University of Leicester

Archaeological Services

An Archaeological Excavation at
28 Newarke Street, Castle Ward, Leicester
NGR: SK 585 040

John Thomas

ULAS Report No 2016-159.

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For: Victoria Hall Ltd. & Capita Symonds

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Summary

A second phase of archaeological excavation took place on land at the junction of 16-26 Oxford Street and 28 Newarke Street, Leicester, in response to redevelopment proposals. The excavation was located on the eastern side of the development area and lay adjacent to three areas investigated during an earlier phase of work in 2013. The results were complementary to those of the earlier excavations, adding new information and enabling a clearer understanding of the sequence of human activity on the site.

A well-preserved sequence of deposits was revealed reflecting Roman, medieval and post-medieval activity. Early Roman activity along the eastern edge of the excavation consisted of several boundary gullies dated to the later 1st-early 2nd century. In the 2nd-3rd century a large boundary ditch was created towards the western side of the area. This may have defined the back edge of domestic or agricultural plots leading away from the main Tripontium Road that ran to the South Gate of the walled town. A human burial lying within the uppermost fill of this ditch was probably of a similar date.

By the 4th century an area of the site nearest to Newarke Street had become part of the southern cemetery of the Roman town. Five burials relating to this phase of the activity were identified, arranged in a well-ordered row on an east-west alignment similar to other excavated burials nearby, interpreted as being of Christian tradition.

Medieval activity was characterised by a scatter of refuse pits reflecting activity between the 12th-15th centuries. These fit into a wider pattern of similarly dated features recorded during previous excavations. Additional evidence for medieval activity and industry was provided by a multi-phased corn-drying kiln on the eastern edge of the excavation. This and the other contemporary archaeological features, probably relate to backyard activity associated with occupation of the street frontage of what is now Oxford Street.

During the 17th/18th century the area was occupied by the towns Civil War defensive earthworks and a massive ditch running along Newarke Street was revealed. Following the disuse and infilling of this ditch a building was constructed alongside Newarke Street. The new structure probably relates to the early re-occupation of the south suburb following the Civil War.

The excavation has proved particularly important in highlighting the prospect of recovering complex and well preserved archaeological information from areas within the southern suburb of Roman and medieval Leicester.

The site archive will be held by Leicester City Museum Service, under the accession code A7.2015.

Introduction

Open area archaeological excavation was undertaken by University of Leicester Archaeological Services (ULAS), on land at 28 Newarke Street, Castle Ward, Leicester between March 23rd – 27th (Characterisation Phase) and March 30th - April 10th 2015 (Excavation Phase). The work represented a second phase of excavation on the site with previous work taking place in Spring 2013 (Thomas 2014). Preliminary assessment work including a desk-based assessment undertaken by WSP Environmental UK (Meek 2006) and a trial trench evaluation by ULAS (Parker and Jarvis 2007), had demonstrated the significant archaeological potential of the site.

The recent excavation was carried out in response to re-development proposals for student and commercial accommodation on the land (Leicester Planning Department Ref: 2013/0696), and was commissioned by Victoria Hall Ltd. and Capita Symonds.

The development site is located to the rear of Allen House which occupies the corner of Oxford Street and Newarke Street (SK 585 040; Fig. 1). The area is broadly rectangular, measuring approximately 0.27 hectares and lies on fairly flat ground at a height of around 64m OD. The recent excavation concentrated on an area along the eastern edge of the development area that was to be affected by reconstruction of the sites boundary wall and excavation for new service runs.

The site lies within an area of significant archaeological potential, as demonstrated by the desk-based assessment (Meek 2006). This highlighted the possibility of surviving remains dating from the Roman, Anglo Saxon and Medieval periods, with the site lying adjacent to the main road leading from the south gate of the town. There was a very high potential for the site to contain the remains of a Roman cemetery, which has been partly revealed during excavations immediately east, during the refurbishment of the Elfed Thomas Law School and to the north, on the opposite side of Newarke Street. Evidence suggested that the cemetery extended towards the Oxford Street area.

The extant buildings on the site were almost all cellared to depths of up to 2m. Given the generally shallow nature of archaeological remains outside the town wall, any surviving features and layers are likely to have been completely removed by the cellaring, but other areas between the buildings will not have been so severely disturbed.

The proximity of the current development area to known archaeological sites, provided a strong indication that significant remains would be present and would be threatened by the proposed development work.

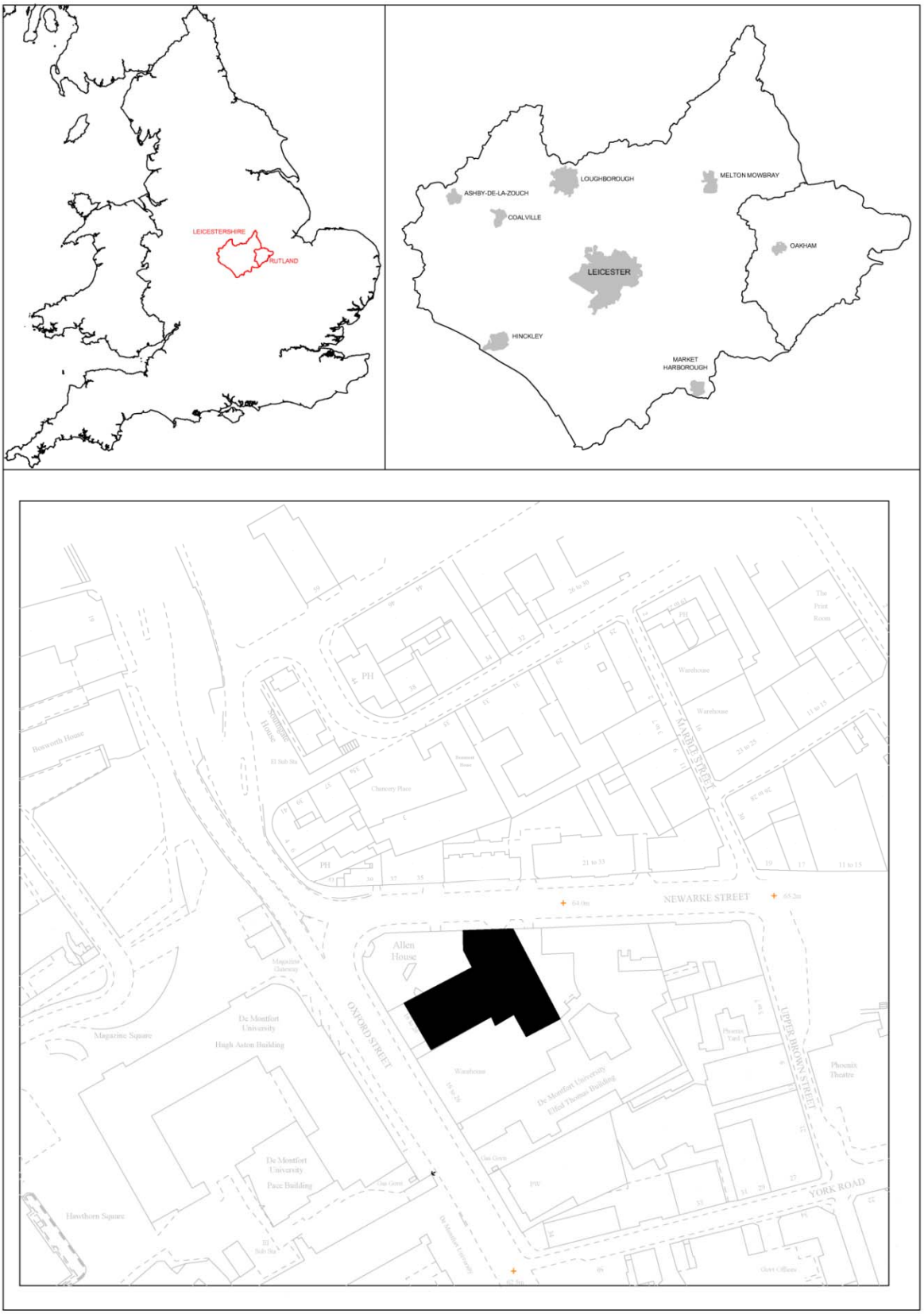

Figure 1: Site location (OS map 233 Leicester & Hinckley area 2000)

Geology

The Ordnance Survey Geological Survey of Great Britain Sheet 156 indicates that the underlying geology consists of Mercia Mudstone with overlying river gravels.

Archaeological and Historical Background

The site lies some 150m to the south of the Roman and medieval town walls of Leicester, and south-east of the location of the town's South Gate (Figs 2 & 3). The line of the Roman Tripontium road which ran from the South Gate of the Roman town to *Tripontium* on the Warwickshire/Leicestershire border, passes just west of the site.

The site lies within the southern suburbs of the walled town, known to have been occupied in the Roman and medieval periods. The area was also used as a cemetery in the Roman period, with burials having been excavated on adjacent sites. Archaeological excavation on the Elfed Thomas site to the east revealed a number of burials lying along the western boundary of the site, with evidence suggesting that this cemetery would project into the development area (Cooper 1996). Roman burials have also been excavated to the north of the site, on the opposite side of Newarke Street (Derrick 2009) and were also recorded during the construction of Allen House in 1926 (Dare 1927 54-55 and Plate 2).

Anglo Saxon occupation has been recorded to the south of the development area on both sides of Oxford Street. Oxford Street follows the line of the medieval road that ran southwards from the South Gate. Medieval suburban occupation following the line of the road has been recorded on either side of the street. The medieval Newarke Precinct is located to the west of Oxford Street, with the Magazine Gateway (the former entrance to the precinct) lying *c.*75m to the north-west on the Oxford Street frontage.

During the English Civil War, additional defences were erected around the walled town of Leicester. The southern part of the town, and especially the Newarke area, was the scene of much activity during 1645. Evidence for Civil War defensive ditches has previously been recorded on Oxford Street.

The 2013 excavation phase had focused on three areas, all of which had revealed well-preserved archaeological remains indicating a long sequence of activity from the Roman to the Post-Medieval periods. Slight evidence was also recovered for prehistoric activity dating to the Neolithic period. Early Roman occupation remains indicated use of the area in the 1st-2nd centuries, characterised by a scatter of post holes, a pit and a sequence of inter-cutting gullies defining plot boundaries. A more substantial boundary was introduced in the 2nd-3rd century when a large ditch was dug in the eastern half of the development area, the function of which may have defined the back edge of plots that lead away from the main Tripontium Road (now Oxford Street) that ran to the south gate of the walled Roman town. By the 4th century this area had become a large Roman cemetery and 11 burials of this period were revealed during the excavations. Some of these burials displayed similarities to those recorded on adjacent excavations but others showed different burial rites, suggesting Pagan traditions, which was unusual.

Medieval activity was represented by a spread of large refuse and cess pits organised in a linear arrangement suggesting backyard activity associated with properties fronting onto Oxford Street. An oven or kiln base was also revealed, as well as some evidence for metalworking.

The Post-Medieval period was represented by a substantial ditch cut into the natural clay. This formed part of a massive ditch system that ran along Newarke Street as part of Leicester's Civil War defences. Following the disuse and backfilling of the Civil War ditches the town's southern suburbs were reoccupied. Remains of a stone and brick building excavated on the northern edge of the site, adjacent to Newarke Street, appear to reflect this phase of activity.

