7.84% (12/153) in males. This was a male overall of 6.22% (14/225) and compares with a female overall prevalence of 14.2% (25/176). Compared to the average prevalence calculated by Roberts and Cox (2003, 263) for the late medieval period, 19.44%, St John's is relatively low.

At St Mary Spital, the prevalence for AMTL for the period 1120-1400 AD ranged from 11.1% (1120-1200 AD) and 9.7% (1200-1250 AD), to 12.5% (1250-1400 AD) (Connell et al 2012, 40-43). The prevalence of AMTL St John's hospital is most similar to the prevalence of the early twelfth century, although this should not be understood as an attempt to date the cemetery. It remains to be highlighted that both hospital sites exemplify similar values in terms of AMTL prevalence.

Table 24 AMTL prevalence - Sex

AMTL		Position Present	AM Loss	%
Male	Possible Male			
Male	Possible Male	72	2	2.78%
Possible Male		153	12	7.84%
Female	Possible Female	82	1	1.22%
Possible Female		94	24	25.53%
Unassigned		33	2	6.06%
Total Tooth Position		434	41	9.45%

4.6 DENTAL ENAMEL HYPOPLASIA

Dental enamel hypoplasia (DEH) is the presence of lines, grooves or pits on the surface of the tooth crown, and occurs as a result of defective formation of tooth enamel during growth (Hillson 1996). Essentially, they represent a period when the crown formation is halted, and they are caused by periods of severe stress, such as episodes of malnutrition or disease, during the first seven years of childhood.

Involvement of the deciduous (milk) teeth can indicate pre-natal stress (Lewis 2007). Trauma can also cause DEH formation, usually in single teeth.

DEH was present in 50% of non-adult teeth observable for analysis (Table 25). In total, 342 non-adult teeth were present and 171 of these showed DEH expressed as lines, pits or grooves, although lines were most common overall (Plate 13). 25% (11/44) of younger juveniles had DEH present, which is a sign for early childhood stress. The slightly older juvenile group had a higher prevalence of 57.43% of DEH, with 58 teeth affected of a total 101. For the adolescent group, 197 teeth were present and 102 teeth showed signs of DEH. This added up to an overall prevalence of 50% (171/342) of DEH presence in teeth.

Table 25 DEH prevalence - Age

DEH		Teeth Present	Teeth with DEH	%
YJ	1-6	44	11	25.00%
OJ	7-11	101	58	57.43%
AO	12-17	197	102	51.78%
Non-Adult Total		342	171	50.00%
YA	18-25	111	34	30.63%
YMA	26-35	106	4	3.77%
OMA	36-45	73	24	32.88%
MA	46+	42	10	23.81%
Adult	18+	81	29	35.80%
Adult Total		413	101	24.46%
Combined Total		755	272	36.03%



Plate 13 Skeleton 239 – DEH on all permanent teeth

The adult group had a prevalence of 24.46% (101/413), which brought the overall population prevalence of DEH to 36.03% (272/755). By far the least DEH was noted in the young middle adult category, where

only four teeth of a total of 106 showed any sign of hypoplasia, which amounted to 3.77%. The adult prevalence of 24.46% contrasted with the adult prevalence recorded for St Mary Spital, which ranged from 14.5% (1120-1200 AD), and 14.3% (1200-1250 AD), to 13.3% (1250-1400 AD) (Connell et al 2012, 40-43).

Table 26 DEH prevalence - Sex

DEH			
	Teeth Present	Teeth with DEH	%
Male	72	25	34.72%
Possible Male	133	10	7.52%
Female	86	35	40.70%
Possible Female	63	27	42.86%
Unassigned	59	4	6.78%
Total	413	101	24.46%

Table 26 highlights that female teeth were more frequently affected by hypoplasia when compared to male teeth. While 41.61% (62/149) of females had DEH, only 17.07% (35/205) of males did. Perhaps this suggests differences in the way girls and boys were raised, or it suggests that females were under greater stress than their male counterparts in their early childhood, which had an effect on the development of the teeth. However, it may also suggest that female had better internal survival mechanisms, which allowed them to live through greater stresses than male children.

Roberts and Cox (2003, 264) recorded an overall prevalence of 35.38% of dentitions affected by dental hypoplasia for the late medieval period. St John's prevalence rate for dentitions affected by dental hypoplasia was 54.35% (25/46), which was remarkably high. At Spital Square, London, the adult prevalence was much closer related to that of St John's with 64.6% (31/48) (Bekvalac *et al* 2007). This consistency is perhaps indicative of the nature of the institution, as similarly high rates were recorded at St Mary Spital for non-adults. Those aged six to eleven had a prevalence of 54.2% (13/24), and the adolescents had an even higher prevalence with 63.9% (23/36) (Connell et al 2012).

4.7 DENTAL ANOMALIES

In Skeleton 110, a young middle adult probable male, did not have both mandibular second premolars. In the context of an otherwise complete dentition, it is likely that these either were impacted or congenitally absent.

In an adolescent, Skeleton 185, the mandibular right canine was impacted in the alveolar bone, while the deciduous right maxillary canine was still present and in the place of the impacted permanent canine. The permanent tooth was visible in the alveolar bone due to a post-mortem break of the mandible. The root of the deciduous tooth was almost half resorbed. Impaction of deciduous teeth is rare, but when it occurs many studies report that the lower second deciduous molar is most likely to be affected (Memarpour *et al.* 2012; Borsatto *et al.* 1999), as seen in Skeleton 2, although other studies have suggested the lower first deciduous molar is more likely to be affected (Messer 1980). Ankylosis, where the tooth roots become

fused directly to the alveolar bone of the jaw, is likely to be one of the main causes of impaction of deciduous teeth (Messer 1980; Memarpour *et al.* 2012; Borsatto *et al.* 1999). However, Memarpour *et al.* (2012) also list several other possible causes, including odontomas (benign tumours composed of dental tissues), congenitally missing permanent teeth, defects in the periodontal membrane, trauma, injuries of the periodontal ligament, and early eruption of the first permanent molar. Some individuals may have a genetic predisposition (*ibid.*). Ankylosis of a tooth can lead to problems with the normal development and eruption of the permanent teeth (Messer 1980).

In Skeleton 185, there were also enamel defects present in the form of small circular smooth-edged holes in the buccal fissures of left mandibular first molar, and chips had broken off of the left maxillary first molar on the lingual and buccal sides, but it was not clear if they were caused ante- or post-mortem.

A further impaction of a deciduous tooth was observable in Skeleton 194. In this individual, the left mandibular canine had become stuck in the alveolar bone, possibly due to the impaction of the left mandibular deciduous canine, which was still present. Due to the post-mortem break of the mandible, it was possible to determine that the canine had moved in a postero-medial direction inside the alveolar bone, where it remained.

In the right maxilla of Skeleton 239, an adolescent, the socket for the right deciduous maxillary canine and the right deciduous second molar were both still present. For the deciduous right second molar, the distal lingual root was impacted in the socket, but had broken off. The empty socket of the right maxillary deciduous canine was located on the buccal side of the alveolar bone, between the right permanent canine and first premolar. This had caused the right permanent premolar to be slightly turned anteriorly with its lingual side, as the root of the deciduous molar was in the way. The same issue occurred with the right deciduous canine and the right permanent canine, causing the permanent canine to be slightly pushed into the palate, with an anterior turn with its labial side. The right maxillary canine was therefore lingual of the other mandibular teeth and thus Skeleton 239 had developed a cross bite.

The permanent maxillary left canine In Skeleton 215 (adolescent) was impacted and pushed against the root of the left second incisor. The root had breached into the left nasal aperture/sinus border and this may have contributed to development of slight sinusitis. Skeleton 215 also had a small notch, or groove in the occlusal surfaces of her right first incisors – mandibular and maxillary (Plate 14). This notch was smooth edged and situated in the middle of both teeth. It is probable that the individual habitually used the right incisors for an occupational activity. The notch measured c 1.3mm medio-laterally but was quite shallow and gradual.



Plate 14 Skeleton 215 –Activity-related notch facet in occlusal surface of right maxillary and mandibular first incisors

Slight crowding in the anterior mandible was noticeable in Skeleton 122 (young middle adult male) and in Skeleton 125 (adolescent). There was slight asymmetry in the size of the maxillary right and left second molars. The right second molar was noticeably larger than the left second molar (8.8 mm medio-laterally; RM² 9.6 mm medio-laterally). Crowding also occurred in the anterior mandible of Skeleton 191 (young adult female).

Skeleton 128 (young middle adult probable male) had some small enamel defects in the mandibular left first molar. This was located buccally, in the fissure (small, smooth hole), in the left second molar (also buccally, inside the fissure) and in the left third molar (inside distal fissure of the occlusal surface). In Skeleton 140, a young juvenile, the left and right maxillary second molars were longitudinally reduced in width and did not adhere to the normal shape. The root of the right mandibular first premolar of Skeleton 161 (adolescent) had turned black, which may have been due to trauma and/or nerve damage. However, no evidence for trauma was visible in the dentition.

4.8 DENTAL CONCLUSIONS

The analysis of 36 available dentitions for St John's hospital cemetery showed evidence for interesting trends in dental pathology. Dental plaque concretion prevalence was very high compared with the late medieval average calculated by Roberts and Cox (2003, 263), but moderate compared with that of the medieval hospital at St Mary Spital, and appears to have increased with age. Males were generally more severely affected than females.

Evidence for periodontal disease was limited further to the poor preservation of jaws. Seven individuals were affected with slight to moderate periodontal disease and a prevalence of 100%.

Cavities prevalence at St John's was comparable to the late medieval mean (Roberts and Cox 2003, 259) at 4.21% and was slightly lower than at St Mary Spital for the period, which suggested that individuals buried at St John's had a less cariogenic diet than those at St Mary's in London. Females were more likely to be affected when compared to males.

Dental abscesses were rare at Lichfield, with only 13.79% of adults affected, which is lower than the British average prevalence at the time. Females were equally affected as males. However, females had higher prevalence of ante-mortem tooth loss, which may be relatable to the higher prevalence of carious lesions. Generally, the caries prevalence of St John's was low compared with the late medieval average, but it was close to the prevalence recorded for the period at St Mary Spital, London.

Dental enamel hypoplasia lesions, which are indicative of childhood stress, were observed in 36.03% of teeth present for analysis, which was higher than the late medieval average calculated by Roberts and Cox (2003). Hypoplasia affected more females than males, which may have been due to a better survival rate of females when confronted with health stresses, or alternatively, increased stress on females during childhood.

Dental anomalies included a number of impacted deciduous teeth, which caused permanent dentition either to be moved from their normal position, or to be impacted as well. Enamel defects were recorded in two skeletons and two individuals had crowding in the anterior mandible. Possible nerve damage in one tooth was recorded for one individual and one adolescent (Skeleton 215) had a likely activity-related notch on the occlusal surfaces of the right maxillary and mandibular incisors.

5.0 FUNERARY ARCHAEOLOGY

All the skeletons recovered from St John's hospital cemetery had been buried in supine extended positions, with the exception of Skeleton 152. This adult was a probable female of African or mixed ancestry and she was found in a twisted position, with her torso prone, her left arm folded under her and her right arm also folded, with her right hand under her chest. She must have been twisted at the hip, because her knees were flexed and supine, albeit slightly turned to her left side. Her head was turned to the left, looking south-east. It has been argued that prone burials reflect a position of humility in Christian contexts (Craig 2009, 20; Thompson 2002). Elsewhere, it has been observed that prone burials are on occasion afforded to individuals with 'physical features which distinguish them' (Gilchrist and Sloane 2005, 153). This may include individuals with syndromes or atrophies. Skeleton 152 did not appear to have any physical changes in this respect, however. A third theory suggests that there was a penitential aspect to this practice, which is supported by historic evidence from early twelfth century France (Gilchrist and Sloane 2005, 154).

All individuals were afforded Christian burials with south-west north-easterly orientation, with the head towards the south-west, orientated towards St Chad's. Most individuals had their arms extended at the sides of the torso, with the lower arms either bent at the elbow and folded over the stomach area or with

the hands placed over hip joints or abdomen. The excavators suggest that coffins were present. Copper stains on some of the individuals indicate the presence of shroud pins. It is also likely that the cemetery used to have grave markers in place, or that the graves were present as slight mounds which made it possible to determine where exactly they were located, as there was no evidence for intercutting.

The excavated area appears to have exposed the south-western-most extent of the cemetery beyond which there was no evidence for further graves. The south-eastern corner of the cemetery also appears to be exposed and the fourth row of graves also appears to be delimited at the north-western side. In sum, it is likely that three sides of the cemetery were exposed in the excavation trench. Due to variable construction levels, not all skeletons in every trench were exposed or excavated.

The graves were arranged neatly in five rows (in the excavated area). Only the penultimate row was made up of only three individuals, an adult female (Skeleton 233), an older juvenile (Skeleton 236) and a younger juvenile (239). Patterns in terms of age and/or sex were investigated, but there did not appear to be a relationship between cemetery location and age, sex or pathology. However, the skeletons of African or mixed ancestry individuals were clustered in the south-eastern corner of what seems to be the extent of the cemetery. Skeletons 110, 113 and 152 were buried beside one another in the most distant row away from the chapel and hospital. Skeleton 182, also of possible African or mixed ancestry, was an outlier, as she was buried two rows further north-east, towards the main buildings.