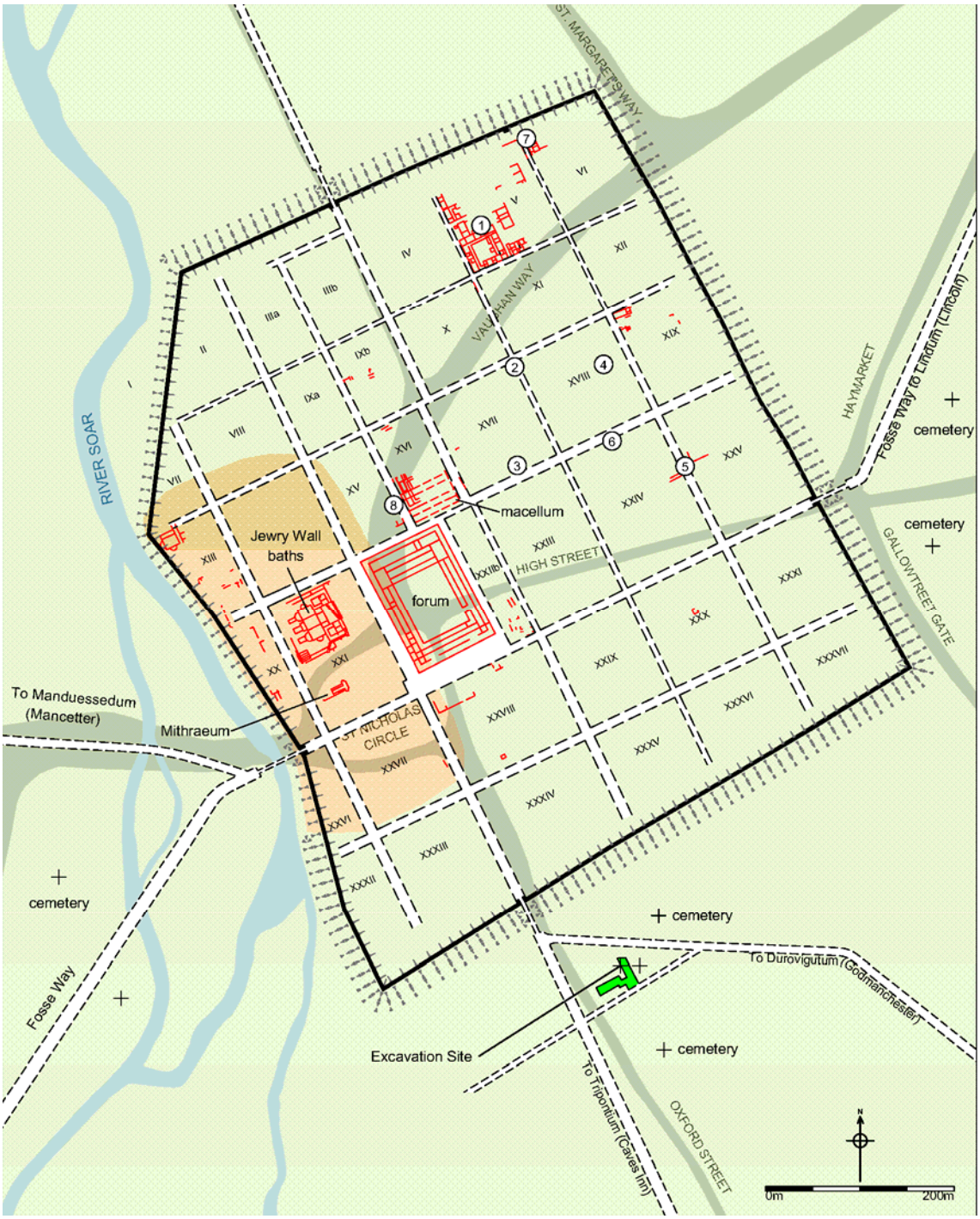

Figure 2: Plan of Roman Leicester with excavation site highlighted

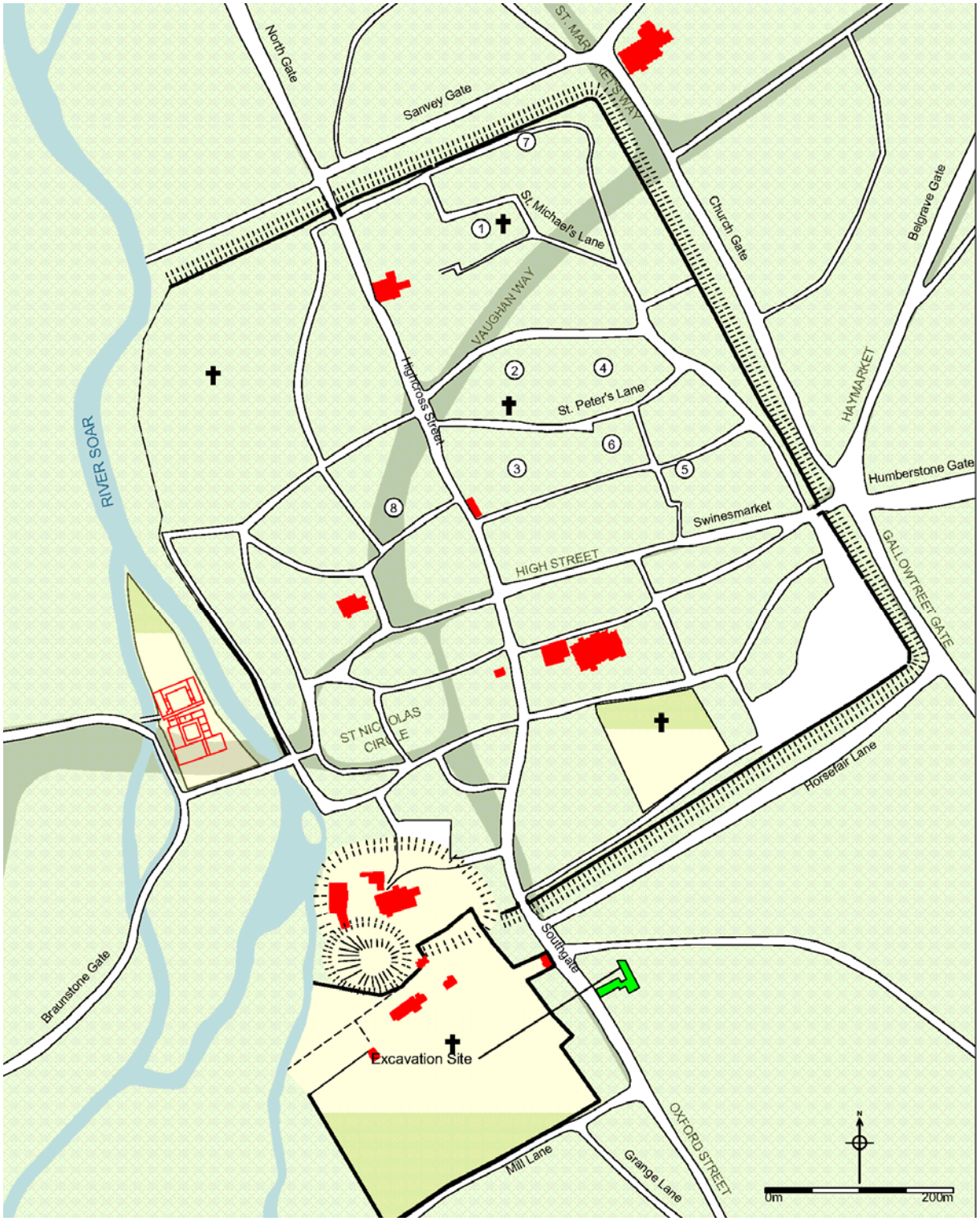

Figure 3: Plan of medieval Leicester with excavation site highlighted

Aims and Objectives

General:

- the establishment of the form, function and chronology of any preserved archaeological remains, utilizing all appropriate scientific and analytical techniques;
- the recognition and investigation of activity and occupation areas;
- the recovery of palaeo-environmental remains, including waterlogged deposits;
- the recovery of artefactual remains to assist in the development of local and regional type series;
- the recognition and investigation of industrial activity.

Prehistoric:

- the identification of any evidence for settlement evidence from the Iron Age or earlier; in particular evidence for the proto-urban, pre-Roman settlement, its extent and character.

Roman:

- the identification of any evidence for any traces of extra-mural suburbs, cemeteries or agricultural activity;
- the role of the immediate southern hinterland of Roman Leicester.

Early Medieval (Anglo-Saxon):

- the identification of any evidence for occupation during the 6th, 7th and 8th centuries;
- the identification of any evidence for the development of extra-mural suburbs or agricultural activity in the centuries before the Norman conquest.

Medieval:

- the identification of any evidence for the development of extra-mural suburbs or agricultural activity in the centuries after the Norman conquest
- the role of the immediate southern hinterland of Medieval Leicester.

The following objectives were also considered:

- establishment of the form, function and chronology of any preserved archaeological remains, utilising all appropriate scientific and analytical techniques;
- the recognition and investigation of activity and occupation areas;
- recovery of palaeo-environmental remains, including waterlogged deposits;
- examination of evidence for settlement development within the hinterland around Leicester;
- recovery of artefactual remains to assist in the development of local and regional type series;

Specific aims of the excavation were to determine:

- The presence of evidence for the continuation of the Roman cemetery that has been previously recorded at the Elfed Thomas site to the east and as a result of previous work on the site..
- The presence of any Anglo-Saxon remains that may be present within the area associated with post-Roman occupation in the southern suburb of the walled town.
- The presence of further medieval remains within the areas fronting Oxford Street and Newarke Street.

Methodology

General Methodology and Standards

All work followed the Institute for Field Archaeologists (IfA) *Code of Conduct* (2012) and adhere to their *Standard and Guidance for Archaeological Excavations* (2008).

Excavation Methodology

The excavation concentrated on a roughly rectangular area measuring approximately 200m^2 along the eastern edge of the development site (Fig 4). The new excavation area was designated Trench 4 to follow on from the previous areas that were called Trenches 1-3. Areas containing existing live drains and services were avoided.

Figure 4: General plan of the development site showing all excavation areas

The uppermost demolition rubble, yard surfaces and topsoil layers were removed from the excavation area using a 360^0 tracked mechanical digger equipped with a toothless ditching bucket and a dumper truck. These layers were removed gradually under constant supervision,

until the first significant archaeological horizon was reached. Removed overburden was stored on site at a safe distance from the excavation areas to enable restoration of the site once the archaeological work was complete.

Following removal of the overburden from the excavation areas the top of the archaeological level was revealed. As part of the initial 'Characterisation Phase' the area was hand-cleaned and a scaled plan was drawn of the archaeological features. Archaeological features were then subject to sample excavation and a written, drawn and photographic record made of each intervention.

Human remains encountered were recorded and removed in compliance with relevant Home Office regulations.

Results of the Excavation

As expected from the results of previous excavation work on the site, Trench 4 produced further evidence of a long history of human activity, including remains of Roman, medieval and post-medieval date. The complexity of the sites archaeology was similar to that encountered in the previous three excavation areas and provided complementary results to the previous work. In general the Trench 4 remains were characterised by reasonably deep, multi-layered deposits, resulting from the long-term occupation on the site, however truncation from former service trenches, and a row of small-scale Victorian buildings along the eastern edge of the site had compromised some of the deposits. The artefacts and other evidence collected from the excavated features and layers provide detailed information about the activities associated with the site during the different periods.

In the description of the archaeological sequence below, Cut numbers are denoted by square brackets (e.g. [408]), while fills and layers are shown in round brackets (e.g. (206)).

Trench 4

Roman Remains (Figures 5 & 6)

Gullies
Three shallow gullies ran along the eastern edge of Area 4 on a North to South alignment. All were truncated by later activity but from their surviving remains it was clear that they ran virtually the full length of the excavated area.

The central gully [409] had a shallow U-shaped profile measuring *c*.0.85m wide x *c*.0.10-0.20m deep. It was filled with a single deposit of mid-brown silty clay (516) with charcoal flecks, which contained a small but varied assemblage of pottery representative of jars, beakers/flagons and a dish dating to the 2nd or 3rd century.

To the east of this, gully [414] lay partly beneath the edge of the excavation but showed similar characteristics to [409]. There was a slight divergence between gullies [414] and [409] but any relationship between them was not apparent. For the most part they ran alongside one another as separate features. As with its neighbouring gully, [414] contained a single fill of silty clay (525) from which two sherds of late 1st – early 2nd century pottery and a 2nd century Roman plate brooch in the shape of a sandal (SF405) was recovered. Very truncated remains of this

feature were also recorded in the south-east corner of the area, where it was recorded as gully [400].

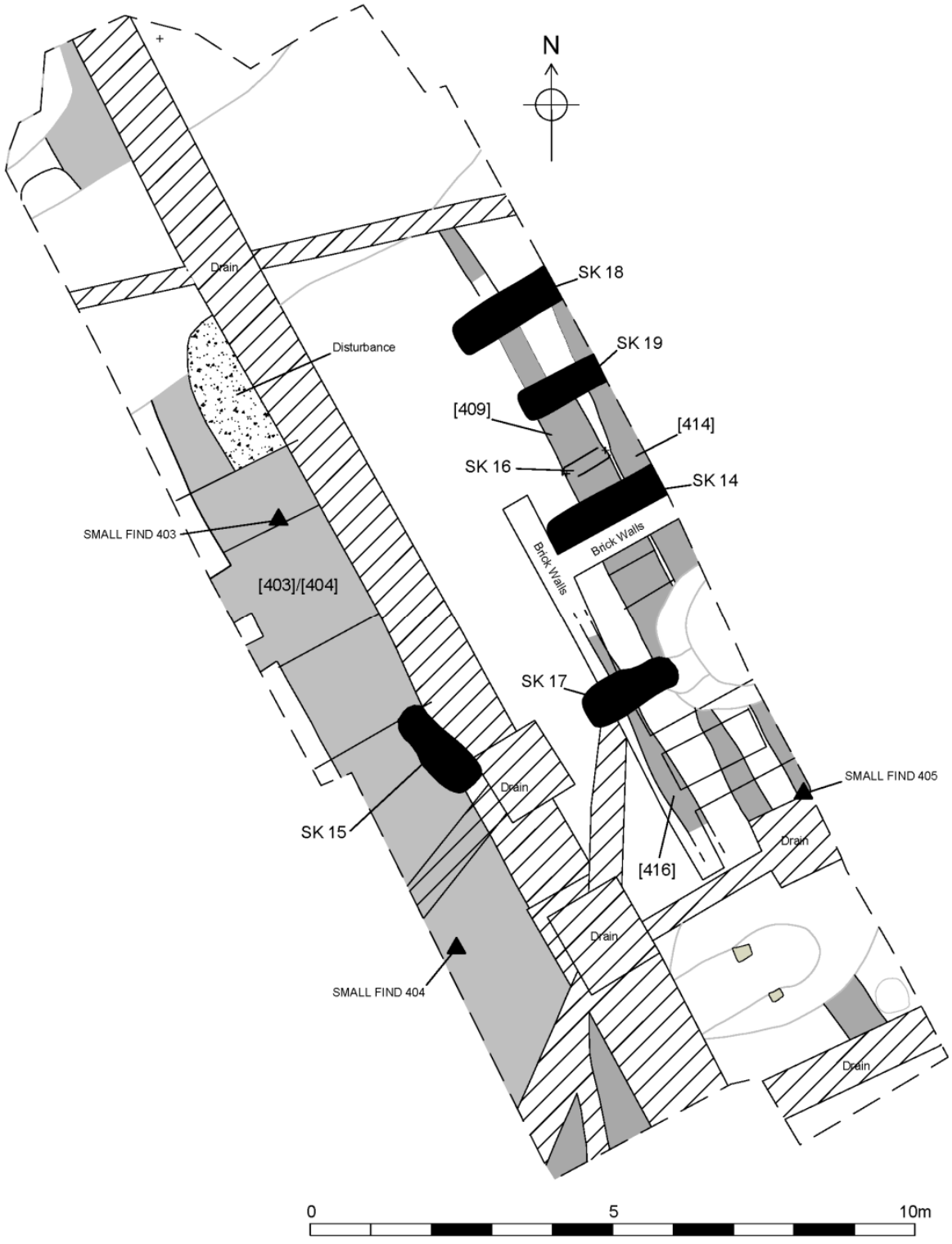

Figure 5 Area 4 – All Roman linear features (grey) and burials (black)

Partial remains of a third gully [416] were also recorded slightly to the west of [409] near the southern end of Area 4. This survived over a length of *c.*2.70m and was *c.*0.45m wide x 0.12m deep with a shallow U-shaped profile. Its single silty clay fill (529) was paler than that of the other gullies and contained animal bone fragments.

Figure 6 Gullies [414] & [409] following excavation and facing south ([409] can be seen carrying on in the background).

Boundary Ditch

A substantial ditch occupied the western edge of the area, lying on a North to South alignment (Figure 7). Although slightly truncated by later activity the ditch was seen to go beyond the northern and southern limits of the excavation and almost certainly represents continuation of a boundary ditch recorded in Trench 2 of the previous excavations (Thomas 2014).

Excavation revealed that the ditch had two clear phases, the earliest of which, [403] had a moderately steep sloping western edge leading to a narrow U-shaped base *c.*0.85m deep (the

eastern edge was obscured by the recut). Ditch [403] contained a sequence of three fills. Its primary fill (507) consisted of greyish brown silty clay containing a small group of 2nd-3rd pottery sherds, animal bone, CBM and burnt hearth fragments. Above this was a layer of yellowish brown clay silt (508) and the ditch was finally filled with a deposit of dark greyish brown silty clay (509). The ditch was redefined by a later recut [404] along the eastern edge. The recut ditch was shallower (*c.*0.60m deep) and measured *c.*1.50m in width. This ditch contained only one fill, (510) a silty clay deposit, from which 59 sherds of 2nd-3rd century pottery, animal bone and CBM were recovered. A human burial (SK15) lay within the recut ditch, towards the top of the fill (see below).

Figure 7 Roman boundary ditch [403]/[404] facing north

Burials

Remains of six burials were revealed during the excavation of Area 4 (Figure 5). One of these was dug into the top of ditch [404] on the western side of the area (see above), while the remainder were all found on the eastern side of the site. All had suffered truncation from later activity and were generally in a poor and incomplete condition.

An isolated burial on the western side of the site had a close association with ditch [404] (Figure 8). A very indistinct grave 'cut' [402] was recorded on the western edge of the ditch, following a similar N-S orientation and measuring *c.*1.20m long x 0.60m wide (although its western edge had been truncated by a later drain). Within the grave were the partial remains of a female individual aged between 36-45 years (SK15) lying in a twisted position such that the pelvic area was prone and the upper torso lay on its right-hand side. This may have resulted from 'rolling' of the bones post-burial, however no nails were recovered to indicate the presence of a coffin. Another scenario may be that the individual was unceremoniously dumped into the ditch as it was backfilled/or that they were buried in the ditch at the time of backfilling and the body twisted as the ditch fills settled. Disarticulated remains of an adult male aged 18+ years were also present in this grave and may have been deposited as charnal during backfilling. The grave cut was filled with a deposit of mid greyish brown silty clay (506) that was barely distinguishable from the ditch fill. Radiocarbon dating of this burial has produced a date of cal AD 240 -330 (68% probability: SUERC-66171) indicating that the interment took place after the ditch had been infilled.

Figure 8 Burial SK15 facing east (modern disturbance on the eastern edge)

On the eastern edge of Area 4 five burials were all oriented East to West in a single row. At the northernmost end a rectangular grave cut [412] protruded from the eastern trench edge and measured *c.*1.85m+ x 0.70m wide and was only *c.*0.05-0.09m deep (Figure 9). The grave had vertical edges and a flat base and contained the partial remains of an adult female (SK18) aged 18+ years, lying in an extended supine position on a West-East alignment. Several nails found within the grave fill (520) indicated that the individual had been buried in a wooden coffin.

Radiocarbon dating of this burial produced a date of cal AD 145 - 321 (68% probability: SUERC-66172).

Figure 9 Burial SK18 facing south

To the south of this was a similar grave, [411], also with vertical sides and a flat base (Figure 10). This grave had similar dimensions to [412], but survived to a slightly greater depth at 0.17m. In contrast the bone survival was poor with only very fragmentary remains recovered. The apparent arrangement of the bones was thought to indicate a disturbed East-West oriented burial with the head at the western end of the grave. Analysis of the bones however, has shown that they consist of mixed adult and juvenile bones as well as animal bone fragments. The grave fill (521) also contained a single iron nail, perhaps indicative of the former presence of a coffin, while at the western end two large stones lay on the edge of the grave cut, close to the skull remains.

Figure 10 Burial SK19 facing north

A third burial lay a short distance to the south but this was badly truncated to the point where no grave cut could be discerned. This was the burial of a child aged between 2-4 years (SK16) lying in a supine position on a West-East alignment (Figure 11). Due to the truncation of this grave and the age of the individual, evidence for this burial was very fragmentary, with only the lower torso and upper leg areas represented.

Figure 11 Burial SK16 facing south

To the south of SK16 a fourth burial (SK14) was also truncated, and lay at the junction of two modern walls (Figure 12). Remarkably however it was one of the better surviving individuals

from the excavation. As with SK16 there was little trace of a grave cut. The SK14 skeleton, comprising the remains of a male aged 46+ years, was virtually complete and lay in an extended supine position with the hands over the pelvis. Radiocarbon dating produced a date of cal AD 420 – 540 (68% probability: SUERC-66176), making SK14 one of the later burials from the excavations. As with the other burials in the row it lay on a West-East alignment.

Figure 12 Burial SK14 facing north

A fifth burial approximately 2.7m to the south consisted of very disturbed human remains in a West-East aligned grave [410]. The grave cut measured *c.*1.20m long x 0.60m wide and was 0.10-0.20m deep with vertical sides (Figure 13). It had been truncated to the east by a medieval pit [413] and a post-medieval feature [408] and to the west by a modern brick wall. The end result was a very disturbed and poorly preserved skeleton (SK17) aged 18+ years. Disturbance made it difficult to assign gender to the individual although it was evident from what remained that they had been buried facing east in a supine position with the legs extended and arms across the pelvis. No nails or other associated finds were recovered from the grave fill (414).

Figure 13 Burial SK17 facing north

Medieval Remains

Medieval activity was represented by four features; three pits and a stone-lined drying kiln with evidence for multiple episodes of use (Figure 14).

Pit [413] lay on the eastern edge of the area and was partly obscured by the edge of the excavation. From what could be seen it appeared that this feature was circular in plan, with a *c.*1.70m diameter. The pit was not fully excavated but the upper fills (522, 523 & 526) contained animal bone and pottery dating to the 12th/13th centuries [413] cut through Roman gullies [409] & [414] and the grave for SK17.

A second pit [419] was partly revealed in the north-western corner of the site where it truncated Roman ditch [403]/[404]. The pit itself had been disturbed by concrete footings to the extent that access for any meaningful excavation was obscured. Assessment of the site plans indicates that [419] is the eastern side of Pit [3024], from the previous excavations, that was dated to the 15th/16th century.

In the south-east corner of the excavated area a truncated small pit/post hole [401] contained 15th/16th century pottery but also yielded a residual sherd of early or middle Saxon pottery.

A large oval pit-like feature [407] in the south-eastern corner of the area was revealed through excavation to be the remains of a stone-lined corn-drying kiln. This feature lay on a north-east to south- west alignment and measured *c.*3.8m x 2.00m wide although the full extent of the feature was obscured by the trench edge to the east and truncation from modern drains to the west. The corn-drier appeared to have had a relatively long life with evidence of at least three separate phases of use between the 12th and later 13th or 14th centuries. This date is consistent with a similar feature excavated immediately west of this site which also appears to have gone out of use in the 13th century (Morris 2010, 63).

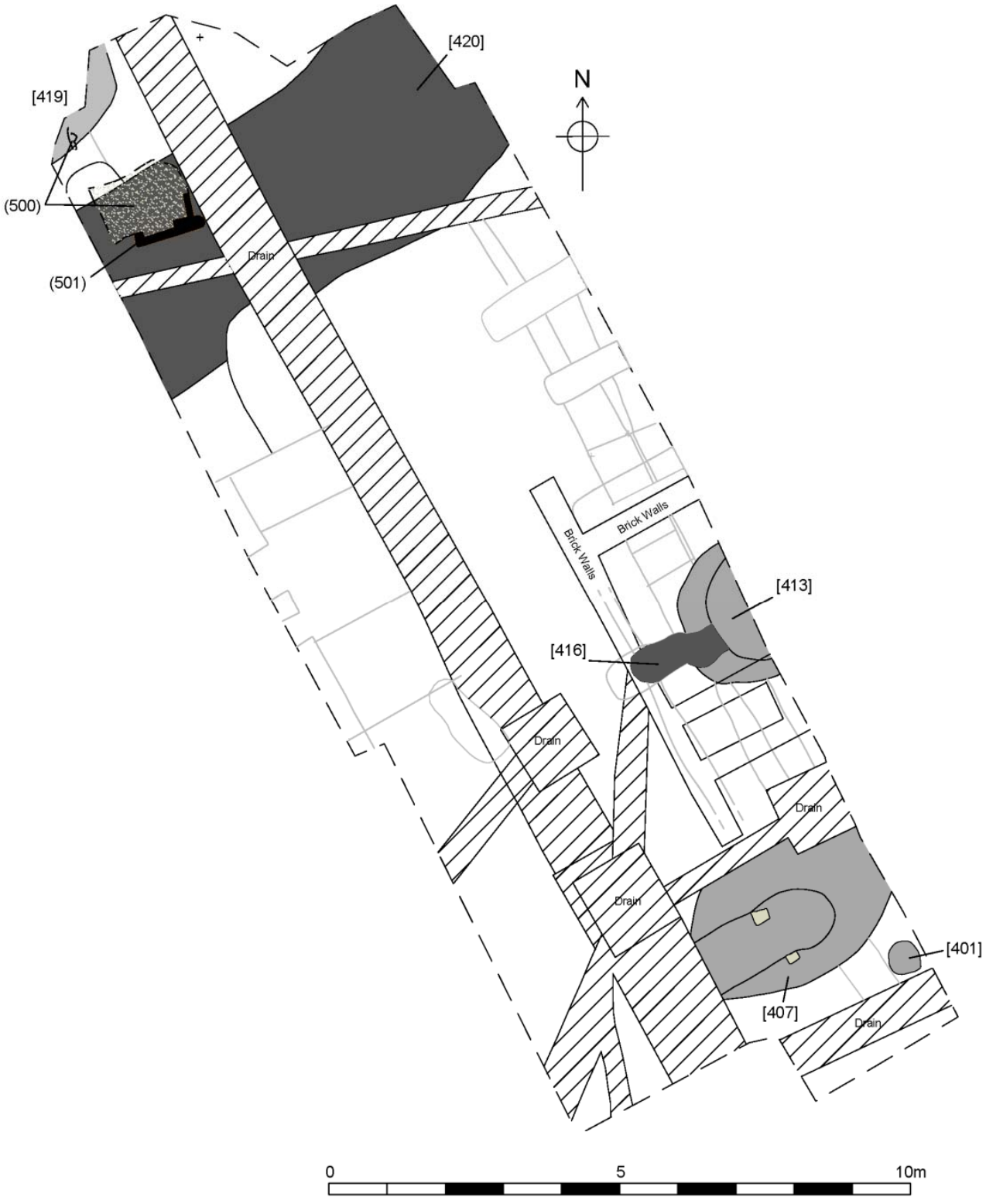

Figure 14 The Medieval (light grey) and Post-Medieval (dark grey) features

In each phase the corn-drier consisted of a circular bowl at the eastern end with a narrower flue projecting from east to west creating a 'keyhole' shape. Each phase was slightly offset from the previous one, resulting in a distortion of the features overall shape. Based on examples of more complete kilns the bowl would originally have been stone-lined, but much of the stone from this example appears to have been robbed out after it had gone out of use, also adding to the distortion of its 'keyhole' shape.

Figure 15 The Medieval corn-drier under excavation showing the stone floor of its final phase.

The main evidence for the kilns continued use came from the circular bowl, where three episodes of flooring were revealed. The first kiln [418] contained a trampled clay layer (537) across its base, probably relating to the kilns original construction. Overlying this was a

circular arrangement of burnt flat granite pieces (538), approximately 0.70m in diameter, forming the floor of the earliest kiln, situated just to the east of the neck of the flue. Above the burnt stone floor a layer of sandy silty clay (530) probably relates to the disuse of this first phase of use. The second phase kiln [417] contained a circular floor of burnt mortar within a border of granite and Daneshill sandstone blocks (534). Overlying this was a series of alternating burnt and unburnt layers (531, 532, 533 and 528) reflecting episodes of use and eventual disuse of the kiln.

The corn-drier was modified for a third time with the construction of [406]. In comparison to the earlier phases the characteristic 'keyhole' plan-shape of kiln [406] had survived well due to the relative lack of disturbance. The bowl of [406] measured approximately 1m in diameter and contained a floor of predominantly unburnt flat granite blocks. Close to the mouth of the flue however, was a re-used millstone (SF406) that had been heavily burnt as a result of its use in the kiln. A *c.*0.03m thick layer of charcoal rich silty sand (517) overlay the burnt floor of the kiln, probably resulting from its final firing. This was overlain by a final backfill deposit of silty clay (513) containing medieval pottery, animal bone, iron nails and CBM, which also filled the flue.

The flue of [406] was approximately 1.5m long x 0.80-0.90m wide with steep edges and a sloping western end. Although much of the kilns stone lining had been removed, evidence for the structure of the flue had survived. Disturbed granite blocks lay along the southern and western edges of the flue, while large granite blocks at the intersection of the bowl and flue probably supported a lintel which defined the flue mouth. The block on the southern side was deeply set into the ground and may have been a constant feature of the kiln throughout its various phases of use.

Environmental remains, in the form of charred grains and legumes, were recovered from soil samples taken from each phase of the kilns use. These indicated that the kiln was used for drying crops, predominantly cereals and peas/beans, for consumption.

Post Medieval Remains

Civil War Ditch

A large ditch [420] measuring *c.*3.5m wide crossed the northern end of the site on a north-east to south-west alignment (Figure 14). This represents an extension of the same ditch previously excavated on the site in 2013 (Thomas 2014) and is thought to relate to the Civil War defences of Leicester. The new information has helped confirm the ditches alignment, adding important new information to the understanding of Leicester's Civil War archaeology. The ditch was excavated during the 2013 work on the site and it was not thought necessary to sample it again.

Later Building

During the 2013 excavations the remains of a stone and brick-built building possibly dating to the 18th century were revealed aligned on Newarke Street, but running eastwards beyond the edge of Trench 3. It was hoped that more information on this building could be gathered during the present excavation but unfortunately, although there was some survival, the building had been heavily disturbed in Area 4.

What remained was an area of flooring (500 – measuring *c.*1.50m x 1.00m) comprising laid granite cobbles mixed with bricks in a silty matrix. The floor layer was disturbed to the north and west, but partially defined to the south and east by an insubstantial brick wall (501).