6.0 DISCUSSION AND SUMMARY

It is likely that the extent of the cemetery was defined on three sides, however, due to varying levels of the proposed construction at the site, not all burials were exposed and excavated. Burial position and orientation corresponded with the contemporary norm, with interment in supine extended positions. One individual was interred in a different, slightly twisted position and there was no obvious reason why this might have been the case. Three of the possible four African or mixed ancestry skeletons were buried near one another.

The osteological analysis of the skeletons excavated from St John the Baptist hospital and almshouses shed some light on the lives of those who were interred at St John's and in the twelfth to fourteenth centuries. A total of 47 skeletons were exposed during the excavation, 46 of which were recovered for further study. One individual only had a few foot bones present which were left *in situ*.

The remains varied greatly in terms of completeness, with most of the skeletons between 0-25% incomplete. The preservation was equally varied and all of the skeletons were affected by taphonomic erosion. Most of them fell into a grade 3 category, which describes moderate to poor surface preservation. Over 60% of the remains were moderately fragmented, but the overall fragmentation ranged from slight to severe. All of these factors made osteological and pathological analysis difficult. Dentition preservation varied as well, with some of them severely degraded causing enamel to chip off the dentine at the slightest touch. Some dentitions were covered with a blackish substance which may have masked dental pathologies, but every attempt was made to accurately record what was present.

The minimum number of individuals at St John's was 38. This number was calculated by considering the presence of fourteen non-adult right and left temporal bones, and 24 adult occipital bones. Among the articulated burials, there were seventeen non-adults (37%) and 29 adults (63%). Dentitions were at least partially present for fourteen of the non-adults and for 22 of the adults, which made it possible to compare dental health not only between age and sex groups at St John's, but also with other relevant late medieval populations.

No infants or perinates were present at St John's, which may have been due to the often shallow burials of infants, or because a particular section of the cemetery was reserved for this age group which was not within the area of excavation (Daniell 1997, 125). Four of the non-adults were between the ages of three to six, five were older juveniles (7-12 years), and eight were adolescents (13-17). This spike of adolescent burials is uncommon if compared to other late medieval cemetery populations, but it corresponded well with the numbers recorded for Spital Square, an Augustinian priory and hospital in north-east London which was in use at the same time as St John's. A similar spike in adolescents was recorded there.

The adult group included five young adults (18-25), four young middle adults (26-35), five old middle adults (36-45) and four mature adults (46+). Additionally, there were eleven individuals who could only be aged beyond suggesting they were aged eighteen years old or older, due to their fragmentary or incomplete condition. The adult group consisted of ten males/probable males (34.48%) and nine females/probable females (31.03%). The remainder of the individuals were unsexed (34.48%, n=10). The relatively large number of unsexed individuals was due to the incomplete nature of many of the skeletons.

Statures at St John's spanned a very wide range for both sexes. The male average was 174.2 cm, which was slightly taller than the late medieval average of 171 cm calculated by Roberts and Cox (2003, 248). The female mean stature was at 160.3 cm, which was slightly above the late medieval average of 159 cm (*ibid*). The short stature of one of the probable females of African origin (Skeleton 152, 150.1 cm) was noted to be similar to that of another female, who was buried closely by (Skeleton 116, 150.9 cm). Although the latter individual did not have any parts observable, which could help to identify her as of African ancestry, the possibility persists that she was.

One issue arose with one of the graves containing an articulated set of legs. Although the excavation photo of Skeleton 176 (Adult, unsexed) appears to show one individual, articulated burial, the relative size of the femora suggested that these were in fact two individuals. Perhaps the burials intercut each other and thus appear articulated (although it does not seem that way from the photograph). It is unlikely that these belong to the same person.

In terms of pathology, an array of conditions was observed in the St John's cemetery. Four males and a female had developmental anomalies in the form of vertebrae from one part of the spine taking on characteristics of those from another part. Two skeletons had minor cortical defects; one of them (Skeleton 122) had a small depression bilaterally in the glenoids and the other (Skeleton 154) had a minor defect on the right mandibular condyle. Skeleton 221 had a prematurely fused sagittal suture, but

it was unclear whether this had affected her in any way. Two further skeletons had retained sutures that normally fused during early childhood. Other congenital conditions at St John included unfused first sacral vertebrae in Skeletons 113, 116, 122 and 194. Skeleton 194 had a very unusual non-fusion rift running vertically through the middle of the posterior spines of the sacrum.

Evidence for childhood stress was high. Metabolic conditions at St John's included one individual with possible osteomalacia (adult Vitamin D deficiency) and/or residual rickets. This accounted for an overall prevalence of 2.2% of osteomalacia/residual rickets at St John's, which was slightly higher than the late medieval prevalence mean of 0.73% (Roberts and Cox 2003, 247-248). In terms of childhood stress in the form of *cribra orbitalia*, the prevalence rate was above the late medieval average, but comparable with other contemporary hospital sites. Further childhood stress in the form of lines or grooves on the teeth termed dental hypoplasia was observed in half the individuals, which was higher than the medieval mean calculated by Roberts and Cox (2003). Discrepancies arose between the adult prevalence for hypoplasia at St John's and that of St Mary Spital, which was much lower. Hypoplasia affected more females than males, which may have been due to a higher survival rate of females when confronted with childhood health stresses, or due to higher stress on female children.

Evidence for trauma was limited. One fracture affected the right shoulder of a mature adult female of African ancestry, Skeleton 182. The other fracture was a muscle avulsion fracture of the left thigh, which was likely related to the severe Legg-Calve-Perthes disease present in the left proximal femur of the individual (Skeleton 197). This is a circulatory condition which causes necrosis (death) of the ball joint of the thigh bone and which had led to severe secondary arthritis in this individual's left hip. Thus, the overall fracture prevalence rate at St John's was 4.35%. *Osteochondritis dissecans* is a form of trauma usually affecting the joints of adolescents. It was present in four individuals and largely affected the knee, as well as one ankle. Notable were the lesions in Skeleton 194, which were bilaterally present in both knees and this occurrence is quite rare. One mature adult male (Skeleton 104) had non-fusion or a fracture (*spondylolysis*) of part of the fifth lumbar vertebra.

Maxillary sinusitis affected a total of 62.86% of observable sinuses and a third of the population, which was almost three times higher than the late medieval mean. Females were also more commonly affected than men, which corresponds to the contemporary norm (Roberts and Cox 2003, 233), usually due to exposure to domestic fire and pollutants. Two adolescents had inflammatory rib lesions. One of these was likely due to a lung infection, such as pneumonia or pulmonary tuberculosis, while the other had external rib lesions, due to trauma or infection.

Fourteen individuals at St John's had signs of receding inflammatory lesions on their leg long bones. However, one adolescent (Skeleton 185) had active woven new bone affecting almost the entire proximal ulna (elbow). There may have been a fusion of the right radial to the radius, or ossification of the annular ligament – perhaps due to a traumatic incident. Unfortunately, erosion was too severe to be able to determine if there was a fracture present. Inflammatory lesions were discovered in the eye brow region of three male adults of various ages, which may have been due to pubic lice infestations. Two individuals had several inflammatory lesions on the inner surface of the cranium. It was suggested that these may

have been secondary reaction to meningioma, a tumour (Brothwell 1967, 327), but could also have been caused by other brain infections.

Joint disease of the spine affected 55.17% of all adults and was most common in the neck. Least of all affected was the sacral area. Extraspinal degenerative changes were recorded in at least half of the adults, with most of them affecting the shoulders, hips and/or knees. More males had signs of the disease. These patterns were expected, although it was noted that the overall prevalence of joint disease was beyond the late medieval average, and may have been influenced by the fact that this was a hospital site. Spinal osteoarthritis was present in seven individuals. Extra-spinal osteoarthritis affected the jaw of one individual (Skeleton 224), and was found in both knees and the right shoulder of Skeleton 197, the individual with Legg-Calve-Perthes disease. Spinal stress in the form of Schmorl's nodes was present in thirteen individuals, with a prevalence of 44.8% of adults.

Nine individuals at St John's had evidence of either cysts or cystic lesions in their skeleton. These were usually small and affected various parts of the skeleton. One large cystic lesion was present in the hip of Skeleton 224 (mature adult probable male).

Dental health was moderate, with a high prevalence rate of dental plaque concretions compared with the medieval mean calculated by Roberts and Cox (2003, 263), but moderate compared with that of the medieval hospital at St Mary Spital. It was determined that males were generally more affected than females, which was consistent with other sites. The prevalence of cavities at St John's was fairly low at 4.21% overall, which was comparable with Roberts and Cox's (2003, 259) prevalence for late medieval populations, and was slightly lower than that of St Mary Spital for the period. This suggested that individuals buried at St John's had a less cariogenic diet than those at St Mary's in London. In contrast to dental plaque concretions, females were more likely to be affected with cavities when compared to males.

Dental abscesses were rare at Lichfield, with only four of 29 adults affected (13.79%), which was lower than the British average prevalence at the time. Females were equally as affected as males. However, females had higher prevalence of ante-mortem tooth loss, which may be related to the higher prevalence of cavities.

Dental anomalies included a number of impacted milk teeth, which caused permanent dentition either to be moved from their normal position, or to be impacted as well. Enamel defects were recorded in two skeletons and two individuals had crowding of teeth in the lower jaw. Possible nerve damage in one tooth was recorded for one individual and one adolescent (Skeleton 215) had a likely activity-related notch on the upper and lower front teeth.

7.0 FUTURE RECOMMENDATIONS

It is suggested that isotope analysis of the individuals identified as of African or mixed ancestry could provide interesting evidence concerning their 'life history'. Strontium and oxygen analysis, where possible, would likely be able enhance our knowledge of movement and mobility in the late medieval

period. Carbon and nitrogen isotope analysis may be able to shed light on their diet and possible inclusion of C4 plants, which were only common in Africa in the period. Both dietary and origin isotope analysis may also be very informative regarding any other of the individuals with the relevant teeth present to find out more about population movement and diet at the hospital.

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St John's Almshouses, Lichfield, Staffordshire – Osteological Analysis

Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Mbl
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	Lo?	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5

Skeleton Number	107
Preservation	G4: Very Poor; Fragmentation: Heavy
Completeness	15%
Age	7-8 years; Older Juvenile
Sex	-
Stature	-
Non-Metric Traits	Ossicle in Lambdoid (bilateral); Mastoid Foramen Extrasutural (left)
Pathology	The inferior facing surface of the sphenoid body is slightly porous – may be growth related. No other pathology visible due to poor condition of the bone.
Dental Health	14 tooth positions; 9 deciduous teeth present; 21 permanent teeth present; 2 permanent teeth lost post-mortem; 1/21 permanent teeth affected by slight calculus; 4/9 deciduous teeth affected by caries; 2/21 permanent teeth with DEH

	Right Dentition								Left Dentition							
Present	NP	E	P	E	E	PM	E	PM	E	E	-	-	E	P	E	NP
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	0	1	0	0	-	0	-	0	0	-	-	0	1	0	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	NP	E	P	-	E	E	E	E	E	E	E	-	-	P	E	NP
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	L	L	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	Sl	-	-
Wear	-	0	1	-	0	0	0	0	0	0	0	-	-	1	0	-
	Deciduous Right Dentition								Deciduous Left Dentition							
Present	P	-	-	-	-	-	-	-	-	-	-	P	P	P	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	Mb	-	-	-	-	-	-	-	-	-	-	-	-	Mbl	Mb	-
Wear	2	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-
Maxilla	e	d	c	b	a	a	b	c	d	e	a	b	c	d	e	e
Mandible	e	d	c	b	a	a	b	c	d	e	a	b	c	d	e	e

Present	P	P	-	-	-	-	-	P	P	P
Calculus	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	Lm	-
Wear	2	2	-	-	-	-	-	2	2	2

Skeleton Number	110		
Preservation	G3: Poor; Fragmentation: Moderate		
Completeness	70%		
Age	26-35; Young Middle Adult		
Sex	Probable Male		
Stature	166.4+/- 3.94 cm		
Ancestry	Skeleton 110 has several features which potentially point towards African ancestry. Most noticeable of these is the nasal guttering at the lower border of the nasal aperture, the wide bridge of the nose, and the square palate. This cannot be determined with certainty, however, as there is damage to other facial areas which could provide more information. Both femora are fairly straight, apart from a slight, normal anterior curvature.		
Non-Metric Traits	Ossicle in Lambdoid (bilateral); Ossicle at Pterion (bilateral); Mastoid Foramen Extrasutural (bilateral); Accessory Lesser Palatine Foramen (bilateral); Anterior Ethmoid Foramen Extrasutural (bilateral); Posterior Ethmoid Foramen Extrasutural (bilateral)		
Pathology	<p>Skeleton 110 has very slight signs of DJC in the spine, although youthful appearance of articular facets is mostly maintained with fine granularity and only occasional marginal osteophytes.</p> <p>One of the cervical vertebrae (recorded as C3) has a small lytic impression in the right superior facet. It measures c 6.8 mm anterior-posteriorly and 3.6 mm medio-laterally.</p> <p>T12 of Skeleton 110 is lumbarised, meaning that there is a cranial shift of the lumbar-thoracic border.</p> <p>Based on the fact that the surface of the skeleton is generally eroded, it is difficult to notice pathology. However, there are slight lamellar striae visible on the entire shaft of the right femur. This seems to be especially prominent on the anterior and lateral surfaces. Striae are also visible on left and right tibiae, on the medial surfaces (mid-shaft) and on the lateral surface (entire shaft). The left femur is too damaged to observe any cortical changes.</p> <p>In the mandible, both second premolars are missing. This may either be due to congenital absence, impaction or AMTL (unlikely based on age of the individual). This absence is conspicuous due to symmetry.</p>		
Dental Health	<p>32 tooth positions; 20 teeth present; 5 teeth present with root only; 5 teeth lost post-mortem; 2 teeth lost ante-mortem or impacted, or congenitally absent; No teeth affected by calculus; 1/26 teeth affected by caries; 4/ 20 teeth with DEH</p> <p>There is evidence of slight periodontal disease in the mandible.</p>		
	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;">Right Dentition</td> <td style="width: 50%; text-align: center;">Left Dentition</td> </tr> </table>	Right Dentition	Left Dentition
Right Dentition	Left Dentition		