Short Linear Feature

A short linear feature [408] on the eastern edge of Trench 4 was undated but may be part of the post-medieval activity by virtue of its stratigraphic position. [408] was a poorly defined rectangular shaped feature on an East-West alignment measuring *c.*2.10m x 0.50m x 0.25-0.30m deep. It cut through the top of medieval pit [413] and truncated the upper levels of grave cut [410]. Its single fill of mid brown clay silt (515) contained disarticulated human bone that may have been disturbed from the underlying grave, but no firm dating evidence was present. A series of similar features was recorded to the east of the present project during the Elfed Thomas excavations. These were broadly dated to the 16th or 17th century and interpreted as possible horticultural features such as bedding trenches (Cooper 1996, 30-31).

Figure 16 Disturbed remains of cobbled floor surface (500) and wall [501]

The Finds

Romano-British Pottery - Elizabeth Johnson

Assemblage Size and Condition

An assemblage comprising 102 sherds of Roman pottery weighing 1.920kg with an EVEs value of 2.15, was retrieved from the excavations. The average sherd weight of 18.8g suggests good levels of preservation. There was evidence of later disturbance, with a few sherds recovered from medieval deposits.

Methodology

The pottery was examined in hand specimen using a binocular microscope at x15 magnification and classified using the Leicestershire fabric series for Roman pottery (Pollard 1994). Specific fabrics were assigned to all sherds wherever possible within the archive dataset, however, in this report the generic ware groups summarised below are used for clarity of quantified data presentation.

Table 1: Summary of Roman pottery fabric series (Pollard 1994).

Fabric Code:	Fabric Type:
Samian	Samian wares
C	Colour-coated wares
MO	Mortaria
AM	Amphora
BB1	Black Burnished wares

Fabric Code:	Fabric Type:
GW	Grey wares
CG	Calcite gritted (shelly)
OW	Oxidised wares
WW	White wares

Quantification was by sherd count, weight (grams) and estimated vessel equivalents (EVEs based on rim values). Average sherd weights (ASW) have also been calculated to provide an indication of the condition of the material and levels of preservation within the assemblage. Vessel forms were assigned where diagnostic sherds allowed, using the Leicestershire Museums form series and other published typologies. The dataset was recorded and analysed within an Excel workbook, which comprises the archive record.

Summary of major pottery fabrics within the assemblage

The table below details a summary of the major pottery fabrics within the assemblage as a whole. Figure 17 shows the percentage of fabrics present by EVEs as a measure of individual vessels identified, whilst sherd count is shown to enable comparison with other published sites. All references to percentage values relate to sherd count unless otherwise stated.

Grey coarse wares account for 51%, the majority of which are most likely locally made providing utilitarian jars and bowls for general household use. Most of the vessels are jars with 9 jar rims recovered, including rounded outcurved, roll necked, everted and lid-seated forms. Decorative styles present include lattice and burnishing.

Table 2: Quantification of the Roman pottery.

Fabric	Sherds	% Sherds	Weight (g)	% Weight	EVEs	% EVEs	ASW (g)
AM	1	1.0%	164	8.5%	0	0.0%	164.0
BB1	12	11.8%	97	5.1%	0.16	7.4%	8.1
C	6	5.9%	18	0.9%	0.1	4.7%	3.0

CG	8	7.8%	76	4.0%	0.1	4.7%	9.5
GW	52	51.0%	846	44.1%	1.19	55.3%	16.3
MO	7	6.9%	503	26.2%	0.2	9.3%	71.9
OW	5	4.9%	26	1.4%	0.175	8.1%	5.2
Samian	6	5.9%	99	5.2%	0.225	10.5%	16.5
WW	5	4.9%	91	4.7%	0	0.0%	18.2
Total	**102**	**100.0%**	**1920**	**100.0%**	**2.15**	**100.0%**	**18.8**

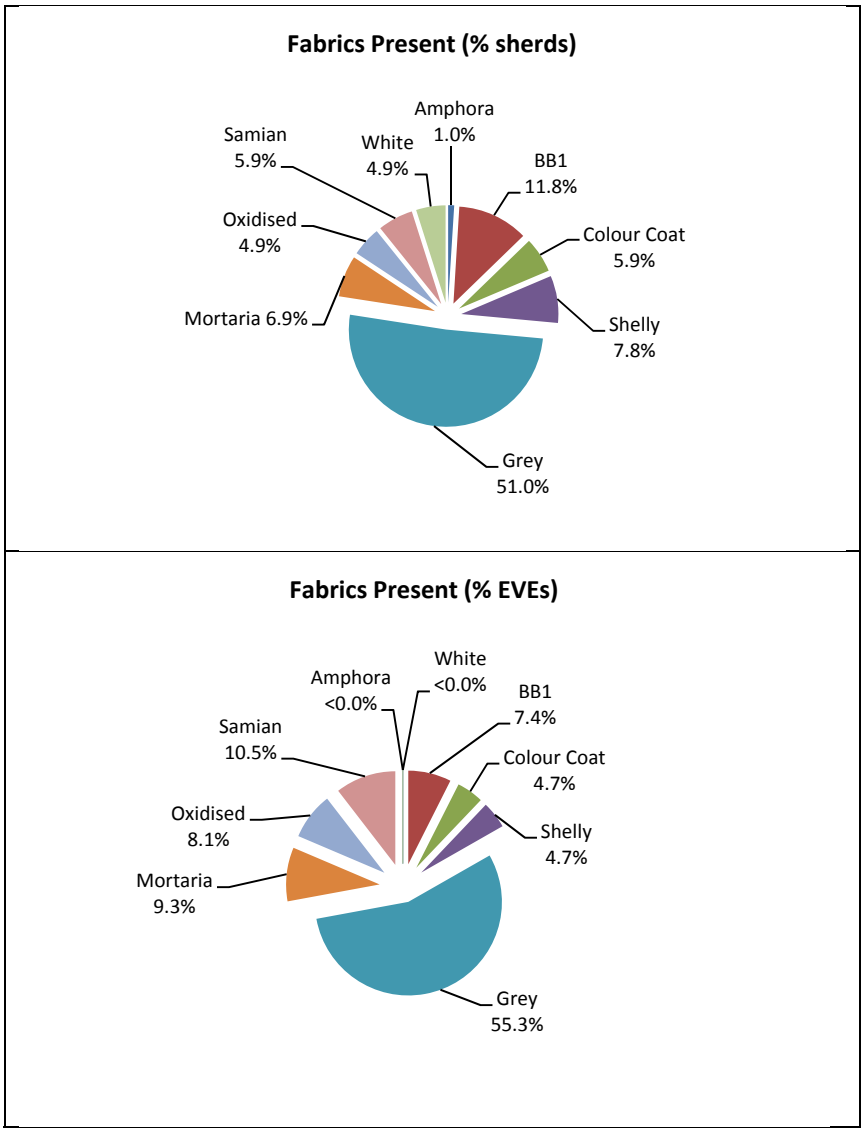

Figure 17: Roman pottery fabrics present by % sherds and EVEs.

The remaining vessels include two bowls and a beaker. One of the bowls has a reeded rim whilst the other has a rounded outcurved rim. The beaker has a small curved rim. Whilst there are plain body sherds that are not closely datable, there is nothing to indicate grey wares dating later than the 2nd century. The presence of a reeded rimmed bowl and lid-seated jars indicates a date from the later 1st to the middle of the 2nd century (Pollard 1994, 77; Johnson 2009, 27).

There are only two shelly ware vessels, both of which are jars from the same context (510). One is a 1st century channel rim jar, whilst the other is a later type from the Bourne-Greetham kilns in Lincolnshire dating to the later 2nd and 3rd centuries.

The remaining coarse wares comprise white, oxidised and Black Burnished wares, illustrating regional pottery supply. Black Burnished wares form the largest component at almost 12%. Most of the vessels are jars with acute lattice decoration. There is also a bowl with intersecting arc decoration, a plain rimmed dish with acute lattice and a dish or bowl base with burnished swirl decoration. As with the grey wares, the forms present suggest a date range within the second half of the 2nd century, although some of the forms are long lived (Holbrook and Bidwell 1991, 107-112). The oxidised wares comprise jars, beakers and a bowl or dish base. Not much is closely datable however, a cornice rim beaker with roulette decoration dates within the 2nd century. The white wares are all flagons dating within the 2nd century. The most likely sources for the oxidised and white wares are Mancetter-Hartshill and Northamptonshire (Swan 1984, 98-101; Pollard 1994, 113-114).

The fine wares comprise samian wares and colour-coated wares, including imports and Romano-British products. Imported samian wares from South and Central Gaul account for 5.9% of the assemblage. The forms present include Drag.18 plates, a Drag 18/31, Drag.31R bowl and Drag.33 cups. The earliest forms are the form 18 plates which date to the 1st century, whilst the latest vessel is the form 31R bowl, dating to the second half of the 2nd century (Webster 1996). Colour-coated wares also account for 5.9% and, with the exception of one imported beaker, are all from the Nene Valley. The imported beaker is from Central Gaul and dates from the middle of the 2nd century into the early 3rd (Tyres 1996, 137-138). The Nene Valley colour-coated wares include a flagon, beakers and possibly a bowl or dish. Flagons are not easy to date as although common during the 3rd and 4th centuries, there is evidence to suggest production began at the end of the 2nd or early 3rd century (Perrin 1999, 98). A beaker body sherd with clay roughcast decoration is of particular note, as this type of decorative style is not usually associated with Nene Valley products, although there is an example from Empingham in Rutland (Cooper 2000, 83-84). The other beaker is a folded form with barbotine scale decoration. This type of decoration is most common during the 3rd century, although vessels with curved rims can date to the late 2nd-early 3rd century (Perrin 1999, 93-94). Unfortunately there is no rim in this assemblage, so it is not possible to tell if the vessel is an early example. The form declined in popularity during the later 3rd century, therefore a date sometime within the 3rd century is most likely (*Ibid*). One abraded sherd from possibly a bowl or dish is unlikely to date before the 3rd century and could be later.

Specialist wares account for 7.9% of the assemblage. The amphora is a Dressel 20 Spanish olive oil amphora. This is one of the most common types found in Leicester and dates from the mid-late 1st century through to the middle of the 3rd century (Peacock and Williams 1986, 136; 142-143). Most of the mortaria are from the Nene Valley, including a form dating from the middle of the 2nd century to the early 3rd century. The single mortarium from Mancetter-Hartshill has a stamped flange and dates to the first half of the 2nd century.

Discussion

The assemblage is small and approximately 18% of the material is residual in post-Roman features. Having said that, the material is generally in good condition and there is enough to characterise the assemblage. The Roman features comprise two gullies and a large ditch.

The two gullies (516) [409] and (525) [414] produced very small quantities of pottery. Only two sherds (44g) were recovered from (525); a white ware flagon and grey ware jar dating from the later 1st to the 2nd century. Although only eight sherds (45g) were present in (516), there

is a nice variety of material, comprising a Black Burnished ware jar, grey ware jar, oxidised ware bowl or dish base, oxidised ware beaker, a strap handle from a white ware flagon and a colour-coated ware beaker and flagon. The oxidised ware beaker has a cornice rim and roulette decoration, typical of wares from Northamptonshire during the 2nd century. The colour-coated wares are both from the Nene Valley and the beaker is the example with clay roughcast decoration discussed above. This highlights the issue of dating some Nene Valley wares, as the rest of the material suggests a 2nd century date, as does clay roughcast decoration, however in general, it is the later 2nd or early 3rd century before this type of colour-coated ware appears in Leicester in any great quantity. Production of colour-coated wares began some time during the second half of the 2nd century in the Nene Valley (Perrin 1999, 87), therefore it is possible for these vessels to fall within the 2nd century.

The most notable feature is the large ditch (507) [403] and (510) [404]. Five sherds (91g) were recovered from (507) and 59 sherds (1.393kg and 1.125 EVEs) were recovered from (510). Combined, this equates to 62.7% of the total sherd count, 77.3% of the total weight and 63.9% of the total EVEs within the assemblage. Just over half the pottery from (510) is grey ware, including jars with everted, roll necked and lid-seated rims suggesting a date within the 2nd century. The Black Burnished ware jar has acute lattice decoration and the bowl has intersecting arc decoration. All four samian ware vessels are from Central Gaul and comprise two Dr.33 cups, a Dr.18/31 dish and a Dr.31R bowl. The Dr.31R bowl is the latest form, suggesting a date from *c*.AD160-200 (Webster 1996, 34-35). A Bourne-Greetham shelly ware jar dates to the later 2nd or 3rd century, as does the Nene Valley colour-coated ware folded beaker with barbotine scale decoration. Three mortaria are present, two from the Nene Valley and one from Mancetter-Hartshill. The Mancetter-Hartshill example dates to the first half of the 2nd century, whilst the Nene Valley examples would date from the middle of the 2nd century onwards. The single sherd of Dressel 20 amphora was recovered from (510). Overall, most of the pottery could easily date within the 2nd century, however, there are a few vessels suggesting at least a later 2nd century or possibly early 3rd century date for the group.

The pottery from (507) is comparable, comprising a Black Burnished ware jar with acute lattice, a Nene Valley mortarium, a grey ware reeded rimmed bowl and two grey ware jars. The reeded rimmed bowl is the earliest datable vessel, dating from the later 1st to the middle of the 2nd century. The Black Burnished ware jar dates from *c*.AD120 to the end of the 2nd century and the mortarium form suggests a date from the later 2nd century to the middle of the 3rd century. All the mortaria sherds from the site were recovered from this feature, with the exception of a single sherd from (514) which is residual in a post-Roman context.

It is worth noting this ditch is a continuation of a feature discovered during earlier excavations at Oxford Street in 2013 (Thomas, 2014). The pottery recovered from those excavations is very similar to the deposits here, insofar as most of the pottery dates within the 2nd century, but there are vessels present suggesting a 3rd century date. These include a Nene Valley colour-coated ware beaker of the same form, but also six East Midlands Burnished type grey ware jars which clearly date to the 3rd century (Johnson 2014, 38). This type of jar is absent from this assemblage. Overall the two groups appear to indicate a single feature back filled at approximately the same time.

The assemblage is similar to other urban assemblages from Leicester, and compares well with the assemblage from the adjacent site excavated in 2013, with most material dating within the 2nd century but some indicating a continuation into the 3rd century.

The Post Roman Pottery - Deborah Sawday

The Ceramic Finds

Methodology

The post Roman pottery; 59 sherds, weighing 964 grams, and a vessel rim equivalent of 0.355, (calculated by adding together the circumference of the surviving rim sherds, where one vessel equals 1.00) was examined under a x20 binocular microscope and catalogued with reference to the guidelines set out by the Medieval Pottery Research Group, (MPRG 1998; MPRG, 2001) and the ULAS fabric series (Blinkhorn 2004, Sawday 1989; Davies and Sawday 1999; Sawday 2009).

The fabric codes and sources – where known – are shown in the fabric list, Table 3.

Table 3: The post Roman pottery fabrics.

Fabric	Common Name/Kiln & Fabric Equivalent where known	Approx. Date Range
SX	Saxon ware (1)	c.400/50-c.650
ST2/1	Stamford - fine, very fine fabrics G B (A)/C (2).	c.1050-13th C.
PM	Potters Marston ware – Potters Marston, Leicestershire (3)	c.1100-c.1300/50+
OS1	Oxidised Sandy ware ?Local/ Brackley fabric T68, (4), Northants CTS fabrics 302-305 (5)	c.12th-13th C.
CS	Coarse Shelly ware - Northants CTS 330 (5)	c.1100-1400
CC1	Chilvers Coton A/Ai (6), Warwick CTS WW01,?WW012 (7)	c.1250-1400
NO3	Nottingham Light Bodied/Reduced Green Glazed ware NOTGL/NOTGR (8)	Early/mid 13th c.1350
BR2	Brill/Boarstall 'standard fabric', Oxford fabric OXAM (9)	c.1200-1400
MS	Medieval Sandy ware – misc. quartz tempered fabric	c.1200-1400
MP3	Midland Purple ware 3 –vitrified MS3, -? Ticknall, Derbyshire (10)	c.1375-1550
EA7	Earthenware 7 - Slipware - Staffs etc	17th C.-18th C.

(1) Blinkhorn 1999, 2004.	(6) Mayes & Scott 1984
(2) Kilmurry 1980, Leach 1987	(7) Soden & Ratkai 1998
(3) Haynes 1952, Sawday 1991	(8) Nailor & Young 2001, Nailor 2005
(4) M. Mellor pers. comm.	(9) Jope & Irvens 1981
(5) Northants CTS	(10) Coppack 1980, Cumberpatch 2002-2003

The Stratigraphic Record

The stratified pottery has been divided into ceramic phases based on the range of pottery fabrics and vessel forms present, however, given the small size of the relevant assemblages this dating evidence must be treated with some caution.

Phase 8 – Earlier Medieval c.1100-1250
Possible Roman grave [400]
Assemblage: 2 sherds, 39 grams, 0.065 EVEs, 19.5 grams ASW (average sherd weight)

The only identifiable vessel was the rim of a Stamford ware jar, fabric ST2/1, with inscribed wavy line decoration on the rim and external sooting. The form - Kilmurry 4-35 - and decoration suggest a date from the mid-12th century (Kilmurry 1980, 143). A heavily sooted base fragment in Potters Marston may be of a similar date.

Table 4: The post Roman pottery site totals by fabric, sherd numbers, weight (grams). AVS (average sherd weight) and EVEs.

Fabric	Sherds	Weight	AVS	EVEs
Saxon				
SX	1	14	14.0	
Late Saxon/Early Medieval				
ST2/1	4	27	6.75	
PM	37	689	18.62	0.075
OS1	1	1	1.0	
CS	2	31	15.5	0.08
Sub-total	**44**	**748**		**0.155**
High/Later Medieval				
CC1	5	44	8.80	
NO3	5	69	13.,80	
BR2	1	1	1.0	
MS	1	34	34.0	
MP3	1	50	50.0	0.06
Sub-total	**13**	**198**		**0.06**
Post medieval				
EA7	1	4	4.0	
Totals	**59**	**964**	**16.33**	**0.355**

Phase 8/9 – Earlier Medieval/Medieval c.1100-1400
Pit [413], pit or ground disturbance [405], corn-drier or malting kiln [407],
Assemblage: 29 sherds, 472 grams, 0.23 EVES, 16.2 grams ASW.

The bulk of this small group of pottery occurred in the corn-drier or kiln, context [407]; where a small jar rim in Stamford ware was found together with an everted hammer headed rim in Potters Marston, possibly part of a storage jar, (Davies & Sawday1999, fig.91.84) and probably dating from the later 12th or 13th centuries. This feature also produced wheel thrown glazed body sherds in Chilvers Coton, Nottingham and Medieval Sandy ware, fabrics CC1, NO3 and MS; which dated from the mid or later 13th or 14th centuries. A Coarse Shelly ware jar, fabric CS, with an upright rim, in the same context dates from the 13th or 14th centuries (McCarthy 1979, fig.82.91). The two remaining contexts contained three sherds, 33 grams, of undiagnostic body sherds in Potters Marston.

Phase 9/12 – Medieval c.1250-1400/ Later Post Medieval c.1650-1750
Corn-drier or malting kiln [406]
Assemblage: 23 sherds, 378 grams, 16.4 grams ASW.

A range of medieval wares, including fragments of Oxidised Sandy ware, OS1 and Brill/Boarstall type ware, fabric BR2, were present with terminal date in the 14th century. However, part of a 17th or 18th century press-moulded buff bodied dish with trailed brown and yellow slip decoration under the glaze occurred in the same context.

Phase 10 – Later Medieval c.1400-1550
Pit [401]
Assemblage: 5 sherds, 75 grams, 0.06 EVES, 15.0 grams ASW.

An Early or Middle Saxon body sherd tempered with angular quartz/quartzite inclusions was recorded in this context together with fragments of Potters Marston and Chilvers Coton. However, a terminal date in the latter medieval period is suggested by the presence of a flared bowl with a simple everted rim in the Midland Purple fabric MP3.

Discussion

The bulk of the post-Roman pottery dated from the Saxo Norman to the later medieval periods; a single residual sherd of early or middle Saxon pottery occurred in the pit or post-hole [401], which also contained later medieval finds. The two sherds of early medieval pottery in the back-fill of the possible Roman grave [400] may have been intrusive.

The excavation of the corn-drier or malting kiln, contexts [407] and [406], had suggested at least three phases of use (J. Thomas, pers. comm.), and this is reflected in the pottery finds which dated from the 12th to the later 13th or 14th centuries. The fragment, weighing 4 grams, of 17th or 18th century Slipware is thought to be intrusive in the latter context.

Conclusion

The previous excavations on the two adjacent sites failed to produce any evidence of early or middle Saxon activity, hence the single Anglo Saxon sherd here is of some interest. Indeed the possibility of an Anglo Saxon settlement in the vicinity was noted at the nearby excavations at Bonners Lane (Finn 2004, 63). The quartz/quartzite temper is similar to fabric BL5 which was recorded in the Early-Middle Anglo-Saxon pottery assemblage from the site (Blinkhorn 2004).

However, no late Saxon pottery such as the coarse Stamford ware, fabric ST3, or Reduced Sandy ware was found here, as had been the case at Newarke Street to the east (Sawday 1996) or on Oxford Street, to the west (Thomas 2014). There was also an absence of late Saxon St Neots, Lincoln Shelly ware or Leicester ware unlike recent excavations at De Montfort University (Sawday 2010).

Most of the pottery assemblage both here and on the previous excavations on the adjacent sites, lay within phases 8 and 9, dating from c.1100 to c.1400 (table 2) and all these finds most probably relate to the street frontage on what is now Oxford Street. Indeed, as was noted at Bonners Lane, this adds to the previous archaeological evidence of 12th and 13th settlement along both sides of Oxford Street, with a range of pits and other features representing back-yard activity (Finn 2004, 63). This is supported by a charter which indicates that both burgesses and customary tenants, (peasants) were living along Southgate Street, now Oxford Street, outside the South Gate by c.1200, (Courtney 1998, 124).

In spite of the limited evidence offered by this small assemblage, the range of fabrics and the few identifiable vessel types appear to be fairly typical of the domestic high and later medieval assemblages in the city and the immediate environs, including the finds from previous excavations in the southern suburbs of the walled town.

Table 5: The medieval and later pottery by fabric, sherd numbers and weight (grams) by context.

context	Fabric/ware	No.	Gr.	EVE	Comments
504 [400] RB grave	ST2/1 - Fine/Very Fine Stamford ware	1	7	0.065	Jar rim, diameter 200mm, inscribed wavy line decoration on rim top, sooted. Kilmurry form 4-35. Form and decoration suggest a date from the mid-12th C (Kilmurry 1980, 143).

504	PM – Potters Marston	1	32		Base, sooted, internally & externally
505 [401] pit/ph	SX - Saxon ware	1	14		Body, angular quartz temper.
505	PM	2	8		Rounded body
505	CC1 – Chilvers Coton A ware	1	3		
505	MP3 - Midland Purple	1	50	0.06	Flared bowl with simple everted rim, diameter 400 mm. Sooted post-deposition.
512 [405] pit	PM	2	18		Body, sooted externally
513 [406] pit	ST2/1	2	14		One glazed, one sooted
513	PM	5	176		Thumbed jug base, joins
513	PM	8	137		Misc. body/base, one with thumbed strip.
513	OS1 – Oxidised Sandy ware 1	1	1		sooted
513	CS – Coarse Shelly	1	6		body
513	CC1	3	30		Glazed body
513	NO3 – Nottingham ware	1	9		Glazed body
513	BR2 – Brill/Boarstall type	1	1		Glazed body
513	EA7 - Slipware	1	4		Press moulded dish, brown & yellow under glaze
514 [407] pit	ST2 – Fine Stamford ware	1	6	0.075	Small jar rim, diameter 120mm
514	PM	15	189		Misc. body/base, some joins
514	CC1	1	11		Glazed body
514	NO3	4	60		Probably representing 4 pots, all glazed
514	CS	1	25	0.08	Upright jar rim, McCarthy 1979, fig.82.91, diameter 280mm, 13th C+.
514	MS – Medieval Sandy ware	1	34		Pale buff sandy fabric, yellow glazed internally.
526 [413] pit	PM	1	15		body
533 [407] pit	PM	2	90		body
533	PM	1	24	0.075	Everted hammer headed rim, possibly part of a storage jar, (Davies & Sawday1999, fig.91.84), diameter 280mm

Roman and Medieval Building Materials – Nicholas J. Cooper

Introduction

Small assemblages of building materials were recovered from Roman and medieval deposits. All classes were quantified by fragment count and weight and samples, as indicated, were retained in the finds archive.

Roman

Over 9kg of building materials were recovered primarily from the fills of Roman ditch features [403] and [404]. The entire quantified record is presented in Table 1 below.

Table 6 Roman building materials

Roman Ceramic Tile, Slate and Daub from Oxford St A7.2015						
Cut	**Context**	**Type**	**Frags**	**Weight**	**Retain?**	**Comment**
	504	Misc	3	130	No	
	505	Tegula	1	25	No	
403	507	Wall	5	2100	yes	corner
403	507	daub	8	3200	sample	
403	508	Tegula	1	220	No	
404	510	misc	20	1200	no	
404	510	Wall	2	470	yes	corner
404	510	Tegula	2	340	no	
404	510	imbrex	2	95	No	
404	510	fluetile	2	120	no	
404	510	slate	2	540	no	
	513	Tegula	4	500	no	nailhole
414	525	wall	1	95	no	
Total			**53**	**9035**		

Over 5kg of Roman ceramic roofing tile and wall tile (brick) was recovered. All occurred in the typical sandy brick fabrics found in Roman Leicester. Flange tegulae and flat wall tiles were the most common, but fragments of curved roof tile (imbrex) and flue tile from hypocaust systems also occurred. Ditch [403] also contained over 3kg of fired clay (daub) in large fragments, and a lump of granite (740g) whilst [404] contained two fragments of local slate, probably from the Groby quarries.

Medieval

Roof slates

Four fragments of roofing slate (2.3kg) manufactured in the quarries in Groby, came from three contexts (Table 2). Three pieces had the characteristic drilled, round suspension hole and one near complete example of a long tile was retained.

Table 7 Medieval roofing slates.

Medieval slate						
Cut	**Con**	**type**	**Frags**	**Weight**	**Retain**	**Comment**
	504	Slate	1	150	no	

	505	slate	1	350	No	roundhole
417	536	Longslate	2	1800	yes	roundhole
Total			**4**	**2300**		

Medieval Inlaid floor tile
One abraded fragment (70g) was recovered from (514).

Re-used stone
Three fragments (2.5kg) from a medieval millstone manufactured from Millstone Grit from Derbyshire was reused in the hearth structure 518. Part of the central hole with a width of 70mm was preserved and the stone had a thickness of 70mm.

Roman Industrial Evidence
Four fragments (850g) of hearth lining with a vitrified and flowing surface appearance was recovered from [403] and another fragment from [404]. There was no metal content and so it is not necessarily related to metalworking specifically.

Table 8 Roman industrial remains

High temperature industrial					
403	507	Hearthlining	4	850	sample
404	510	hearthlining	1	10	sample
Total			**5**	**860**	

The Small Finds - Nicholas J. Cooper

Introduction
A small assemblage of finds were recovered mainly by metal detection.

Roman object of personal adornment or dress

Brooch
1) Sf 405 Roman gully (md find). Copper alloy and enamel. Complete plate brooch in the shape of a shoe sole with head loop, pin and catch plate (Fig.1). Upper surface comprises a single cell filled with clear pale green enamel with three opaque white spots. Length 42mm, width 11mm.