Present	P	P	P	P	P	PM	PM	P	PM	PM	PM	P	P	P	P	P
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	L	L	-	-	-	-	-	-	-	-	-	-	-	-	L	L
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	3	4	4	4	3	-	-	4	-	-	-	3	4	5	4	3
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	P	P	P	AM/IMP	RO	P	RO	RO	RO	RO	P	P	AM/IMP	P	P	P
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	4	4	4	-	-	4	-	-	-	-	3	3	-	6	4	4

Skeleton Number	113
Preservation	G3: Poor; Fragmentation: Moderate
Completeness	85%
Age	26-35; Young Middle Adult
Sex	Probable Male
Stature	171.4 +/- 2.99 cm
Ancestry	Skeleton 113 has nasal guttering in the left anterior nasal spine, while the right side is a more defined edge. Possibly African or mixed ancestry?
Non-Metric Traits	Parietal Foramen (bilateral); Foramen of Huschke (left); Double Anterior Condylar Canal (bilateral); Incomplete Foramen Ovale (bilateral); Maxillary Torus (bilateral); Mandibular Torus (left); Exostosis in Trochanteric Fossa (right), Medial Tibial Squatting Facet (bilateral)
Pathology	<p>Skeleton 113 has a small lytic lesion on the posterior superior margin of L5. This is circular in shape and has hollowed out a small area immediately inferior to the rim of the body. It measures 3 mm superior-inferiorly and 5.6 mm medio-laterally. This is similar to the one in Skeleton 122.</p> <p>There is a circular lesion on the medial condyle of the right distal femur, on the articular surface. It is located approximately mid-condyle but touches on the laterally –facing side of the intercondylar notch on its posterolateral aspect. The lesion measures 22 mm anterior-posteriorly and 18.9 mm medio-laterally. Although the hollowed out lesion shows trabecular bone, this appears smooth and rounded, with patches of denser bone similar to the articular surface. The rim is also rounded and a shallow depression circulates the medial and posterior sides of the lesion. Within the lesion, there is eburnation present (articulated with bone fragment described below). – Osteochondritis dissecans.</p> <p>A small, round flattish fragment of bone was recovered with the right leg, which appears to be the 'joint mouse' (named because of the high pitched noise the articulation causes in the joint) of the above mentioned OD lesion. The small piece of bone is roughly circular in shape, with distinct trabecular bone on one side, the other appears to be joint surface. The exposed trabecular is polished (eburnation) and smooth. A few spicules of new bone are present on the margins.</p>

		<p>Lamellar striae are visible on the proximal mid-shaft of the right femur. These are located mostly on the distal end, but too much damage obstructs the view of the true extent. These striae are also visible on the lateral mid-shaft of the right tibia. On the left tibia, striae are visible on the lateral proximal surface. There is only slight evidence for striations visible on the proximal mid-shaft and antero-medial and -lateral surfaces of the left femur.</p> <p>On the antero-proximal right humerus, there is an excavated muscle attachment at the site of the latissimus dorsi. This is longitudinal and vertical, measuring 29.1 mm superior-inferiorly x 2.7 mm medio-laterally.</p> <p>There are Schmorl's nodes present in T4-T10 (except T7), but there is no OA.</p> <p>S1 is bifid.</p> <p>There is very slight <i>cribra orbitalia</i> in the antero-intermediate and medio-lateral areas of both orbits.</p> <p>Slight sinusitis is present in both sinuses.</p>															
Dental Health		32 tooth positions; 29 teeth present; 2/32 teeth lost post-mortem; 1/32 teeth lost ante-mortem; 10/29 teeth affected by flecks to slight calculus; 1/29 teeth affected by caries; No teeth with DEH															
	Right Dentition								Left Dentition								
Present	P	P	P	P	P	P	PM	P	PM	P	P	P	P	AM	P	P	
Calculus	-	-	-	-	-	Fd	-	-	-	-	-	-	-	-	-	-	
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Wear	3	3	6	3	3	2	-	5	-	4	4	2	2	-	4	3	
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Present	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
Calculus	Sml	Fl	Fd	-	-	-	-	-	Fd	-	-	Fm	Fl	Fl	Sm	Sld	
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	Sd	-	-	
Wear	3	5	6	3	2	3	3	4	4	3	4	2	3	4	4	3	

Skeleton Number	116
Preservation	G4: Very Poor; Fragmentation: Heavy
Completeness	60%
Age	36-45; Old Middle Adult
Sex	Probable Female
Stature	150.9 +/- 3.75 cm
Non-Metric Traits	Ossicle in Lambdoid (bilateral); Metopic Suture; Ossicle at Pterion (bilateral); Mastoid Foramen Extrasutural (bilateral)
Pathology	Skeleton 116 has slight joint degeneration, mostly in the form of slight osteophytes. However, there is also some OA present in the upper thoracic spine with T3, T4, and T5 involved (only articular facets). This also

	<p>includes porosity.</p> <p>S1 has not fused and is thus bifid. Both sides are fused to the anterior aspects of S2.</p> <p>This individual has auricular surfaces which show different stages of ageing. While the left a.s. is generally coarsely granular without striae or billowing, the right auricular surfaces seems younger, with some deep striae and more regular – although the granulations seem similar in size. As Skeleton 116 also has coxa vara and a 1cm longer left femoral shaft, the individual's asymmetry has potentially contributed to the asymmetry in the age of the auricular surface.</p> <p>Skeleton 116 has coxa vara, as the angle of the femoral neck and head is at approx. 90 degrees to the shaft. The femoral trochanter is thus at the same height as the femoral head (highest point). Both femora also seem to have exaggerated anterior bowing which may exceed normal variation and indicate residual rickets or osteomalacia. This exaggerated bowing is especially noticeable in the distal shaft.</p> <p>Inside the right acetabulum, there is a small lytic lesion. The bone on the proximal surface of the lunate surface, immediately inferior of the iliac crest, is destroyed with macroporosity (smooth edges) which look lytic. The area measures 16.2 mm anterior-posteriorly at its longest extent and is max 6.9 mm medio-laterally wide.</p> <p>There is a lytic lesion in the centre of the proximal radial articular surface. This is circular and has a diameter of 4.3 mm. It is hollowed out and smoothed trabecular spicules are visible (sub-chondral cyst?)</p> <p>Slight sinusitis in right maxillary sinus.</p>															
Dental Health	18 tooth positions; 6 teeth present; 1 tooth present with root only; 11/18 teeth lost post-mortem; 8 teeth lost ante-mortem; No teeth affected by calculus; 1/6 teeth affected by caries; 1 tooth not present															
	Right Dentition								Left Dentition							
Present	-	-	AM	P	P	PM	PM	PM	PM	P	P	PM	AM	AM	AM	P
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Sd
Wear	-	-	-	5	4	-	-	-	-	3	3	-	-	-	-	4
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	NP	AM	AM	PM	PM	PM	-	-	P	-	PM	PM	PM	AM	AM	RO
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
Skeleton Number	119															
Preservation	G3: Poor; Fragmentation: Moderate															
Completeness	<5%															
Age	18+; Adult															

Sex	Undetermined
Stature	-
Non-Metric Traits	-
Pathology	-
Dental Health	-

Skeleton Number	122
Preservation	G5: Very Severe; Fragmentation: Moderate
Completeness	75%
Age	26-35; Young Middle Adult
Sex	Male
Stature	167.8 +/- 3.27 cm
Non-Metric Traits	Parietal Foramen (right); Ossicle at Parietal Notch (right); Mastoid Foramen Extrasutural (right); Double Anterior Condylar Canal Open (bilateral); Accessory Lesser Palatine Foramen (bilateral); Maxillary Torus (right); Mandibular Torus (right); Absent Zygomaticofacial Foramen (right); Accessory Supraorbital Foramen (right); Double Anterior Calcaneal Facet (left); Double inferior Talar Facet (bilateral)
Pathology	<p>There is hypervascularity on the orbital rims and the glabella. Periosteal reaction.</p> <p>There are slight DJCs in the lower thoracic spine (T9 (I), T10 (I), T11 (S)) There are some small, but well defined Schmorl's nodes visible on the bodies. In the lumbar spine, there are Schmorl's nodes on L1, L2 (S), L3 and L4. These are also well defined due to the otherwise good condition of the vertebrae.</p> <p>On L5, there is a small lytic lesion present on the superior margin of the posterior body. This looks like a Schmorl's node but is obviously not located on the vertebral body, but at the rim. It has destroyed part of the margin of the body and measures 13.4 mm medio-laterally and 3.1 mm superior-inferiorly.</p> <p>L5 also has extreme DJC on the right inferior facet, which is mirrored in its severity in the articulating right superior facet of S1. Heavy new bone formation surrounds the facet which appears larger and less curved laterally than its left counterpart – which is completely unaffected by change. Mid-facet, there is a large area of porosity/exposure of trabecular bone, and eburnation. This porous area measures 16.5 mm superior-inferiorly and 7.4 mm medio-laterally and is located in the centre of the enlarged facet.</p> <p>In S1, the right superior facet is also less curved and almost flat. Almost the entire enlarged surface is porous, and affected by eburnation. It is possible that there is a fracture of the facet, or a developmental issue such as spondylolysis underlying the heavy deformation. The spine of S1 is also bifid.</p> <p>In both scapulae, the glenoids are marked by a small, circular lesion in the centre of the articular surface. In the right side, this measures 6 mm in diameter, in the left it is more longitudinal (6.4 mm x 1.6 mm, horizontally). – Developmental rather than infectious.</p> <p>Some slight porosity (possibly subchondral destruction) in both acetabuli, on the superior demiface of the lunate surface; c. 3mm in diameter.</p>

	<p>Lamellar striae are found covering the lateral mid-shaft of the right femur. These striae may extend to the anterior surface, although this is less visible due to the erosion of the cortical bone. There is also well healed lamellar bone visible on the medial surface of the mid-shaft.</p> <p>Very distinct lamellar striae are covering the anterior lateral aspect of the mid-shaft of the left tibia. Unfortunately most of the anterior crest is eroded and no cortical surface remains. As the same kind of striae are visible on the anterior aspect of the medial side, it is likely that these cover the crest as well.</p> <p>In the left femur the lamellar striae are visible on the posterior mid-shaft. There is bilateral <i>cribra orbitalia</i> present and slight sinusitis.</p>																
Dental Health	<p>30 tooth positions; 30/30 teeth present; No teeth lost post-mortem; 26/30 teeth affected by flecks to medium calculus; 2/30 teeth affected by caries; 2 teeth not present.</p> <p>Slight crowding with canines (medial side) pushing anteriorly beyond L+R second mandibular incisors. slight periodontists</p>																
	Right Dentition								Left Dentition								
Present	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	
Calculus	Sb	-	Fb	-	Sa	Fm d	Fm d	-	-	Fm d	Fm d	Fmd l	F d	Fm l	Fml d	Fl	
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Wear	2	3	6	5	4	4	4	4	4	4	4	4	4	5	5	3	2
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Present	N P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	N P	
Calculus	-	Fm l	Fl b	F a	F a	Fa	Sa	M a	M a	Sa	Fd	Fa	Fb	Fl	Fm	-	
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Caries	-	Sl	-	-	-	-	-	-	-	-	-	-	-	-	Sl	-	
Wear	-	4	5	4	4	3	3	4	4	3	3	2	4	5	4	-	

Skeleton Number	125
Preservation	G4: Very Poor; Fragmentation: Severe
Completeness	65%
Age	12-15; Adolescent
Sex	-
Stature	-
Non-Metric Traits	Double Anterior Condylar Canal Open (bilateral); Accessory Supraorbital Foramen (right); Posterior Ethmoid Foramen Extrasutural (left); Double Anterior Calcaneal Facet (left)
Pathology	There are small arachnoid granulations on the endocranial surface of the frontal bone on the right side. Size c. 4 mm superior-inferiorly and 3.9 mm medio-laterally.