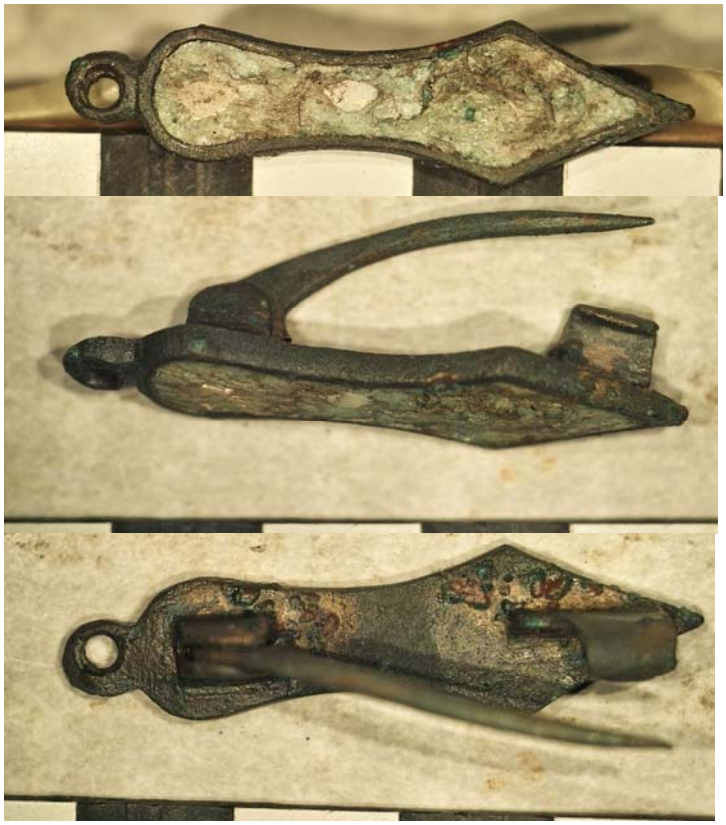

Fig. 1 upper, side and lower views of plate brooch Sf.405

The head loop suggests that it was linked by a chain to a second brooch, presumably forming a pair, securing the shoulders of a woman's peplos-type gown. The shape of the plate is slightly asymmetric suggesting that this was a left-hand sole. Plate brooches representing shoe soles are relatively unusual finds with six varieties illustrated in the Mackreth Corpus, one of which (with pointed toe) is similar in profile and decoration to the present example (Mackreth 2011, 126 pl.123 Type 1.1e, no.11681 with five dots within the field representing hobnails). An example from London with a more rounded profile is similarly filled with a field of green enamel with inset spots of yellow and turquoise, rather than white (Bayley and Butcher 2004, 48, fig.33 and pl.20 Hull Type T275). The floruit for enameling is during the 2nd century, and dating for this type appears to be from the Early 2nd to the early 3rd.

Roman Fasteners and Fittings

Iron Coffin Nails

Coffin nails were recovered from the graves of Skeleton 18 and 19 as follows.

2) SK18. Six fragmentary iron coffin nails of Manning (1985) Type 1b, with flat circular heads and square sectioned shafts. The longest and most complete (70mm) is set into a small fragment of mineralised wood.

3) SK19 [411] (521). Single fragment of Type 1b nail shaft. Length 44mm.

Other nails

4) Sf403 Roman ditch. Iron nail (md find).
5) Sf407 (533) fill of oven or kiln. Bent length of Type 1b nail shaft. Length 55mm.

Medieval Agricultural Objects

Millstone

6) Sf 406 Hearth 518. Three fragments (2.5kg) from a medieval millstone manufactured from Millstone Grit from Derbyshire was reused in the hearth or oven structure 518. Part of the central hole with a width of 70mm was preserved and the stone had a thickness of 70mm.

Osteological Analysis of Human Remains – Katie Keefe and Malin Holst

INTRODUCTION

In October 2013 York Osteoarchaeology Ltd was commissioned by University of Leicester Archaeological Services to carry out the osteological analysis of thirteen skeletons from Oxford Street, Leicester and a further individual from the opposite side of the road, on Newarke Street (NGR SK 586038). The remains were recovered in 2013 during an archaeological evaluation to determine the potential for surviving archaeological deposits in an area heavily disturbed by cellars belonging to 19th and 20th century industrial buildings, in advance of a development scheme. Further excavations in March and April 2015 identified an additional six graves, which contained the remains of a further six individuals and a small quantity of disarticulated human bone.

While the burials derived from three different phases of excavation (19 burials from Oxford Street; A2.2013 & A7.2015 and one from Newarke Street; A7.2013), all the burials belonged to a large extra-mural late 4th century Roman cemetery, located south of the extant remains of the Roman settlement, approximately 130m from the town's south gate. Because of their interment in the same cemetery, the twenty individuals have been considered together throughout the report. As two sites produced skeletons labelled Skeleton 1, the Newarke Street skeleton will be referred to as Skeleton 1.A7.

All but one of the excavated graves contained a single inhumation. The remains of two different individuals were recovered from the grave containing Skeleton 15. Unfortunately, it was not possible to ascertain whether both assemblages had been articulated and mistakenly identified as one individual or if only one had been articulated, with the second individual recovered from the grave fill as disarticulated remains. They were thus labelled Skeleton 15A and Skeleton 15B. During analysis the remains of Skeleton 19 were revealed to be a mixture fragmented human adult and juvenile, and animal bones. None of the bones could be confidently assigned to a single individual and as such have been treated as disarticulated bone.

Burial positions varied widely within the assemblage (Table 9), whereas orientations were generally uniform. Fourteen of the twenty burials were orientated east to west, however, the positioning of the body within the grave was a little more varied; twelve skeletons were buried with their heads to the west and the other two lay with their heads to the east. Skeleton 2 (a juvenile) had been decapitated and was orientated north to south with the head below their feet at the south end of the grave. This individual was also accompanied by two pottery vessels, also placed at their feet.

Table 9 Summary of archaeological information of inhumed skeletons

Skeleton No	Cut No	Site	Orientation (head first)	Position	Burial type	Finds	Date
1.A7	55	A7.2013	West to east	Extended supine	Simple	Two granite rocks, on south edge of grave	Early C4th

1	3049	A2.2013	East to west	Extended supine, right upper leg disturbed	Simple, (nails found in fill may suggest coffined)	Tile and residual pottery fragments	Early C4th
2	3048	A2.2013	North to south (head south at feet)	Slightly flexed on left side, head on feet	Possibly coffined	Nene valley and grey ware broken pots at feet	Early C4th
3	3052	A2.2013	West to east	Uncertain (only partial skull remains)	Simple	None	Early C4th
4	3054	A2.2013	West to east	Extended supine	Coffined with stone packing around head of grave	Two rings on left hand, quern stone fragment used as packing, iron object beneath skull	Early C4th
5	3062/3075	A2.2013	West to east	Extended supine	Coffined with stone packing between the coffin and the grave cut	None	Early C4th
6	3071	A2.2013	East to west, head looking south	On left side	Coffined	Copper alloy disc above head (SF15) copper alloy object beneath head (SF 18) pottery in backfill	Early C4th
7	2025	A2.2013	Unclear (skull fragments only)	Unclear (skull only)	Coffined skull only, found in a much larger grave, nails around skull suggest skull in a box	Pottery in backfill	Early C4th
8	3082	A2.2013	West to east	Extended supine	Simple, possibly coffined but no nails recovered, stone packing around the edge of the cut.	Residual pottery and tile	Early C4th
9	2027	A2.2013	Northwest to southeast	Extended supine	Coffined	Hair pins near skull (SF22), hobnails near feet (SF19), residual pottery fragments in backfill	Early C4th

10	3085	A2.2013	West to east	Extended prone	Coffined	Bent pin on right shoulder (SF16) Bronze buckle (SF17) location unclear	Early C4th
11	3088	A2.2013	West to east (head looking north)	Extended, torso and skull on left side	Simple, possibly coffined	Coin in pelvis (SF24)	Early C4th
12	3090	A2.2013	West to east (head looking south)	Extended supine	Coffined	Copper alloy hair pin (SF26) could belong to Sk 12 or Sk13	Early C4th
13	3092	A2.2013	West to east	Extended supine	Coffined	Copper alloy hair pin (SF26) could belong to Sk 13 or Sk12	Early C4th
14	-	A7.2015	West to east	Extended supine	Simple	None	Roman
15A	402	A7.2015	South to north	Prone	Simple	None	Roman
15B	402	A7.2015	-	-	Simple	None	Roman
16	-	A7.2015	West to east	Extended supine	Simple	None	Roman
17	-	A7.2015	West to east	Extended supine	Simple	None	Roman
18	-	A7.2015	West to east	Extended supine	Simple	None	Roman

Skeleton 15A (old middle adult female) had been placed in the grave prone, on a north-south orientation, with her head to the south. This grave was located at some distance to the west of Skeletons 14, 16, 17 and 18. Another juvenile (Skeleton 7) was also afforded an unusual burial rite. This individual consisted only of the remains of a skull, and was believed by the excavator to be a skull in a box burial. Skeleton 9 lay in a grave orientated northwest to southeast, with their head at the north-western end. Positions of the bodies within the graves varied; eight individuals were in an extended supine position (on their backs), one individual was extended and prone (lying face down), three of the skeletons lay on their left side, one of which was slightly flexed and the remaining two burial positions could not be discerned.

Previous excavations carried out at the same cemetery in 1993 (Cooper and Buckley 1996) recovered 38 individuals, in an area immediately east of the current evaluation, and further excavations carried out in 2002 (Derrick 2009) revealed 30 more inhumations further east. Excavations at another extramural cemetery, to the east of the fortress at Clarence Street (approximately 0.7 miles to the northeast of Oxford and Newarke Street) uncovered another 91 inhumations from the mid 3rd to 4th century (Gardner 2005), while an archaeological evaluation at Western Road, (approximately 0.8 miles southwest of Oxford Street and Newarke Street) recovered seventeen more inhumations in 2010 (Morris). Data from these cemetery publications will be used here for comparative analysis.

AIMS AND OBJECTIVES

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

METHODOLOGY

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

OSTEOLOGICAL ANALYSIS

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

PRESERVATION

Skeletal preservation depends upon a number of factors, including the age and sex of the individual as well as the size, shape and robusticity of the bone. Burial environment, post-depositional disturbance and treatment following excavation can also have a considerable impact on bone condition. Preservation of human skeletal remains is assessed subjectively, depending upon the severity of bone surface erosion and post-mortem breaks, but disregarding completeness.

Preservation was assessed using a grading system of five categories: very poor, poor, moderate, good and excellent. Excellent preservation implied no bone surface erosion and very few or no breaks, whereas very poor preservation indicated complete or almost complete loss of the bone surface due to erosion and severe fragmentation.

The preservation of the skeletons ranged from very good to very poor (Table 10); indeed the preservation varied immensely within individual skeletons, for example the upper limbs and torso of Skeleton 12 survived in good condition, whereas the lower limbs of the same individual were in very poor condition.

Table 10 Summary of osteological and palaeopathological results

Skeleton No	Preservation	Completeness	Age	Sex	Stature	Pathology
1.A7	Good	30%	36-45	Male	163.3cm ± 2.99cm	DJD in the right shoulder, elbow, hip, knee, ankle and

						foot, *osteochondritis dissecans* on right distal tibia
1	Moderate	90%	9-12	-	-	Bilateral *cribra orbitalia*, maxillary sinusitis, periosteal reaction on the left maxilla, right frontal. Slight calculus, caries, DEH
2	Good	90%	2-3	-	-	Periosteal reactions on occipital, mandible, sphenoid, maxillae. Calculus
3	Good	5%	18+	Female?	-	Osteoarthritis on C7; mild DJD on C5, 6 and T1. Slight to moderate calculus, DEH, mild periodontal disease
4	Poor	80%	26-45	Female	159.4 ± 4.30cm	Cribra orbitalia, maxillary sinusitis, mild DJD in the cervical and upper thoracic spine, right wrist, both hips, OA in lumbar spine, sacrum and right radius, tuberculoid lesions in the spine, Potts spine; fusion of L2 and L3, lytic lesion in L2, fusion of L1 and T12, bodies of T11 and T12 almost entirely destroyed, T10 and T9 fused, T7 and T6 fused, lytic lesion in T4, T5, periosteal reaction on T3, left ribs 4-10, right ribs 5-10, left tibia, sinusitis. Calculus
5	Moderate	80%	26-35	Male	179.8 ± 2.99cm	Spina bifida occulta, (S1), DJD in the left wrist, right hip, left ankle, probable tuberculoid changes to the spine, fusion of L4 and L5, periosteal reaction on calcaneus. Calculus, DEH, AMTL, periodontal disease
6	Good	15-20%	18-25	Male	-	*Cribra orbitalia*, periosteal reaction on frontal bone.

						Calculus, caries AMTL, periodontal disease, and tooth chipping
7	Good	10%	1-3	-	-	Periosteal reaction on right temporal, occipital, parietals, frontal
8	Moderate	75%	46+	Male	164.4 ± 2.99cm cm	Bilateral DJD on the manubrium, hamates, proximal femora, distal tibiae, distal fibulae, and calcaneus, left distal radius, right lunate, Schmorl's node, bifid spinous process of S1, possible DISH; fusion of anterior longitudinal ligament of T11-9, general bone forming activity
9	Good	95%	26-35	Female	158.8 ± 3.55cm	Lumbar ribs (bilateral), DJD on mid thoracic vertebrae, shoulders and left arm, Schmorl's nodes, periosteal reaction on the tibiae, fibulae, and femora, right calcaneus left pelvis, both humeri, four right ribs (probable pulmonary osteoarthropathy). Calculus, moderate periodontal disease, DEH, dental chipping
10	Poor	95%	26-35	Male	172 ± 2.99 cm	Schmorl's nodes, DJD in the cervical and upper thoracic vertebrae, left arm and right hip, periosteal reactions on occipital, frontal and parietals, femora, right humerus; *osteochondritis dissecans* on proximal 1st foot phalanx for the left MT1, spina bifida occulta S2,3 and 4 with mal-union of S1, asymmetry of transverse foramina of C6; asymmetry

						between the humeri - possible healed fracture, calculus periodontal disease, caries DEH, chipping, abscess
11	Moderate	90%	46+	Female	159.6 ± 3.55cm	Mild DJD in the spine, shoulders and hip, wedge shaped T1 - possible crush fracture, periosteal reactions on frontal and parietal, right lower ribs, exhibit an acute angulation at the angle of the rib reflecting possible binding Calculus, five congenitally absent teeth, retention of two deciduous teeth, AMTL, periodontal disease, DEH, caries
12	Poor	85%	46+	Male	161.8 ± 2.99cm (Caucasian) or 165.8 ± 3.53cm (African)	Well-healed fracture to the right distal radius, possible trauma of right femur/right tibia, secondary OA, periosteal reaction on mandible, zygomatics, maxillae, frontal, DJD on right 1st and 2nd metatarsals, torsion left humerus – possibly a fracture
13	Moderate	70%	26-35	Female	158.2 ± 3.55cm	Schmorl's nodes, DJD in spine, right shoulder, right and left hip
14	Very Good	85%	46+	Male	186.1± 2.99cm	DJD in cervical vertebrae. Schmorl's nodes in lumbar vertebrae, proximal humeri, left distal tibia, left distal fibula, left talus, left navicular. Healed fracture to distal left fibula, distal left tibia. Lamellar bone on left tibia and both femora. Myositis ossificans traumatica on left femur at the insertion of the short head of biceps and vastus

						intermedius. Transitional vertebrae. Ossified haematomas on left tibia shaft.
15A	Very Good	50%	36-45	Female	-	DJD in thoracic vertebrae. Schmorl's nodes in lumbar vertebrae
15B	Poor	30%	18+	Male	-	OA in cervical vertebrae. DJD in cervical, thoracic and lumbar vertebrae and left glenoid. Schmorl's nodes in thoracic vertebrae
16	Good	30%	2-3 years	-	-	-
17	Poor	30%	18+	-	-	-
18	Moderate	40%	18+	Female	-	DJD in right scapula and proximal humerus, right distal femur, right distal fibula, and two left hand phalanges

Key: DJD – degenerative joint disease, OA – osteoarthritis, DEH – dental enamel hypoplasia, AMTL – ante-mortem tooth loss, C – cervical vertebra, T – thoracic vertebra, L – lumbar vertebra, S – sacral vertebra

Completeness of the skeletons ranged from 5% to 95% (see Table 2); the majority of skeletons (55%) were over 50% complete, and six (30%) were between 49-25% complete. The remaining three skeletons (15%) were less than 20% complete.

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.

Based on the bone count, a minimum of fifteen individuals overall were present in the Oxford and Newarke Street burials, moderately less than the number of individuals identified archaeologically. These included two young juveniles, identified by two right orbital rims (part of the eye socket), one older juvenile, identified by numerous elements including both left and

right unfused femur, tibia and fibula. A further twelve adults were identified by twelve proximal ulnae.

ASSESSMENT OF AGE

Age was determined using standard ageing techniques, as specified in Scheuer and Black (2000a; 2000b) and Cox (2000a). Age estimation relies on the presence of the pelvis and uses different stages of bone development and degeneration in order to calculate the age of an individual. Age is split into a number of categories, from foetus (up to 40 weeks in *utero*), neonate (around the time of birth), infant (newborn to one year), juvenile (1-12 years), adolescent (13-17 years), young adult (ya; 18-25 years), young middle adult (yma; 26-35 years), old middle adult (oma; 36-45 years, mature adult (ma; 46+) to adult (an individual whose age could not be determined more accurately as over the age of seventeen). The categories defined here should perhaps 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; no doubt many of those aged '46+' would in actuality have been in their sixties, seventies or eighties when they died.

It was possible to determine the age at death of thirteen of the adults and all of the non-adults recovered from Oxford and Newarke Street, although in the case of one female and two males aging was based solely on dental attrition, as no other aging criteria survived. The skeletons from Oxford and Newarke Street consisted of sixteen adults (80%) and four non-adults (20%). A higher proportion of males (37.5%) reached older adulthood (46+ years), compared to 14% of females (see Table 2). The female age at death appeared to peak at middle adulthood (26-35 years), with 43% of females dying in this age bracket. Only one individual died in young adulthood, male Skeleton 6. The non-adults were all juveniles, aged between one and twelve years.

At Newarke Street, a greater proportion of males survived into mature adulthood compared to women (Jacklin and Chapman 2009), similar to Western Street. Unfortunately, age classifications for non-adults from this site were not comparable. Neonates and infants were present at Clarence Street (Waldron 2005), where they made up 6.6% of the overall population, and a greater number of males reached mature adulthood than females. A similar pattern of adult mortality was observed at Newarke Street (Wakely and Carter 1996) and a small number of infants was also present.

SEX DETERMINATION

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

Among the analysed skeletons, the adults were almost evenly divided between the sexes, with seven females and eight males (53.3% and 46.7% respectively of the fifteen adults that sex could be determined for). It was possible to determine the sex for 94% of the adult individuals.

METRIC ANALYSIS

Stature depends on two main factors, heredity and environment; it can also fluctuate between chronological periods. Stature can only be established in skeletons if at least one complete and fully fused long bone is present, but preferably using the combined femur and tibia. The bone is measured on an osteometric board, and stature is then calculated using a regression formula developed upon individuals of known stature (Trotter 1970). Leg measurements were obtained from the femora and tibiae and used to calculate robusticity (*meric* and *cnemic* indices).

Stature could be estimated for ten (63%) of the analysed adult skeletons, with fragmentation or the incomplete nature of the remains prohibiting the estimation of stature for six of the adults. The females ranged in height from 158cm to 160cm, with a mean stature of 159cm (see Table 10). This was consistent with the female average living height from the 1993 excavations at Newarke Street (Wakely and Carter 1996) of 159cm, but was lower than the average height of the females excavated during 2002 at Newarke Street (Jacklin and Chapman 2009) of 165cm (although this was only based on two individuals). The mean female stature at Oxford Street/Newarke Street directly corresponds with the Roman female mean (159cm) given by Roberts and Cox (2003).

The living height of the males varied more widely and was complicated by the fact that one individual (Skeleton 12) exhibited certain morphological traits which might suggest they were of African descent. The formula for estimating stature depends upon the individual's ancestry; as a result the stature of Skeleton 12 was calculated using both formulae. Estimated heights for the males ranged from 161cm to 186cm, with a mean of 171.2 cm when Skeleton 12's ancestry is treated as Caucasian or with a mean of 171.9cm when Skeleton 12's ancestry is treated as African. This was within the male range of heights observed previously at Newarke Street (Jacklin and Chapman 2009) and was above the mean (167cm). While the male range from excavations at Newarke Street in 1993 (Wakely and Carter 1996) was between 161-176cm, with a mean of 171cm, which was more comparable to those examined in the current study. The Oxford and Newarke Street males were slightly taller than the national mean (169cm) given for late Roman sites by Roberts and Cox (2003). It should be noted that Skeleton 14 (mature adult male) greatly affected the overall mean of the population, as he was 6cm taller than the second tallest male and 14cm taller than the third tallest male.

The *meric* index is a method of calculating the shape and robusticity of the adult femoral shaft. Calculations could be made for ten right femora (five female and five male) and nine left femora (four female and five male). Just under 89% of the female femora fell into the *platymeric* range (broad and flat), with the remainder being *eurymeric* (rounded). Male femora were also largely *platymeric* with 60% falling into the board and flat range; the remaining 30% were *eurymeric.*

Plate 1 Ossicle in lambdoid (R) Sk 9

The *cnemic* index of the tibiae was calculated in order to establish the degree of tibial shaft flatness. Calculations could be made for eight right tibiae (three female and five male) and nine left tibiae (four female, five male). All of the tibiae were *eurycnemic* (broad).

Very few cranial indices could be measured due to the heavily fragmented nature of the crania present. Of the ten adults with crania, only three could be measured for indices pertaining to the facial skeleton (one female and two males).

One female fell into the *leptorrhinic* (wide nasal aperture) range of the nasal index, while the only male whose nasal index could be measured was *mesorrhinic* (average). The results of the orbital index revealed that the female had *hypsiconchic* (narrow orbits) and the only other individual to have measurable orbits (a male) was *chamaeonchic* (had wide orbits). The maxilloalveolar index provided mixed results among the measurable individuals; two individuals (a female and male) had *brachuranic* maxillae (broad), while the third individual (a male) had a *leptostaphyline* palate (narrow). Finally, the palatal index revealed that one individual (a female) had a *leptostaphylic* (narrow) palate and a second individual (a male) had a *mesostaphylinic* (average/medium) palate.

NON-METRIC TRAITS

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

A total of thirty cranial (skull) and thirty post-cranial (bones of the body and limbs) non-metric traits were selected from the osteological literature (Buikstra and Ubelaker 1994, Finnegan 1978, Berry and Berry 1967) and recorded. The disarticulated bones were also scanned for non-metric traits.

Numerous cranial and post cranial non-metric traits were identified amongst the individuals from Oxford and Newarke Street, Leicester. *Ossicles* (additional bones in the sutures) were present in two thirds of the left and right lambdoid sutures (at the back of the cranium). In two individuals the ossicles were so large that they occupied a large portion of the occipital bone (Plate 1). Bennett (1965) has suggested that the formation of *ossicles* in this suture may be

related to stresses placed on the growing cranium during foetal life and early infancy. *Ossicles* were more prevalent in males than females at Oxford and Newarke Street. One individual also exhibited an *ossicle* at the left parietal notch. *Foramen of Huschke* (a small hole below the ear) and *bridging of the supraorbital notch* (spicule of bone above the eye) were equally common, affecting around 25% of the population. *Mastoid foramina* (holes around the ear bone area) tended to be *extrasutural*, and *accessory supraorbital foramen* (small holes above the eye sockets) were more frequently observed on the right side. Other traits were also present (Table 11).

Table 11 Cranial non-metric traits (adults)

Midline Traits	Trait Present	Part Present	%
Ossicle at Lambda	0	8	0%
Ossicle at Bregma	0	7	0%
Metopic Suture	0	10	0%
Palatine Torus	1	5	20%
Precondylar Tubercle	4	10	40%

Paired Traits	Right			Left		
	Trait Present	Part Present	%	Trait Present	Part Present	%
Highest Nuchal Line	0	6	0%	0	6	0%
Lambdoid Ossicle	3	5	60%	3	5	60%
Coronal Ossicle	0	7	0%	0	7	0%
Ossicle at Asterion	0	3	0%	0	4	0%
Ossicle at Parietal Notch	0	3	0%	1	5	20%
Ossicle at Pterion	0	3	0%	0	4	0%
Parietal Foramen	3	6	50%	3	6	50%
Auditory Torus	0	10	0%	0	9	0%
Foramen of Huschke	2	10	20%	2	9	22.2%
Mastoid For. Extrasutural	6	9	66.6%	8	8	100%
Sutural Mastoid Foramen	0	5	0%	1	4	25%
Open Post. Condylar Canal	2	5	40%	1	4	25%
Double Condylar Facet	0	8	0%	0	7	0%
Double Ant. Condylar Canal	4	8	50%	2	7	28.6%
For. Ovale Incomplete	1	4	25%	1	2	50%
Open For. Spinosum	1	4	25%	1	2	50%
Access. Less. Palat. For.	1	2	50%	0	1	0%
Maxillary Torus	2	7	28.6 %	1	7	14.3%
Mandibular Torus	1	10	10%	2	11	18.2%
Zygomatic. Facial For. Abs.	0	6	0%	0	4	0%
Access. Infra-orb. For.	2	5	40%	1	3	33.3%
Access. Supraorbital For.	4	9	44.4%	2	7	28.6%
Bridging Supraorbital Notch	2	9	22.2%	2	7	28.6%
Anterior Ethmoid For. Ex.	0	1	0.0%	1	3	33.3%

Posterior Ethmoid For. Ex.	0	0	0%	1	112	50%

Double anterior calcaneal facets and *double inferior talar facets* (differences in the shape of the joints of the heel) were common, affected 47.4% of tali and 59% of calcanei. Bipartite *transverse foramina* (double rather than single holes in the neck vertebrae) were also common, as was *Plaque* (roughened area of bone on the neck of the femur) and *hypotrochanteric fossa* (groove in the back of the femur). Other traits were less frequently observed (Table 12).

Table 12 Post-cranial non-metric traits (adults)

Midline Traits	Trait Present	Part Present	%
Sternal Foramen	0	1	0 %

Paired Traits	**Right**			**Left**		
	Trait Present	Part Present	%	Trait Present	Part Present	%
Lateral Atlas Bridging	0	8	0%	0	8	0%
Double Atlas Facet	2	10	20%	1	8	12.5%
Posterior Atlas Bridging	0	10	0%	0	9	0%
Transverse For. Bipartite	2	6	33.3%	2	6	33.3%
Suprascapular Foramen	4	7	57.1%	3	7	42.9%
Accessory Acromial Facet	0	3	0.0%	0	1	0%
Circumflex Sulcus	2	4	50%	2	6	33.3%
Supracondyloid Process	0	12	0 %	0	9	0%
Septal Aperture	1	10	10%	1	7	14.3%
Accessory Sacral Facet	0	3	0%	0	4	0%
Acetabular Crease	1	11	9.1%	2	9	22.2%
Allen's Fossa	1	8	12.5%	2	7	28.6%
Poirier's Facet	2	7	28.6%	1	6	16.6%
Plaque	2	5	40%	2	8	25%
Hypotrochanteric Fossa	4	11	36.4%	3	8	37.5%
Exostosis in Troch. Fossa	2	8	25%	2	5	40%
Third Trochanter	2	9	22.2%	2	8	25%
Emarginate Patella	0	4	0%	0	4	0%
Vastus Notch	0	4	0%	0	4	0%
Vastus Fossa	0	4	0%	0	4	0%
Med. Tib. Squatting Facet	1	10	11.1%	0	9	0%
Lat. Tib. Squatting Facet	2	10	20%	1	10	10%
Peroneal Tubercle	5	6	83.3%	1	4	25%
Double Ant. Calc. Facet	5	9	55.6%	5	8	62.5%
Absent Ant. Calc. Facet	0	8	0%	0	8	0%
Double Inf. Talar Facet	4	10	40%	5	9	55.5%
Med. Talar Facet	0	10	0%	0	9	0%
Lat. Talar Extension	0	10	0%	0	9	0%
Os Trigonum	1	10	10%	0	9	0%

The incidence of some non-metric traits may suggest a shared genetic heritage, where rarer traits were shared amongst skeletons; their distribution throughout the cemetery was examined to see if they were located within the same area, however, individuals with shared traits appeared to be randomly distributed throughout the cemetery.

CONCLUSION

The skeletal remains were generally moderately preserved and largely over 50% complete. Osteological investigation has shown that a lower than average proportion of non-adults for the period was recorded, with youngest age groups (foetuses and neonates) being absent. Other than this, the small group contained a wide age range, extending from one year old to mature adulthood. The majority of females were aged between 26 to 35 years, while more males appeared to reach mature adulthood. The non-adults were all in the juvenile category, aged from one to twelve years. The adults were almost evenly divided between males and females. The living height of the male adult population was slightly above the national average for the Roman period, while the females were of average Roman height. A number of shared non metric traits amongst the skeletons suggest a shared genetic heritage among some of the individuals, although familial groups or plots within the cemetery were not visible.

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.

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 these individuals will usually have been unaware of their condition. 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 (Barnes 1994). It may also provide information on levels of maternal health (Sture 2001).