	<p>Slightly abnormal maxillozygomatic joint at the inferior margin of the right orbit. The maxilla here does not seem to have fused smoothly with zygomatic bone at the suture, which seems to be folded over each other. Thus, the surface is irregular.</p> <p>On the distal epiphysis of the right tibia, there is an osteochondritis dissecans lesion on the lateral, distal aspect of the surface. It measures 6.2 mm anterior-posteriorly and 4 mm medio-laterally. It is oval in shape and there is trabecular bone visible below the joint surface in the affected area.</p> <p>There is extremely porous bone visible in the distal femoral diaphyses superior to the medial and lateral condylar posterior processes. On the right, this extends to c 15 mm above the diaphysis end and tapers outward distally. Some more rough lamellar bone surrounds this area – this is especially noticeable on the medial aspect. Porous woven bone is also visible on the proximal and distal ends of the diaphyses on all sides. This has turned into striae, but is not integrated into the cortical bone yet and is still porous.</p>
Dental Health	<p>32 tooth positions; 32 teeth present; No teeth lost post-mortem; 8/32 teeth affected by flecks to slight calculus; 23/32 teeth with DEH; 4 teeth erupting</p> <p>There is slight asymmetry in the teeth with the RM² larger than LM² (8.8 mm m – l; RM² 9.6 mm medio-laterally).</p>

	Right Dentition								Left Dentition							
Present	E	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E
Calculus	-	Fb	Fd	-	-	-	-	-	-	-	-	-	Fd	Fb	-	-
DEH	-	L	L	G	-	G	G	L	L	G	G	L	-	L	L	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	3	3	2	2	1	1	2	2	2	1	2	2	3	3	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	E	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E
Calculus	-	Fl	Fl	-	-	-	-	Sbd	-	Fb	-	-	-	-	-	-
DEH	-	-	L	-	G	G	L	L	L	L	L,G	L	-	L	G	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	2	2	2	2	2	2	3	3	3	2	2	2	3	2	-

Skeleton Number	128
Preservation	G4: Very Poor; Fragmentation: Moderate
Completeness	70%
Age	26-35; Young Middle Adult
Sex	Probable Male
Stature	167.8 +/- 3.27 cm
Non-Metric Traits	Ossicle at Lambda; Ossicle in Lambdoid (bilateral); Parietal Foramen (right); Mastoid Foramen Extrasutural (right); Precondylar Tubercle; Accessory Supraorbital Foramen (right); Septal Aperture (right); Medial Tibial Squatting Facet (bilateral); Double Anterior Calcaneal

	Facet (right); Double Inferior Talar Facet (right)
Pathology	<p>The vertebrae are in generally good condition, apart from some slight DJC. There is a small lytic impression in the inferior left facet of T10 which is longitudinal in shape, measuring 5.9 mm medio-laterally and 0.5 mm superior-inferiorly.</p> <p>Porosity is visible on right supraorbital ridge. This is noticeably covered in small pin-prick sized holes, some slightly larger. It extends to c. 15.5 mm above the orbital rim, but the true extent is unknown due to erosion.</p> <p>There is slight <i>cribra orbitalia</i> in the right orbit. Slight sinusitis also present.</p>
Dental Health	<p>32 tooth positions; 27 teeth present; 5/32 teeth lost post-mortem; 20/27 teeth affected by flecks to slight calculus; 3/27 teeth affected by caries</p> <p>Some small enamel defects are present in the mandibular left first molar (buccally, in the fissure – small, smooth hole), in the left second molar (also buccally, inside the fissure) and in the left third molar (inside distal fissure of the occlusal surface).</p>

	Right Dentition								Left Dentition							
Present	P	P	P	P	P	P	PM	PM	PM	P	PM	P	P	P	P	PM
Calculus	-	Sl	Slb	Sl	-	Sb	-	-	-	Sb	-	-	-	Sl	Sl	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	2	3	3	3	3	4	4	-	-	-	-	-	-	3	2	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	p
Calculus	Fl	Sl	Sl	Sl	Sa	Sb	Sb	Sb	-	Sb	Sb	Fl	-	Sl	Sl	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	MbSdo	-	So	-	-	-	-	-	-	-	-	-	-	-	-	Sb
Wear	2	2	4	3	3	4	3	3	-	3	4	2	2	4	2	2

Skeleton Number	131
Preservation	G2: Moderate; Fragmentation: Moderate
Completeness	10%
Age	4-6; Young Juvenile
Sex	-
Stature	-
Non-Metric Traits	Ossicle in Lambdoid (right); Metopic Suture; Absent Zygomaticofacial Foramen (right)
Pathology	<p>The right mandible exhibits several areas of porous bone – especially around the condyle/condylar neck and along the inside surface proximally of the lingual – may be related to growth.</p> <p>Moderate sinusitis in right sinus.</p>
Dental Health	7 tooth positions; 8 deciduous teeth present; 7 permanent teeth present;

		Two teeth lost post-mortem; 1/8 teeth affected by flecks of calculus; 4/7 permanent teeth with DEH														
		Right Dentition							Left Dentition							
Present	-	-	P	-	-	-	-	P	-	-	-	-	-	P	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	P	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	P	-	-	-	-	-	L	-	-	-	-	L,P	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	P	-	-	-	P	PM	P	-	-	-	-	P	-	-
		Deciduous Right Dentition							Deciduous Left Dentition							
Present	P	P	-	-	-	-	-	-	-	-	-	-	P	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	1	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-
Maxilla	e	d	c	b	a	a	b	c	d	e	a	b	c	d	e	
Mandible	e	d	c	b	a	a	b	c	d	e	a	b	c	d	e	
Present	P	P	P	PM	P	-	-	-	P	-	-	-	P	-	-	-
Calculus	Fb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	2	1	1	-	3	-	-	-	2	-	-	-	2	-	-	-

Skeleton Number	134
Preservation	G3: Poor; Fragmentation: Moderate
Completeness	<10%
Age	18+; Adult
Sex	F?
Stature	-
Non-Metric Traits	Parietal Foramen (bilateral); Mastoid Foramen Extrasutural (left)
Pathology	Skeleton 134 has OA in the neck area (C2 and C3), in the form of eburnation.

	<p>There are several arachnoid granulations on the endocranial surface of the skull on both sides of the sagittal suture and the sagittal sulcus. Max diameter is 4.2 mm, and they are circular in shape. There are three smooth depressions inside the frontal bone – two are located just right of the metopic suture (not present), at the mid-suture. One other groove is more proximally placed, to the left of the metopic suture. They measure 11.6 mm in length and 4.6 mm in width. They are quite shallow and may have to do with blood collection in those areas.</p> <p>There is slight <i>cribra orbitalia</i> in the left antero-medial, –lateral and intermediate lateral areas of the orbit.</p>															
Dental Health	11 tooth positions; 2 teeth present (roots only); 9 teeth lost post-mortem; 5 teeth lost ante-mortem															
	Right Dentition								Left Dentition							
Present	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	NP	AM	AM	PM	PM	PM	PM	PM	PM	PU	PU	PM	PM	AM	AM	PM
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Skeleton Number	137
Preservation	G4: Very Poor; Fragmentation: Heavy
Completeness	<10%
Age	7-12; Older Juvenile
Sex	-
Stature	-
Non-Metric Traits	Ossicle in Lambdoid (left); Posterior Condylar Canal Open (bilateral)
Pathology	<p>Skeleton 137 has DEH on almost all permanent teeth which are present. Unfortunately, the enamel is very brittle and comes off the dentine in chips.</p> <p>There is slight sinusitis present in both sides as evidenced by small spicules of bone.</p> <p>There is slight <i>cribra orbitalia</i> visible on a fragment of the left orbit, but the true extent cannot be determined.</p> <p>The bone surface is in very poor condition, so no superficial pathology could be observed.</p>
Dental Health	28 tooth positions; 26 teeth present; 2 deciduous teeth present; 1/28 tooth lost post-mortem; 23/26 permanent teeth with DEH; 5 teeth not present; 4 teeth erupting;

	Right Dentition								Left Dentition							
Present	NP	P	P	P	P	P	P	P	P	P	P	PM	P	P	E	NP
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	L	L	L	L	L	L	L	-	-	L	-	L	L	L	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	1	1	1	1	1	2	1	1	1	-	1	1	-	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	NP	E	P	P	E	P	P	P	P	P	P	P	NP	P	E	NP
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	L	L	-	L	L	L	L	L	L	L	L	-	L	L	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	0	1	0	1	1	1	2	2	1	1	1	-	1	0	-

Skeleton Number	140															
Preservation	G2: Moderate; Fragmentation: Moderate															
Completeness	<10%															
Age	5-6; Younger Juvenile															
Sex	-															
Stature	-															
Non-Metric Traits	Ossicle in Lambdoid (bilateral); Accessory Lesser Palatine Foramen (left)															
Pathology	<p>There is slight porosity visible on the inferior surface of the central pars basilaris which may be growth related.</p> <p>There is also slight <i>cribra orbitalia</i> present in the left orbit (right not present for analysis). This is expressed by small, scattered pin-prick sized foramina which are found across the entire roof of the orbit.</p> <p>Skeleton 140 has slight sinusitis in the form of new bone spicules in both maxillary sinuses.</p>															
Dental Health	<p>13 tooth positions; 8 permanent teeth present; 9 deciduous teeth present; 5/9 deciduous teeth lost post-mortem; 7/8 permanent teeth with DEH; 2/30 teeth affected by caries; 5 teeth not present.</p> <p>Skeleton 140 has DEH on almost all permanent teeth which are present for study. This is especially noticeable on latest-forming maxillary right and left second molar - perhaps prolonged stress before death?</p> <p>The left and right maxillary second molars are also longitudinally reduced in width and do not adhere to the normal shape. DEH grooves present.</p>															
	Right Dentition								Left Dentition							
Present	NP	E	P	-	-	-	-	-	-	-	-	-	-	P	E	NP
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	G,P	G	-	-	-	-	-	-	-	-	-	-	G,P	G,P	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	0	1	-	-	-	-	-	-	-	-	-	-	1	0	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-

Skeleton Number	149															
Preservation	G3: Poor; Fragmentation: Moderate															
Completeness	5%															
Age	18+; Adult															
Sex	Undetermined															
Stature	-															
Non-Metric Traits	Parietal Foramen (right); Mastoid Foramen Extrasutural (right)															
Pathology	<p>Skeleton 149 has several endocranial lesions or foci on the left parietal surface. The larger one of two visible is located in the centre of the parietal. It measures 18.7 mm superior-inferiorly and 13.7 mm anterior-posteriorly. The edges are smooth and sloping, and smooth trabecular bone of the diploe is exposed inside the lesion. Both of them are quite shallow and only affect the inner table, not the outer table.</p> <p>A smaller focus is located more distally towards the temporal suture. It measures 6 mm superior-inferiorly and 6 mm medio-laterally. Although both lesions are roughly circular in shape, the edges are irregular.</p> <p>A third lesion is located on the endocranial surface of the occipital planum, within the superior sulcus of the occipital crest. The edges of this lesion are difficult to make out due to taphonomic damage, but it seems to be concentrated on the superior sulcus and it measures 14.4 mm anterior-posteriorly and 8 mm medio-laterally. These lesions may be secondary reaction to meningioma or localised periostitis?</p> <p>On the mid-right parietal bone, c 5 cm from the sagittal suture, there is a circular pit with smooth edges, which is quite deep and measures c 3.9 mm in diameter. This may be an isolated, extreme arachnoid granulation, but it might also be a lytic lesion.</p> <p>On the left end of the coronal suture, there is a sheet of new bone formation visible on the ectocranial surface. This seems to extend from the left parietal to the left frontal bone. This 'sheet' of bone is smooth and dense and looks cortical in appearance, well integrated. The true extent is unknown, however, due to taphonomy and damage. It covers at least 45 mm of the left end of the coronal suture. May be an ossified haematoma.</p>															
Dental Health	1 tooth position; 3 teeth present; all loose; No teeth lost post-mortem; 2 teeth lost AM; 1/3 teeth with DEH															
	Right Dentition								Left Dentition							
Present	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

Present	NP	P	AM	AM	P	-	-	-	-	-	P	-	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	L	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	4	-	-	4	-	-	-	-	-	4					-

Skeleton Number	152															
Preservation	G4: Very Poor; Fragmentation: Moderate															
Completeness	40%															
Age	18+; Adult															
Sex	Possible Female															
Stature	150.1 +/- 3.70 cm															
Ancestry	Skeleton 152 has a very long and narrow skull and nasal guttering, which suggests possible African or mixed ancestry.															
Non-Metric Traits	Ossicle in Lambdoid (right); Parietal Foramen (bilateral); Ossicle at Bregma; Accessory Infraorbital Foramen (bilateral)															
Pathology	<p>In the vicinity right and left of the right and left mental eminence along the inferior margin of the mandible, there are two small, round protuberances, which may be enthesal changes or of genetic origin.</p> <p>No cribra visible, but slight bilateral sinusitis.</p> <p>Skeleton 152 is the only skeleton excavated who was buried prone, albeit in a severely twisted position, with the legs turned in supine direction and flexed at the knees.</p>															
Dental Health	<p>24 tooth positions present; 19/24 teeth present; 3/24 teeth not present; 6/24 teeth lost ante-mortem; 3/19 teeth affected by flecks of calculus, 18/19 teeth with DEH; 2/24 teeth present with pulp only.</p> <p>One small abscess in right mid mandibular body in area of mandibular symphysis, just mesial of RI₁ root – measures c 3mm a-i and 1mm medio-laterally. Larger periapical abscess in right maxilla at root end of RP¹, which was lost post-mortem. slight periodontists</p>															
	Right Dentition								Left Dentition							
Present	-	-	P	P	PM	P	P	P	P	P	PU	PM	P	P	P	PM
Calculus	-	-	Fb	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	L	-	L	L	L	L	L	-	-	L	L	L	-
Caries	-	-	-	Mm	-	-	-	-	-	-	-	-	-	-	Mdo	-
Wear	-	-	3	2	-	4	4	4	4	4	-	-	2	2	2	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	AM	AM	AM	AM	P	P	P	P	P	P	P	P	P	AM	AM	PU
Calculus	-	-	-	-	-	-	-	Flb	Flb	-	-	-	-	-	-	-
DEH	-	-	-	-	-	L	L	L	L	L	L	L	L	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-		-	/	4	4	4	4	4	4	3	3	-	-	-

Skeleton Number	155															
Preservation	G3: Poor ; Fragmentation: Moderate															
Completeness	50%															
Age	14-15; Adolescent															
Sex	-															
Stature	-															
Non-Metric Traits	Ossicle in Lambdoid (right); Parietal Foramen (bilateral); Double Anterior Condylar Canal (right)															
Pathology	<p>On the posterior facing surface of the ribs of both sides there slight striated lamellar bone visible, on the mid-shaft. This is generally very slight and not immediately noticeable. Possibly related to growth? It is very well integrated into the cortex and only visible in fine lines.</p> <p>There is also some porotic new bone on the lateral surface of both ilia, proximally of the unfused acromion. Area roughly covers 20mm a-l along the inferior gluteal line. It is expressed slightly stronger on the left ilium and includes large foramina. While there are also large foramina on the right ilium, they are less frequent and smaller.</p> <p>Both unfused distal radial epiphyses show signs of slight woven bone and porous bone on the articular surface and along the margins. This is greyish in colour and especially prominent on the anteromedial margin.</p> <p>Porous bone also around the posterior proximal shaft of the right femur, around the unfused surface of the lesser trochanter.</p>															
Dental Health	16 tooth positions present; 14 teeth present; 3/16 teeth lost post-mortem; 12/14 teeth with DEH; 1/16 teeth present with pulp only; 2/14 teeth affected by moderate cavities.															
	Right Dentition								Left Dentition							
Present	P	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	L	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	2xMo	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	P	P	P	P	P	P	PM	PU	PM	PM	P	P	P	P	P	P
Calculus	-	Mo	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	L	L	G	G	G	-	-	-	-	G	G	G	L	L	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	0	3	4	2	2	2	-	-	-	-	3	2	2	4	3	0

Skeleton Number	158															
Preservation	G2: Moderate; Fragmentation: Slight															
Completeness	25%															
Age	18-25; Young Adult															

Sex	Undetermined
Stature	-
Non-Metric Traits	Posterior Condylar Canal open (bilateral); Accessory Lesser Palatine Foramen (bilateral); Anterior Ethmoid Foramen Extrasutural (left); Double Atlas Facet (bilateral)
Pathology	<p>Slight porosity around both mandibular lingula, especially just anteriorly (approx 9mm anterior-posteriorly).</p> <p>There is also some irregular new bone visible below the zygomatic arch on the temporal bones, anterior to the temporo-mandibular joint. It has an irregular appearance but has slightly smoothed over areas. On both sides, new bone is exclusively on the temporal bone, not the sphenoid.</p> <p>The jugular growth plate of this individual has fused but the proximal humeral epiphysis has not fused to the diaphysis yet. Appears to be in the early 20s.</p> <p>Skeleton 158 has slight sinusitis as expressed by spicules of bone in both sinuses. It also has <i>cribra orbitalia</i> in both orbits in the form of small foramina scattered in the anterolateral area of the orbits.</p>
Dental Health	<p>29 tooth positions present; 29 teeth present; 2/29 teeth with dental enamel hypoplasia; 25/29 teeth affected by calculus; 3 teeth not present (impacted or congenitally absent), slight periodontitis</p> <p>There is a reverse v-shaped groove visible on the lingual surface of the maxillary right and left second incisor. Likely genetic.</p>

	Right Dentition								Left Dentition							
Present	NP	P	P	P	P	P	P	P	P	P	P	P	P	P	P	NP
Calculus	-	-	Flb	Slb	-	Fm	Fl	Sb	Sl	Fl	Fl	-	Flb	Slm	Sm	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	Sb	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	1	3	2	2	3	3	4	4	3	3	2	2	3	2	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	NP	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Calculus	-	Fl	Sl	Fb	Fb	Fl	Flb	Sm	Sl	Sl	Sb	Sl	Sl	Sl	Sl	-
DEH	-	-	-	-	-	G	-	-	-	G	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	2	3	2	2	3	4	4	4	4	3	2	2	4	3	2

Skeleton Number	161
Preservation	G4: Very Poor; Fragmentation: Slight
Completeness	60%
Age	15-16; Adolescent
Sex	-
Stature	-
Non-Metric Traits	Ossicle in Lambdoid (bilateral); Parietal Foramen (right); Ossicle at Parietal Notch (right); Foramen of Huschke (bilateral); Mastoid Foramen Extrasutural (right); Accessory Lesser Palatine Foramen (bilateral);

	Bridging of Supraorbital Notch (right); Accessory Supraorbital Foramen (bilateral); Accessory Infraorbital Foramen (left); Allen's Fossa (left)
Pathology	<p>Skeleton 161 has slight porosity in retroauricular area, bilaterally. This is focussed in two areas – firstly along the retroauricular line towards the iliac tuberosity, covering a strip of max 8mm and min 2 mm. This strip is following the auricular surface margin and becomes less wide along the inferior demiface. Secondly, on the raised area of the iliac tuberosity, which is almost completely covered by it.</p> <p>There is one left mid-shaft rib fragment which shows woven bone on the visceral, inner surface. As the fragment is only 74 mm long, the true extent of the reaction is not known. It is also unclear which exact rib it is – likely a central rib. Erosion also affects some of the area. The distinct patch of woven bone covers 8.1 mm longitudinally and 1.4mm superior-inferiorly. This was originally likely a larger area, but cannot be observed clearly. This woven bone may indicate a periosteal reaction.</p> <p>S1 is bifid; even though individual is young, it is noticeable that the arch of S1 is not fused together. This is because the left arch does not seem to be damaged and was never fused to the right arch.</p> <p>There is <i>cribra orbitalia</i> in the form of small foramina on the antero-intermediate are of both orbits. The sinuses of this individual are complete and thus are not observable.</p>
Dental Health	<p>32 tooth positions; 30/32 teeth present; 2/30 teeth lost post-mortem; 8/30 teeth affected by flecks or slight calculus</p> <p>The root of the right mandibular first premolar has turned black – possibly nerve damage? No signs of damage visible.</p>

	Right Dentition								Left Dentition							
Present	U	P	P	P	P	P	PM	P	P	PM	P	P	P	P	P	U
Calculus	-	Sb	Sbm	-	-	-	-	-	-	-	-	Fm	-	Sbm	Sb	-
DEH	-	L	L	-	-	L	-	L	L	-	L	-	-	L	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	2	2	2	2	1	-	2	2	-	2	2	2	3	2	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	U	P	P	P	P	P	P	P	P	P	P	P	P	P	P	U
Calculus	-	-	-	-	-	-	Fb	Flm	Fb	-	-	-	-	-	-	-
DEH	-	L	L	L	-	L	-	L	L	-	L	-	L	L	L	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	1	3	2	2	2	1	2	2	1	2	2	2	3	3	-

Skeleton Number	164
Preservation	G2: Moderate; Fragmentation: Moderate
Completeness	55%
Age	18-25; Young Adult
Sex	Male
Stature	175.2 +/- 4.05 cm
Non-Metric Traits	Ossicle in Lambdoid (right); Parietal Foramen (bilateral); Mastoid

		Foramen Extrasutural (bilateral)															
Pathology		<p>There are Schmorl's nodes on the vertebral bodies of most of the thoracic and lumbar spine. This starts with a slight node on T3, on the superior body and ends in the last available lumbar vertebra, L4. The nodes are expressed most severely in T12-L2 (i.e. T11 (I) and T12 (S)). In T11 (I) and T12 (S), it measures 28.4mm medio-laterally and 17.3mm anterior-posteriorly. It is triangular in shape, with the longest side posteriorly. This is mirrored in the superior articulating body of T12.</p> <p>There is also a cranial shift of the thoracic-lumbar border, with T11 looking like T12 and T12 with the appearance of L1, albeit with rib facets on the mid body, laterally.</p> <p>On the inferior posterior margin of the right glenoid there is a lytic lesion along the edge of the articular surface. This has three larger hollows on one very shallow hollow on the superior aspect. They are closely linked and thus appear to be one longitudinal lesion. This measures 19.2mm superior-inferiorly and 2.3mm medio-laterally.</p> <p>On the right condyle of the mandible, a small circular pit of 2mm diameter is noticeable. It is smooth and well integrated into the condylar surface and it is located medially. Likely developmental</p>															
Dental Health		<p>19 tooth positions present; 19 teeth present, 1 loose; 1 tooth lost post-mortem; 1 tooth lost ante-mortem; 8/19 teeth affected by flecks or slight calculus.; 6/19 teeth with DEH; 2 teeth not present.</p> <p>Slight periodontal disease in anterior mandible</p>															
		Right Dentition								Left Dentition							
Present	PM	P	P	-	-	-	-	-	-	-	-	-	-	P	P	P	P
Calculus	-	Fd	-	-	-	-	-	-	-	-	-	-	-	-	-	Sl	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	4	5	-	-	-	-	-	-	-	-	-	-	3	5	2	1
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Present	NP	P	P	P	P	P	P	P	P	P	P	P	P	AM	P	P	NP
Calculus	-	-	-	-	-	Sb	Fb	Fb	Fmd	Sdm	Fdm	-	-	-	-	-	
DEH	-	L	L	L	-	L	-	L	L	-	L	-	L	L	L	-	
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Wear	-	1	3	2	2	2	1	2	2	1	2	2	2	3	3	-	

Skeleton Number	167
Preservation	G4: Very Poor; Fragmentation: Slight
Completeness	30%
Age	7-12; Older Juvenile
Sex	-
Stature	-
Non-Metric Traits	-
Pathology	Due to severely degenerated cortical preservation limited available bone,

	no pathology was observed. Age determined using long bone length: 8.5 to 9.5 years old.
Dental Health	-

Skeleton Number	170
Preservation	G3: Poor; Fragmentation: Moderate
Completeness	20%
Age	14-16; Adolescent
Sex	-
Stature	-
Non-Metric Traits	-
Pathology	<p>This set of lower limbs is similar to Skeleton 167 in that it is poorly preserved and it is likely an adolescent. This individual is slightly older than Skeleton 167 buried to his/her right, but this is based on one single bone measurement.</p> <p>Cortical preservation does not allow for much observation of pathology, but there are some distinct lamellar striae noticeable along the medial surface of the left tibial shaft. This is fine-looking, but much more distinct than anywhere else in this skeleton.</p>
Dental Health	-

Skeleton Number	173
Preservation	G: Poor; Fragmentation: Moderate
Completeness	10%
Age	18-25; Young Adult
Sex	Undetermined
Stature	-
Non-Metric Traits	-
Pathology	Lamellar striae are visible on both posterior femora, just proximal of the condyles. These are slight in appearance and quite smooth – well healed as they are well integrated into the cortical bone.
Dental Health	-

Skeleton Number	176
Preservation	G3: Poor; Fragmentation: Moderate
Completeness	10%
Age	18+; Adult
Sex	Undetermined
Stature	-
Non-Metric Traits	-
Pathology	Although the excavation photo of Skeleton 176 appears to show one individual, articulated burial, the relative size of the femora suggests that these are in fact two individuals. Perhaps the burials intercut each other and thus appear articulated (although it does not seem that way from the

	<p>photo). It is highly unlikely that these belong to the same person. Yet, it is clear from size and shape that the right ischium belongs to the right femur and vice versa on the left side. The same is confirmed for the proximal tibiae, which belong to the respective femur.</p> <p>Well integrated lamellar bone striae visible on the cortical bone of the lateral surface of the left proximal femur.</p>
Dental Health	-

Skeleton Number	179
Preservation	G4: Very Poor; Fragmentation: Moderate
Completeness	25%
Age	18-25; Young Adult
Sex	Female
Stature	161.3 +/- 3.72 cm
Non-Metric Traits	Parietal Foramen (left)
Pathology	<p>There are arachnoid granulations on either side of the sagittal suture (normal). There is no pathology notable in Skeleton 179 which may be due to the fact that the surface preservation is very poor.</p> <p>Slight sinusitis is present in in both sinuses.</p>
Dental Health	-

Skeleton Number	182
Preservation	G2: Moderate; Fragmentation: Moderate
Completeness	85%
Age	45+; Mature Adult
Sex	Probable Female
Stature	161.7 +/- 3.41 cm
Ancestry	<p>There is pronounced nasal guttering visible on the nasal aperture, which may suggest African or mixed ancestry. This would be supported by the heavy set of bones and the robust, broad mandible. Unfortunately the maxilla is too damaged to confirm this completely, but it is squarish in shape.</p>
Non-Metric Traits	Ossicle at Lambda; Parietal Foramen (bilateral); Mastoid Foramen Extrasutural (bilateral); Sutural Mastoid Foramen (left); Medial Tibial Squatting Facet (right)
Pathology	<p>There is an abscess present at the site of the LP², around the socket (widening it). This has hollowed out the alveolar bone and has protruded into the left maxillary sinus. The abscess measures 10.1mm superior-inferiorly, is open anteriorly and also opens into the sinus (open on three sides). The anterior opening has a max width of 7.2mm medio-laterally.</p> <p>The lateral end of the right clavicle is sharply angled anteriorly. This may have happened in the course of a fracture, but is unlikely to be confirmed without a radiograph. Due to heavy damage, this may prove difficult as well. On the articulating acromion, the facet appears to have angled medially to accommodate the shape of the lateral clavicle (extension of acromial facet medially). Unfortunately, the acromion is not complete and thus the facet is not visible in its entirety.</p>

	<p>Skeleton 182 has OA in the spine in the upper thoracic (T1, T2, T3) and lower thoracic (T11, T12 <- rib facets) as well as in L3 and on S1 (on body and facets). Additionally, there was eburnation in 2 disarticulated facets of the cervical spine. OA was also found in the left proximal and distal femur.</p> <p>Schmorl's Nodes were present the lower Thoracic and lower lumbar spine.</p> <p>There are spicules of porous new bone covering the superior lateral margins of the fused occipital and sphenoid bodies. This looks smooth and is located most prominently at the aspects closest to the temporal petrous portion. It follows the entire length of the bodies (more noticeable on right side) and measures 2.6 mm superior-inferiorly and 21.9 mm anterior-posteriorly.</p> <p>Copper stains on right superolateral ectocranial surface of the occipital and mid-left parietal bone. Also on right temporal.</p> <p>Arachnoid granulations along sagittal suture endocranially.</p> <p>Hyperostosis Frontalis Interna highlights age as MA. Dense, cortical new bone is present on mid-frontal, endocranial surface, just left of metopic suture. New bone has irregular margin and measures 6.8 mm superior-inferiorly and 13.3 mm medio-laterally.</p>
Dental Health	<p>16 tooth positions present; 15 teeth present, 1 loose; 2 teeth lost post-mortem; 5 tooth lost ante-mortem; 3/16 teeth affected by flecks to medium calculus; 4/16 teeth affected by caries; 4/16 teeth with DEH; 3 teeth not present.</p> <p>One large abscess in left mandible at site of LP₂. This has widened the socket and breeched the alveolar bone into the right sinus. Skeleton 182 has very unequal wear patterns. Almost all teeth have different angles of use, especially in the right mandible. LI² and LC¹ are sloped mesially and anteriorly.</p>

	Right Dentition								Left Dentition							
Present	-	-	-	-	AM	RO	PM	P-	-	-	PM	AM	P	Am	P	NP
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Mbd	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	Mm	-	Sb	-
Wear	-	-	-	-	-	-	-	6	-	-	-	-	6	-	5	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	NP	AM	AM	P	P	P	P	RO	RO	P	P	P	P	AM	P	NP
Calculus	-	-	-	-	Fl	-	-	-	-	-	-	-	-	-	Sl	-
DEH	-	-	-	-	-	-	L	-	-	-	L	L	L	-	-	-
Caries	-	-	-	-	Sb	-	-	-	-	-	-	-	-	-	Lb	-
Wear	-	-	-	7	5	6	5	-	-	5	6	3	5	-	6	-

Skeleton Number	185
Preservation	G3: Poor; Fragmentation: Moderate
Completeness	85%
Age	15-16; Adolescent
Sex	-

Wear	-	1	2	2	2	-	2	3	3	2	2	2	1	3	1	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	U	P	RO	P	P	P	P	P	P	P	P	P	P	P	P	U
Calculus	-	Slbd	-	Fm	Fdm	Fd	Fm	Sdm	Flm	Flm	Fl	-	-	Fd	-	-
DEH	-	-	-	-	L	L	L	L	L	L	L	L	L	L	L	-
Caries	-	-	Lo	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	2	-	1	1	1	2	3	3	2	2	3	2	2	2	-

Skeleton Number	188
Preservation	G3: Poor; Fragmentation: Moderate
Completeness	60%
Age	46+; Mature Adult
Sex	Undetermined
Stature	-
Non-Metric Traits	-
Pathology	<p>Skeleton 188 has a very small circular lytic lesion in the superior aspect of the left acetabulum. This measures c 3.1 mm in diameter and is quite shallow. The underlying trabecular bone visible and smooth-edged.</p> <p>Lamellar bone (well healed and re-integrated into the cortex) is present on the posterior mid-shaft of the right femur and on the distal shaft (on all surfaces). This is mirrored in the left femur, however erosion has affected most of the shaft. Lamellar bone of the same appearance is also noticeable on the medial aspect of the left tibial shaft. The true extent is not observable due to erosion.</p> <p>Skeleton 188 has a very wide sciatic notch, but measurements of the right femoral head and some cranial traits suggest M? Sexed indeterminate because of this.</p>
Dental Health	-

Skeleton Number	191
Preservation	G3: Poor; Fragmentation: Slight
Completeness	85%
Age	18-25; Young Adult
Sex	Female
Stature	169.1 +/- 3.55 cm
Non-Metric Traits	Ossicle in Lambdoid (bilateral); Parietal Foramen (left); Ossicle at Pterion (left); Accessory Lesser Palatine Foramen (bilateral); Accessory Lesser Palatine Foramen (bilateral); Absent Zygomaticofacial Foramen (right); Vastus notch (right), Lateral Tibial Squatting Facet (right)
Pathology	Skeleton 191 has lamellar bone on the medial surface of the mid-shaft of the right femur as well as on the posterior shaft. There are also well integrated striae on the anterior surface, distally above the condyles. The true extent is unclear due to erosion. The right tibia also exhibits well healed lamellar bone on the mid-shaft. This is especially noticeable on the

	<p>posterior and medial surfaces. Erosion has affected other areas. Lamellar striae are also present on the lateral and posterior mid-shaft of the left femur.</p> <p>Skeleton 191 is a young adult. The fusion lines are still visible at the proximal humeri and the distal femora. The rib heads are not all fused and the bones appear quite thin, though this is likely due to the heavy erosion.</p> <p>There is very slight <i>cribra orbitalia</i> noticeable in the left antero-lateral orbit.</p>															
Dental Health	<p>32 tooth positions; 31 teeth present; 1/31 teeth lost post-mortem; 3/31 teeth affected by flecks of calculus</p> <p>Dental crowding with Ri2 and Li₁₊₂ located slightly posterior of Ri₁ and canines. Enamel is very brittle and flakes off dentine easily (may have caused evidence of dental disease to disappear)</p>															
	Right Dentition								Left Dentition							
Present	P	P	P	P	P	PM	P	P	P	P	P	P	P	P	P	P
Calculus	-	-	-	-	-	-	-	-	-	-	-	Fd	Fl	-	-	-
DEH	G	G	G	G	G	-	-	-	-	-	G	G	G	G	G	G
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	1	2	3	1	1	-	-	-	-	-	3	2	2	3	3	2
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Calculus	-	Fm	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	G	G	G	G	G	-	-	-	-	-	-	-	G	G	G	G
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	1	3	4	2	2	-	-	-	-	-	-	2	2	4	3	1

Skeleton Number	194
Preservation	G3: Poor; Fragmentation: Moderate
Completeness	90%
Age	36-45; Old Middle Adult
Sex	Male
Stature	172 +/- 2.99 cm
Non-Metric Traits	Parietal Foramen (bilateral); Ossicle at Pterion (left); Mastoid Foramen Extrasutural (right); Accessory Lesser Palatine Foramen (bilateral); Accessory Supraorbital Foramen (right); Anterior Ethmoid Foramen Extrasutural (bilateral)
Pathology	<p>The inferior facets of C1 both have lytic lesions on the anterior margin. They are smooth and small and measure 4.8 mm medio-laterally x 0.8 mm anterior-posteriorly (right) and 5mm medio-laterally x 2 mm anterior-posteriorly (left).</p> <p>There is a cranial shift of the thoracic-lumbar border. This means that Skeleton 194 has six lumbar and eleven thoracic vertebrae as T12 is lumbarised. L5, the sixth lumbar vertebra, is bifid. This non-fusion has occurred even though both ends of the arches touch each other. S1 is also bifid, without the ends of the spinous arches touching.</p>

		<p>There is a non-fusion rift running vertically through the middle of the posterior spines of the sacrum (S2-S4 at least). This appears to be spina bifida, but the rift is almost closed and in fact looks like it is a pm break. It is not, however, as the edges are rounded and in parts almost look folded into each other. May have extended to S5, but pm damage prevents observation.</p> <p>There is a lytic lesion present on the manubrium, on the left anterior margin of the articular facet with medial clavicle. It is circular and hollow, with smooth spicules of bone exposed. It measures 6.2 mm in diameter.</p> <p>There is osteochondritis dissecans in both medial condyles of the distal femora. In the right femur, the lesion measures 22.7 mm anterior-posteriorly and 18 mm medio-laterally. It is roughly circular and located laterally on the medial condyle. There is irregular, porous bone visible inside the hollowed out lesion. In the left femur, it is also located laterally on the medial condyle. It is circular and slightly smaller than the one in the right femur. It measures 11.8 mm in diameter and exposes slightly porous bone and spicules of trabecular bone inside the hollow.</p> <p>Lamellar striae are noticeable on the cortical bone of the lateral mid-shaft of the right tibia. Erosion affects most long bones, thus it is not visible to its true extent.</p> <p>Schmorl's nodes are present in lower thoracic and lumbar spine. And there is OA in both hips (proximal femora)</p> <p>On the orbital ridges, porous and vascularised bone is present.</p> <p>Very slight <i>cribra orbitalia</i> observable in left antero-lateral orbit.</p>															
Dental Health		<p>24 tooth positions; 27 teeth present; 1/27 teeth lost post-mortem; 22/27 teeth affected by flecks or slight calculus; 15/27 teeth with DEH</p> <p>LC₁ has impacted. Due to the break (pm) of the mandible, it is possible to determine that it moved in posteromedial direction inside the alveolar bone when it impacted. The root of the deciduous Lc₁ is still present.</p>															
		Right Dentition								Left Dentition							
Present	NP	P	P	P	P	P	P	PM	P	P	P	P	P	P	P	NP	
Calculus	-	Flb	Slb	Slb	Slb	Sb	Sa	-	Slm	-	Sb	Sb	Sbl	Sbl	Fbl	-	
DEH	-	-	-	L	L	L	L	-	L	L	-	-	-	L	-	-	
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Wear	-	2	3	2	1	3	2	-	4	3	3	1	2	4	3	-	
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Present	NP	P	P	P	P-	P-	P-	P-	P	P	IMP	P	P	P	P	NP	
Calculus	-	Sld	Sb	-	Sl	Sl	Fmd	Fmd	-	-	-	Flb	Flm	Smdb	Sdl	-	
DEH	-	-	-	L	L	L	L	L	L	L	-	L	-	-	-	-	
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Wear	-	2	4	2	2	3	2	3	3	3	-	2	2	4	3	-	

Skeleton Number	197
Preservation	G3: Poor; Fragmentation: Moderate
Completeness	90%
Age	36-45; Old Middle Adult

Sex	Male
Stature	177.6 +/- 3.27 cm
Non-Metric Traits	Ossicle in Lambdoid (left); Parietal Foramen (bilateral); Posterior Condylar Canal Open (right); Open Foramen Spinosum (right); Accessory Lesser Palatine Foramen (bilateral); Accessory Infraorbital Foramen (left); Accessory Supraorbital Foramen (bilateral); Posterior Ethmoid Foramen Extrasutural (bilateral); Acetabular Crease (right); Exostosis in Trochanteric Fossa (right)
Pathology	<p>Skeleton 197 has an avulsion fracture of the left lesser trochanter. The lesser trochanter has been completely removed from the shaft. Where it was originally located, there are spikes of bone visible and some lamellar new bone (irregular), especially in anterior direction on the medial side. The spikes are pointing proximally and slightly anteriorly. It appears that the avulsion happened some time before death and thus had time to heal and smooth over.</p> <p>The head of the left femur is completely deformed and necrotic. This may be due to Legg-Calve-Perthes disease which results in necrosis, deformation and 'mushroom-shaped' appearance. The neck of the femur is heavily widened and measures c 52.7 mm at its minimum width superior-inferiorly. The minimum width anterior-posteriorly is 37.4 mm. The neck is also severely shortened. The head itself is of an irregular shape and, with damage, measures 67.4 mm superior-inferiorly, and 56.4 mm anterior-posteriorly. The superior facing aspect of the femoral head has a necrotic, roughly circular area of macroporous, irregular bone which features some eburnation on the edges and small bumps. This area is slightly depressed while the surrounding 'mushroom-cap' shaped head has a smoother appearance. At the tip of the head, it is slightly pointy and this part is parted by a smooth-edged rift running in antero-proximal to posterior-distal direction. It is c 20.9 mm long and 10.8 mm deep. There is some pm damage on the inferior aspect of the head, which exposes necrotic trabecular bone.</p> <p>Because of the Legg-Calve-Perthes disease of the left femur, the left acetabulum has changed as well. It is noticeably widened and the rim extends 11.4 mm beyond the normal rim edge to accommodate the larger femoral head. There is macroporous necrotic bone visible in the acetabulum as well, especially on the superior lunate surface and the acetabular notch area, which is filled partially with new bone lumps (especially on the inferior edge of the superior demiface of the lunate surface). This 'lump' is also affected by macroporosity. Eburnation is visible especially on the superior lunate surface (where necrotic macroporosity is located). The surface of the lunate is irregular and the general shape has adapted to the shape of the femoral head. This seems to indicate that movement was highly restricted.</p> <p>T11's inferior left facet is curved (lumbar-shape). This is mirrored in T12's superior left facet. The left side of the arch (the left pedicle, precisely) is wider and slightly longer than the left. This occurrence is repeated in L1 (both left facets are wider and more robust than the right facets), L2, in L3, (slightly less so) in L4, and in L5. This is likely related to the avulsion fracture of the left lesser trochanter, as the trochanter is connected to the left transverse processes of T12/L1 to L3/L4 by the Psoas Major. It may possibly also be related to the Legg-Calve-Perthes disease in that there was massive strain on the Psoas Major muscle which caused the trochanter to be avulsed. L4 has an extension of the right superior facet to accommodate the right inferior facet of L3. This looks like a double facet, is circular in appearance and measures 8.6 mm in diameter. It is located inferior and medially of the normal facet.</p> <p>Schmorl's nodes are present in slight to moderate form in the mid and lower</p>

	<p>thoracic spine. T11 has a left inferior facet which is of lumbar appearance. There is very slight <i>cribra orbitalia</i> visible in the left orbit.</p> <p>Slight eburnation is present on the anterior margin of the right proximal humerus and the distal femora (medial condyles).</p>															
Dental Health	<p>29 tooth positions; 26 teeth present; 3/26 teeth lost post-mortem; 18/26 teeth affected by flecks to heavy calculus; 1/26 teeth affected by caries; 5/26 teeth with DEH</p> <p>Two peri-apical abscesses are present in the left maxilla. They are located at the socket of LM1 and at LM2. The abscess at LM1 has slightly widened the socket and is likely responsible for the loss of the tooth. The inside of the socket looks smooth, but exposes trabecular bone.</p> <p>The second abscess in the socket of LM2 is slightly wider than that of LM1, but the tooth has managed to stay within the socket, even though the entire crown has disappeared (caries?). There is a small hole (2.4 mm diameter) at the location of the apex which opens the abscess laterally through the alveolar bone. This may have occurred pm, due to the thinning of the alveolar bone in this area.</p>															
	Right Dentition								Left Dentition							
Present	-	-	P	P	P	P	P	PM	PM	P	P	P	P	AM/PM	RO	P
Calculus	-	-	-	-	Sml	-	-	-	-	Sl	Sl	Sl	Slb	-	-	Sa
DEH	-	-	-	-	-	L	-	-	-	-	L	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Lo	-
Wear	-	-	6	5	5	4	3	-	-	3	4	3	3	-	-	3
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	P	P	P	P	P	P	P	P	PM	P	P	P	P	P	P	P
Calculus	Sd	-	-	Fm	Mml	Hlm	Mmld	Fm	-	Sdm	Sd	-	Sbl	Fbl	Fbl	-
DEH	-	-	-	-	-	L	-	L	-	-	L	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	3	4	7	4	4	4	3	4	-	4	4	4	4	5	3	2

Skeleton Number	200
Preservation	G2: Moderate; Fragmentation: Heavy
Completeness	60%
Age	18+; Adult
Sex	Probable Female
Stature	155.4 +/- 3.72 cm
Non-Metric Traits	Parietal Foramen (bilateral); Posterior Condylar Canal Open (bilateral); Open Foramen Spinosum (bilateral); Septal Aperture (left); Acetabular Crease (bilateral); Medial Tibial Squatting Facet (bilateral)
Pathology	<p>Medial torsion is observable in the mid and distal left femoral shaft. The posterior condyles appear to turn laterally (slightly). There is also anterior curvature which seems slightly beyond normal. Torsion in the right tibia is not as pronounced as in the femur, but the proximal shaft is bent slightly laterally. This may be within normal variation, however.</p> <p>There is slight <i>cribra orbitalia</i> visible in the antero-medial aspect of the</p>

	right orbit. Only a small fragment is available, so the true extent is not observable.															
Dental Health	14 tooth positions; 7 teeth present; 7/14 teeth lost post-mortem; 7/14 teeth affected by flecks or slight calculus; 1 tooth lost ante-mortem; 2/14 teeth affected by caries;															
	Right Dentition								Left Dentition							
Present	-	-	-	-	-	PM	PM	PM	PM	PM	PM	PM	P	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	Mm	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	-	-	-	-	-	-	-	-	-	P	P	P	P	AM	P	P
Calculus	-	-	-	-	-	-	-	-	-	Fd	Fd	Fdm	Fm	-	Sd	Sm
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Lb	Mm
Wear	-	-	-	-	-	-	-	-	-	4	3	3	3	-	3	3

Skeleton Number	203
Preservation	G3: Poor; Fragmentation: Heavy
Completeness	10%
Age	18+; Adult
Sex	Undetermined
Stature	-
Non-Metric Traits	Medial Tibial Squatting Facet (left)
Pathology	On the right tibia, there is lamellar bone on the medial surface of the mid-shaft. It is quite pronounced but already integrated into the cortex. There is, however, too much erosion to see the true extent.
Dental Health	-

Skeleton Number	206
Preservation	G4: Very Poor; Fragmentation: Moderate
Completeness	<5%
Age	2.5-7.5; Younger Juvenile
Sex	-
Stature	-
Non-Metric Traits	-
Pathology	No pathology visible. This individual is very incomplete, but considering the measured length of at least 190 mm of the left femur (2.5-3.5 years) it is likely that Skeleton

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Wear	5	5	5	4	-	-	-	-	-	-	-	-	-	5	5	5
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Skeleton Number	215															
Preservation	G4: Very Poor; Fragmentation: Heavy															
Completeness	40%															
Age	15-16; Adolescent															
Sex	-															
Stature	-															
Non-Metric Traits	Ossicle at Lambda; Ossicle in Lambdoid (bilateral); Parietal Foramen (right); Posterior Condylar Canal Open (left); Double Anterior Condylar Canal (right) Ossicle at Parietal Notch (right); Foramen of Huschke (bilateral); Double Atlas Facet (right)															
Pathology	Skeleton 215 has a small notch/groove in the occlusal surfaces of her right first incisors – mandibular and maxillary. This notch is smooth edged and situated in the middle of both teeth. This indicates that the individual may have habitually used the right incisors for a certain activity (likely work related). May also have caused the enamel to crack vertically in the mandibular incisor, but this could also be pm damage. The notch measures c 1.3mm medio-laterally but is quite shallow and gradual. Slight sinusitis is observable in both sinuses (grooves and spicules)															
Dental Health	30 tooth positions; 30 teeth present; No teeth lost post-mortem; 8/30 teeth affected by flecks or slight calculus; 17/30 teeth with DEH; 4 teeth unerupted; 1 tooth impacted Maxillary left canine is impacted and pushes against LI2 (root). The root has breached into the left nasal aperture/sinus border.															
	Right Dentition								Left Dentition							
Present	U	P	P	P	P	P	PM	P	-	-	IMP	P	P	P	P	U
Calculus	-	-	-	-	Fb	-	-	Fd	-	-	-	-	-	-	Sb	-
DEH	G	G	G,L	-	-	G	-	-	-	-	-	G	G	L	G	G
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	2	2	2	2	1	1	2	-	-	-	1	1	2	1	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	U	P	P	P	P	P	P	P	P	P	P	P	P	P	P	U
Calculus	Fd	Fl	Fl	-	-	-	-	-	-	-	-	-	-	Sl	Fd	-
DEH	-	L	L	-	-	L	-	-	-	-	L	L	L	L	L	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	2	3	2	2	2	1	2	2	1	2	2	2	3	2	-

Skeleton Number	218															
Preservation	G4: Very Poor; Fragmentation: Severe															
Completeness	5%															
Age	3-4; Younger Juvenile															
Sex	-															

Stature	-															
Non-Metric Traits	-															
Pathology	<p>Some lamellar bone is visible on a right tibia fragment. It is unclear where exactly it is from, but the area affected covers c 30 mm x 10 mm.</p> <p>There is also some slight woven bone visible on a right femoral shaft fragment. It is unclear where exactly it is from, but it measures c 40 mm x 10 mm. This may be growth related.</p> <p>No other pathology visible due to poor preservation.</p>															
Dental Health	10 deciduous tooth positions; 7 deciduous teeth present; 5 permanent teeth erupting; 5/10 deciduous teeth lost post-mortem; 1/7 teeth affected by slight calculus															
	Right Dentition								Left Dentition							
Present	-	-	-	-	-	-	-	-	-	-	E	-	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	-	-	E	-	E	-	-	-	-	-	-	-	-	E	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Deciduous Right Dentition					Deciduous Left Dentition										
Present	-	-	-	-	-	-	-	-	P	P						
Calculus	-	-	-	-	-	-	-	-	-	-						
DEH	-	-	-	-	-	-	-	-	-	-						
Caries	-	-	-	-	-	-	-	-	-	-						
Wear	-	-	-	-	-	-	-	-	1	1						
Maxilla	e	d	c	b	a	a	b	c	d	e						
Mandible	e	d	c	b	a	a	b	c	d	e						
Present	P	P	P	PM	PM	PM	PM	PM	P	P						
Calculus	Sb	-	-	-	-	-	-	-	-	-						
DEH	-	-	-	-	-	-	-	-	-	-						
Caries	-	-	-	-	-	-	-	-	-	-						
Wear	1	1	1	-	-	-	-	-	1	1						

Skeleton Number	221
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Preservation	G3: Poor; Fragmentation: Heavy															
Completeness	50%															
Age	16-17; Adolescent															
Sex	-															
Stature	-															
Non-Metric Traits	Accessory Lesser Palatine Foramen (bilateral); Accessory Lesser Palatine Foramen (bilateral); Absent Zygomaticofacial Foramen (left); Posterior Atlas Bridging (left)															
Pathology	Even though Skeleton 221 is aged very young (c. 16-17 years), the sagittal suture has completely fused. It is not visible any longer, while there is a longitudinal sulcus along the suture line (slight). Several large foramina are also visible along the suture endocranially. It is unclear whether this had any effect on the shape of the skull and/or the brain as it is very fragmented and damaged. Amongst the fragments of the cranium, there is evidence for the retention of at least part of the metopic suture (20 mm). Skeleton 221 shows evidence of slight sinusitis and slight <i>cribra orbitalia</i> in the entire anterior left orbit.															
Dental Health	32 tooth positions; 29 teeth present; 3/29 teeth lost post-mortem; 19/29 teeth affected by flecks or slight calculus; 20/29 teeth with DEH															
	Right Dentition								Left Dentition							
Present	P	P	P	P	P	PM	P	PM	P	PM	P	P	P	P	P	P
Calculus	-	Sbd	Sbm	Fdm	-	-	-	-	-	-	-	-	Sl	Sa	Sdm	-
DEH	L	L	L	L	L	-	L	-	-	-	L	L	L	L	L	L
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	1	2	3	2	2	1	2	2	4	-	3	2	2	4	2	1
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Calculus	-	-	Sl	Fd	Fl	Sm	Sa	Ma	Ma	Sa	Sm	Fl	Fl	Fa	Fl	-
DEH	-	-	-	-	L	L	L	L	L	L	L	L	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	1	2	4	2	2	2	3	4	4	3	2	2	2	4	2	1

Skeleton Number	224
Preservation	G2: Moderate; Fragmentation: Moderate
Completeness	80%
Age	46+; Mature Adult
Sex	Probable Male
Stature	169.9 +/- 4.05 cm
Non-Metric Traits	Metopic Suture; Ossicle in Lambdoid (right); Parietal Foramen (right); Ossicle at Parietal Notch (bilateral); Mastoid Foramen Extrasutural (bilateral); Posterior Condylar Canal Open (left); Exostosis in Trochanteric Fossa (bilateral)
Pathology	Skeleton 224 has a very large cystic lesion just inferior of the right

	<p>anterior inferior iliac spine (just superior of the acetabular superior rim). The opening measures c. 14.6 mm superior-inferiorly and 13.9 mm medio-laterally. It is deep and has hollowed out a considerable part of the trabecular bone. The walls inside the hollow are smooth, but the shape is generally irregularly rounded.</p> <p>There is a cranial shift of the thoracic/lumbar border. Thus there are six lumbar and eleven thoracic vertebrae. L5 (L6) is bifid at the spine, the processes of which touches at the ends and bend posteriorly, but have not fused. Non-fusion is also visible in S1, the ends of which spinous process are not touching.</p> <p>Schmorl's nodes are present in mild form in the mid to lower thoracic and upper lumbar spine.</p> <p>There are several spicules of bone present in the left maxillary sinus, which suggest the presence of sinusitis.</p> <p><i>Cribra orbitalia</i> is expressed as slight vascular impressions in the antero-intermediate and antero-lateral areas of both orbits.</p>
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Dental Health	11 tooth positions; 11 teeth present; 4 teeth lost post-mortem; 9/11 teeth affected by flecks to heavy calculus; 4 teeth lost ante-mortem; 1/11 teeth affected by caries; 6/11 teeth with DEH; 2 teeth not present; 2 teeth are present with root only
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	Right Dentition								Left Dentition							
Present	RO-	P-	P-	P-	P-	P-	-	-	-	-	P-	P	PM	P	P	-
Calculus	-	Hbm	Mb	Smd	Smd	-	-	-	-	-	Fm	Sd	-	Mbd	Hbd	-
DEH	-	G	-	-	-	L	-	-	-	-	L	-	-	G	G	-
Caries	-	Md	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	3	3	3	3	-	-	-	-	-	-	3	-	4	3	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	NP	AM	AM	P	PM	PM	-	-	-	RO	P	RO	PM	AM	AM	NP
Calculus	-	-	-	-	-	-	-	-	-	-	Sa	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	L	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	2	-	-	-	-	-	-	3	-	-	-	-	-

Skeleton Number	227
Preservation	G3: Poor; Fragmentation: Heavy
Completeness	60%
Age	18+; Adult
Sex	Probable Female
Stature	-
Non-Metric Traits	Parietal Foramen (bilateral); Double Anterior Condylar Canal (right)
Pathology	There are arachnoid granulations on the endocranial surface of Skeleton 227, along both sides of the sagittal suture which measure c 1.5 mm max. There is a single granulation on the right occipital endocranial surface, just right of the superior occipital sulcus which measures c 3 mm in diameter.

		<p>Skeleton 227 has a small, circular area of irregular nodules of bone on the left distal femur. This measures c. 9.8 mm in diameter and is located on the inferior-facing surface of the anterior portion of the condyles. Very granulated, dense patch of bone which is noticeable on the otherwise smooth surface of the joint. Possibly healed OD? There is a copper stain on the right side of C2.</p>															
Dental Health		6 tooth positions; 4 teeth present; 2 teeth lost post-mortem; 8/30; No teeth affected by calculus; 1/4 teeth with DEH															
	Right Dentition								Left Dentition								
Present	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Present	-	-	-	-	-	-	-	-	-	-	PM	P	P	P	P	PM	
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	G	-	
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Wear	-	-	-	-	-	-	-	-	-	-	-	4	4	6	6	-	

Skeleton Number	230
Preservation	G2: Moderate; Fragmentation: Moderate
Completeness	85%
Age	36-45; Old Middle Adult
Sex	Male
Stature	180.65 +/- 3.27 cm
Non-Metric Traits	Ossicle in Lambdoid (bilateral); Parietal Foramen (right); Mastoid Foramen Extrasutural (bilateral); Posterior Condylar Canal Open (right); Septal Aperture (right); Poirer's Facet (bilateral)
Pathology	<p>Skeleton 230 has arachnoid granulations present on the endocranial surface along the sagittal suture. These are small, with a diameter of c 1.5 mm.</p> <p>There is slight OA in T8, on the right superior process, as well as on the left distal femur.</p> <p>Schmorl's nodes are present in slight to moderate form in the mid thoracic and upper lumbar spine.</p>
Dental Health	-

Skeleton Number	233
Preservation	G3: Poor; Fragmentation: Moderate
Completeness	80%
Age	18+; Adult

Sex	Female															
Stature	164.68 +/- 3.55															
Non-Metric Traits	Ossicle at Lambda; Ossicle in Lambdoid (right); Parietal Foramen (left); Ossicle at Pterion (right); Ossicle at Parietal Notch (right); Foramen of Huschke (bilateral); Mastoid Foramen Extrasutural (bilateral); Posterior Condylar Canal Open (bilateral); Open Foramen Spinosum (bilateral); Double Atlas Facet (right); Medial Tibial Squatting Facet (right)															
Pathology	<p>On the anterior surface of the left distal humerus, Skeleton 233 has a small bony ridge (part of cortex and well integrated into bone). This may be related to the insertion of the Brachialis muscle, but is very slim for an ossified muscle attachment. It measures approximately 29.2 mm superior-inferiorly and 3.4 mm medio-laterally.</p> <p>On the concave inferior right talar facet with the calcaneus, there is a small oval lesion which might be osteochondritis dissecans. This is located on the medial posterior end of the articular surface and measures 4.7 mm medio-laterally and 2.7 mm anterior-posteriorly.</p> <p>In the sacrum of Skeleton 233, S1 and S2 have not completely fused at the spinous process so that a hole remains between the spinous processes of the two vertebrae. This is likely due to the lumbarisation of S1. S2 and S3 have completely fused.</p> <p>Schmorl's node on the inferior body of T5.</p> <p>Slight OA in right distal femur.</p>															
Dental Health	18 tooth positions; 23 teeth present; 1/18 teeth lost post-mortem; 1 tooth lost ante-mortem; 15/23 teeth affected by flecks to slight calculus; 1/23 teeth affected by caries; 9/23 teeth with DEH; 1 tooth not present; 1 tooth present with root only, slight periodontists															
	Right Dentition								Left Dentition							
Present	P-	P-	P-	P	P	P-	-	-	-	-	P	P	P	-	P-	-
Calculus	Sa	Fb	-	Fd	-	-	-	-	-	-	Sm	Fbl	Fl	-	Fa	-
DEH	-	-	-	-	L	-	-	-	-	-	L	L	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	3	3	5	3	3	-	-	-	-	-	3	3	3	-	3	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	NP	P	RO	P	P	P	P	P	P	P	P	P	P	P	AM	P
Calculus	-	Fd	-	Sl	Sll	Flb	-	-	-	-	Ml	Sl	Sl	-	-	Mdb
DEH	-	-	-	-	-	L	L	L	L	-	L	L	-	-	-	-
Caries	-	-	Lo	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	3	-	3	3	4	5	4	4	4	4	3	3	5	-	3

Skeleton Number	236
Preservation	G4: Very Poor; Fragmentation: Severe
Completeness	5%
Age	7-8; Older Juvenile
Sex	-

Stature	-															
Non-Metric Traits	-															
Pathology	Skeleton 236 is in very poor condition, but the dentition allows the individual to be aged c 7-7.5 years of age. Although no caries or calculus is present, the child has DEH on every single permanent tooth (19/19), erupted and unerupted. This suggests that the child suffered stress for some time before death.															
Dental Health	15 tooth positions; 19 permanent teeth present; 8 deciduous teeth present; No teeth affected by calculus; No teeth affected by caries; 19/19 permanent teeth with DEH															
	Right Dentition								Left Dentition							
Present	-	U	P	-	U	U	-	P	-	-	-	U	U	P	U	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	L	L	-	L	L	-	L	-	-	-	L	L	L	L	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	1	-	-	-	-	1	-	-	-	-	-	1	-	-
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Present	-	U	P	U	-	U	P	P	P	P	U	-	-	P	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	L	L	L	-	L	L	L	L	L	L	-	-	L	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	1	-	-	-	1	2	2	1	-	-	-	1	-	-
	Deciduous Right Dentition							Deciduous Left Dentition								
Present	P	-	P	-	-	-	-	-	-	P	-	-	P	-	-	
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Wear	1	-	1	-	-	-	-	-	-	1	-	-	1	-	1	
Maxilla	e	d	c	b	a	-	-	a	b	c	d	e	-	-	-	
Mandible	e	d	c	b	a	-	-	a	b	c	d	e	-	-	-	
Present	P	P	-	-	-	-	-	-	-	-	P	P	-	-	-	
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Wear	1	1	-	-	-	-	-	-	-	-	1	1	-	-	-	
Skeleton Number	239															
Preservation	G3: Poor; Fragmentation: Moderate															

Completeness	70%																
Age	15-17.5 Adolescent																
Sex	-																
Stature	-																
Non-Metric Traits	Ossicle in Lambdoid (bilateral); Parietal Foramen (right); Absent Zygomaticofacial Foramen (right)																
Pathology	<p>There are lamellar striae on the medial side of the anterior left tibial surface, but there is too much erosion present to perceive the true extent of this.</p> <p>There is no sign of <i>cribra orbitalia</i> or sinusitis.</p> <p>The individual appears to be female based on cranial and pelvic traits but is still an adolescent, so sexing is ill-advised.</p> <p>Copper stain present on the right ectocranial temporal bone.</p>																
Dental Health	<p>30 tooth positions; 28 teeth present; 1 deciduous root present; 3 teeth lost post-mortem; 4/28 teeth affected by slight calculus; 3/28 teeth affected by caries; No teeth with DEH</p> <p>In the right maxilla of Skeleton 239, the socket for the right deciduous maxillary canine and the right deciduous second molar. For the deciduous right second molar, the distal lingual root is still present in the socket, albeit broken off. The empty socket of Rc1 is located on the buccal side of the alveolar bone, between RC1 and RP1. This has caused RP2 to be slightly turned anteriorly with its lingual side as the root of Rm2 is in the way. The same issue occurred with Rc1 and RC1, causing the RC1 to be slightly pushed into the palate, with an anterior turn with its labial side. RC1 is therefore lingual of the other mandibular teeth.</p>																
	Right Dentition								Left Dentition								
Present	U	P	P	P	P	P	PM	PM	P	P	P	P	P	P	P	NP	
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	Fb	-	-	
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Caries	-	-	-	-	-	-	-	-	-	Sm	-	-	-	-	Mo	-	
Wear	-	1	2	1	1	1	-	-	2	2	1	1	1	2	1	-	
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Present	U	P	P	P	P	P	P	P	P	P	P	P	P	P	P	PM	
Calculus	-	-	-	-	-	-	-	Smld	Smld	Smld	-	-	-	-	-	-	
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Mo	-	
Wear	-	1	2	2	2	2	2	3	3	2	2	2	2	2	1	-	

KEY:

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

Non-adult age categories: f (foetus, <38 weeks *in utero*), p (perinate, c. birth), n (neonate, 0-1m), i (infant, 1-12m), j (juvenile, 1-12y), ad (adolescent 13-17y)

Adult age categories: ya (young adult, 18-25y), yma (young middle adult, 26-35y), oma (old middle adult, 36-45y), ma (mature adult, 46+y), a (adult, 18+y)

R – Right; L – Left; DJD – degenerative joint disease; OA - osteoarthritis

Present - Tooth presence; am - ante-mortem tooth loss; pm - post-mortem tooth loss; p - tooth present; - - jaw not present

St John's Almshouses, Lichfield, Staffordshire – Osteological Analysis

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

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

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

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

Appendix B: Osteological and Palaeopathological Catalogue – Disarticulated Bone

Context	Bone Element	Detailed Description	Side	%	SP	No. Frags	Age	Sex	Other
176	Femur	Fragments of proximal and distal femur	R	50	4	6	Adult	-	-
176	Tibia	Proximal ¼	R	10	4	2	Adult	-	-
176	Pelvis	Ischium	R	10	4	2	Adult	-	-
197	Vertebra	Atlas	-	100	2	1	Adult	-	-

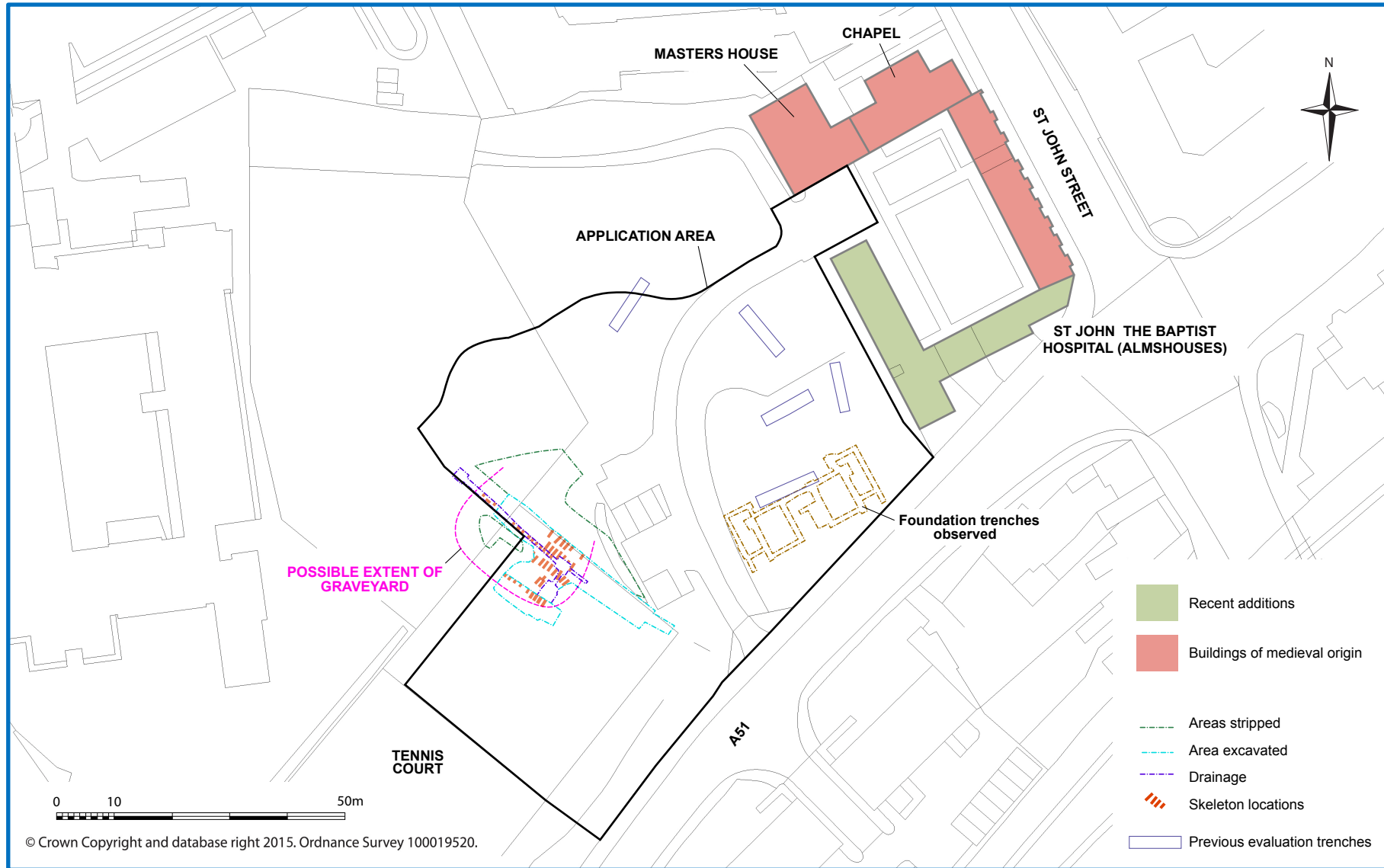


Fig 1: Location of application area and skeletons excavated