Lumbar Ribs

Normally, there are twelve ribs on each side of the body, each attaching to one of the twelve thoracic vertebrae. Occasionally, there are ribs that attach to the seventh cervical or first lumbar vertebra. Skeleton 9 (young middle adult female) had two lumbar ribs (Plate 2). Examination of the thoracic vertebrae revealed that each vertebral body possessed an articular facet for a rib, suggesting that there had not been any border shifting, and that the two small ribs were

Plate 2 Lumbar ribs, Sk 9

Plate 3 *Spina bifida occulta* in S2-4 of Sk 10

accessory ribs. Lumbar ribs were found in 0.9% of patients in a clinical study (Merks *et al* 2005). It is unlikely that the individual would have known about the anomaly.

3.1.2 Cleft Neural Arches

Cleft (open) neural arches occur when the two halves of the neural arch, the part of the vertebra, which surrounds and protects the spinal cord, fail to unite during development (Barnes 1994). The gap in the bone is filled with a tough fibrous tissue in life and so the spinal cord remains protected and these defects are asymptomatic. They are usually seen at the border regions between different vertebral types, particularly in the lumbo-sacral region when the entire sacrum may be involved (*ibid*). Cleft neural arches are often referred to as *spina bifida occulta*. Cleft neural arches were seen in two individuals, both young middle adult males. Skeletons 5 and 10 both had clefts in the arches of the sacral vertebrae, in Skeleton 10 the second, third, and fourth neural arches were cleft (Plate 3), and the first vertebra was bifid, while in Skeleton 5 only the first sacral vertebra was cleft. The frequency of *spina bifida occulta* among the adult population was 66.6% of complete or nearly complete adult sacra. This figure is considerably higher than the maximum of 25% of the population suggested by Barnes (*ibid*), but the sample is small. *Spina bifida occulta* was observed in one individual from Newarke Street (Wakely and Carter 1996).

Transitional Vertebrae

The normal human spine consists of seven cervical (neck), twelve thoracic (chest) and five lumbar (lower back) vertebrae, making a total of 24 independent segments. The sacrum (at the

base of the spine, forming the back of the pelvis) is usually composed of five fused vertebral segments, and the coccyx (vestigial tail) is normally made up of four fused vertebral segments. The overall total of vertebral segments is therefore 33.

Additional vertebrae occur when there is an extra vertebral segment, increasing the total number of segments in the spine. They usually occur at the junction between the thoracic and lumbar vertebrae (where they take on the appearance of a thoracic vertebra), or at the junction between the lumbar vertebrae and the sacrum. In the latter instance they either appear as an additional (sixth) lumbar vertebra, or become partially or fully incorporated into the sacrum (Barnes 1994, 78).

Transitional vertebrae can occur at the borders between different types of vertebra, when a vertebra from one group takes on some or all of the characteristics of an adjacent group, for example the first lumbar vertebra (in the lower back) may develop vestigial ribs (Barnes 1994, 79-116). The process by which this happens is known as 'border shifting'. The end result is to increase the number of segments in one part of the spine at the expense of the adjoining part (e.g. increasing the number of thoracic vertebrae to 13 through incorporating the first lumbar vertebra, but decreasing the number of lumbar vertebrae to four). Transitional vertebrae are reasonably common, particularly at the lumbo-sacral border (between the fifth lumbar vertebra and the sacrum, at the base of the spine), but the consequences of the border shift become more severe the higher up the spine it occurs (Barnes 1994, 79-116).

A complete and well preserved spine is required to determine whether any variation in the expected number of vertebrae in each group is the result of a genuine extra vertebral segment (i.e. an additional vertebra) or due to a border shift, and if the latter, what kind of shift has taken place.

The first coccygeal vertebrae of Skeleton 14 (mature adult male) had fused to the body of the sacrum; the neural arches of the fifth sacral vertebra have fused with the lateral margins of the coccyx, although the cornua and the superior surface of the body remained unfused. A further shift was also identified in the male skeleton's sacrum; the first sacral vertebra appeared partially expressed. The vertebral body was located considerably higher than the ala and the neural arch of the first sacral vertebrae remained distinct from the rest of the sacrum, with its inferior articulating facet also appearing to be separate. The border shifts both appeared to be caudal (the border moves further away from the cranium because the inferior vertebra becomes incorporated into the superior region of the spine).

METABOLIC CONDITIONS

Humans require an adequate supply of nutrients during childhood to support normal growth and development. Particular conditions are associated with the lack of specific nutrients, for example scurvy results from a diet lacking in vitamin C (found in fresh fruit and vegetables, and marine fish) and rickets from a lack of vitamin D (produced by the body during exposure to sunlight). Diagnosis of nutritional deficiencies in ancient populations is complicated by the fact that the skeletal changes can be difficult to diagnose, and that nutritional deficiencies tend not to occur in isolation (a diet deficient in one nutrient is very often deficient in others). In addition, many of the skeletal changes that develop in a child as a response to nutritional deficiency will be largely remodelled by the time the individual reaches adulthood (Ortner

2003, Lewis 2007).

Cribra Orbitalia and Anaemia

Cribra orbitalia, or fine pitting of the orbital roof, tends to develop during childhood, and often recedes during adolescence or early adulthood. Until recently, it was thought to be related to iron deficiency anaemia, a condition with complex causes linked to the environment, hygiene and diet (Stuart-Macadam 1992). However, a recent study has suggested that other forms of anaemia are more likely causes (Walker *et al* 2009). These include megaloblastic anaemia, which results following a diet deficient in Vitamin B_{12} (found in animal products) and/ or folic acid, and haemolytic anaemia (e.g. sickle cell anaemia and thalassemia, found in areas of the Old World prone to malaria). It was also suggested that chronic infections and scurvy (Vitamin C deficiency) may have led to the development of *cribra orbitalia* in Europe (*ibid*). *Cribra orbitalia* is commonly observed in archaeological populations, particularly associated with agricultural economies (Roberts and Cox 2003), and is often used as an indicator of general stress (Lewis 2000, Roberts and Manchester 2005).

Two adult and four non-adult eye orbits were assessed for the presence or absence of *cribra orbitalia*. It was observed in all (100%) of the non-adult orbits available for examination One quarter of the adults with orbits available for examination were affected (Table 13). Males were less likely to be affected than females. However; juveniles were more frequently affected than adults, suggesting that individuals affected with *cribra orbitalia* were less likely to reach adulthood or alternatively, that the lesions remodelled in adults.

Table 13 Prevalence of *cribra orbitalia*

Age/Sex	Frequencies			Skeletons
	Right Orbit	Left Orbit	Individuals	
Males	1/4 (25.0%)	1/4 (25.0%)	1/5 (20.0%)	SK 6
Females	1/2 (50.0%)	0/2 (0.0%)	1/3 (33.3%)	SK 4
Total Adults	**2/6 (33.3%)**	**1/6 (16.6%)**	**2/8 (25.0%)**	
Juveniles	3/3 (100%)	1/1 (100%)	3/3 (100%)	SK 1A2, SK 2, SK7
Total Individuals	**5/9 (44.4%)**	**2/7 (28.6%)**	**5/11 (45.5%)**	

Eight individuals from Newarke Street (Wakely and Carter 1996) had *cribra orbitalia*, providing a crude prevalence rate of 21% of the population. A further five individuals excavated from the Oxford Street cemetery in 2002 were affected, providing a prevalence rate of 28% of the population (Jacklin and Chapman 2009). A further individual, an immature skeleton, recovered from the Clarence Street excavations (Waldron 2005) was the only individual from the assemblage to exhibit *cribra orbitalia*, providing a crude prevalence rate of 1.1%. This suggests that the condition was unusually prevalent in the Oxford Street non-adults, particularly compared with the average Roman prevalence rate of 9.64% (Roberts and Cox 2003).

Scurvy

Scurvy develops following a prolonged deficiency in Vitamin C, which is found in fresh fruits and vegetables, as well as in marine fish. It is important to bear in mind that cooking food will destroy a large percentage of the Vitamin C it contains (Ortner 2003, 384). According to Aufderheide and Rodríguez-Martín (1998) it will take one to three months for the first symptoms to appear, if the consumption of Vitamin C is stopped completely. Children and infants are more likely to develop scurvy than adults, and the skeletal changes are usually most severe in infants. Ortner (2003, 384) has reported that the highest prevalence of scurvy occurs among infants between eight to ten months of age, although Lewis (2007, 127) indicates a broader age bracket of six months to two years.

One of the non-adults, Skeleton 7 (juvenile 2-3 years old), displayed skeletal changes frequently attributed to scurvy (Ortner 2003, 384-387). These included woven bone and fine porotic bone on the external and internal surfaces of many of the cranial bones. However; the post-cranial skeleton of the juvenile did not survive and as such it was not possible to observe whether or not manifestations of the disease seen elsewhere in the axial skeleton were present, and as such a differential diagnosis cannot be made. A prevalence rate of 0.03% has been recorded for scurvy for the Roman period (Roberts and Cox 2003).

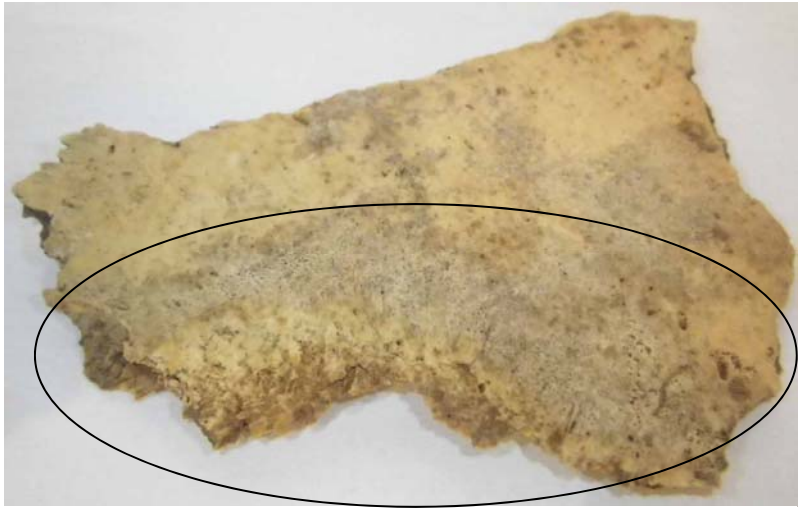

Plate 4 Porotic plaque like bone along temporal articulation, left parietal, SK 7

New bone formation was present on the external surface of the right occipital where a hyper-porotic plaque like layer of bone was evident adjacent to the suture and on the right temporal, where porotic plaque-like bone with vascular impressions extended from the superior margin of the external auditory meatus (ear hole), along the zygomatic process and supra mental crest. Bilateral new bone formation was also evident on the parietals; the left was affected along the temporal articulation (Plate 4) and the right along the coronal and sagittal sutures, where porotic, plaque like new bone formation occurred. Similar bone was also observed on a fragment of left frontal bone along the coronal suture. Disorganised porotic woven bone was also identified in the right orbit of the frontal bone. The endocranial lesions were visible on the frontal bone along the frontal crest. A further four unidentifiable vault fragments exhibited dense, disorganised, plaque-like bone on the endocranial surface, adjacent to the sutural margins. While the lesions cannot be definitively ascribed to scurvy, the bone formation does bear a resemblance to the type and distribution of lesions encountered in the cranial bones of individuals suffering from scurvy (Ortner 2003).

TRAUMA

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

Fractures

Three adults had one or more bones fractured during life (18.8% of all adults), with the total number of bones fractured being four. These figures are high compared to the Romano-British average, of 10.7% of individuals suffering from fractures (Roberts and Cox 2003).

Two possible further incidents of trauma, involving the femur and tibia and two metatarsals, were also evident in Skeleton 12 (mature adult male), but could not be positively diagnosed as fractures and therefore have not been included in the prevalence rate, however they are discussed further below.

The first thoracic vertebrae of Skeleton 11 (mature adult female) was wedge shaped, with an anterior body height of 22.9mm and a posterior body height of 29.5mm, and may have been a compression fracture. Crush or compression fractures of the thoracic spine are most common in 'elderly patients with porotic bone who slip and fall on their bottom (Dandy and Edwards 2003, 154) or in 'younger patients who fall from a height and land on their heels (*ibid*). So long as 50% of the height of the body is not lost medical intervention may not be needed, however, 'even in slight deformities, back pain may persist for two or more years after injury and sometimes indefinitely' (*ibid*). The crude prevalence rate for vertebrae affected by crush fractures was 0.8% (1/132) or 10% of the adult population with one or more observable vertebral bodies.

Two vertebral end plate fractures were observed amongst the vertebrae of one mature adult male from Clarence Street (Waldron 2005), providing a crude prevalence rate of 1.25% (1/80 adults with vertebral crush fractures).
A further spinal crush fracture was evident in the remains of an individual from Newarke Street (Wakely and Carter 1996) providing a crude prevalence rate of (2.6%).

Skeleton 12 (mature adult male) exhibited a well-healed fracture to the right distal radius. The fracture ran superiorly from the medio-anterior border inferiorly to the latero-anterior edge, with no evidence of displacement of the distal fragment. The break was very well remodelled with only a slight callus evident, consisting of smooth lamellar bone. A lack of visible displacement and mal-union would suggest that the fracture was neither a Colles', Smith's or Barton's fracture. Instead it appears to have been an isolated fracture of the radius, in which non-union is uncommon (Dandy and Edwards 2003, 203) and can be caused by direct trauma (*ibid*). The crude prevalence rate for radial fractures was 5.3% (1/19) or 10% of the population with at least one radius.

A mature adult male (Skeleton 14) had incurred healed fractures to his distal fibula and tibia. The fracture to his distal left fibula was located 15mm superior to the distal epiphyses, and appeared to be oblique with posterior and inferior displacement of the proximal fragment, and 26mm of overlap. The posterior and anterior surfaces of the callus were smooth and well remodelled with dense lamellar bone, however; the medial surface had two irregular ossified nodules at the fracture site, possibly as a result of *myositis ossificans traumatica*. Abrasion of the callus revealed it had a honeycomb interior. The skeleton also had a probable fracture and extensive soft tissue damage to his distal left tibia. The posterior-medial margin of the distal articulation appeared as if it has been crushed and displaced superiorly. The posterior-lateral metaphyseal area consisted of a large lobule of fibrous bone, which extended medially. The medial margin of the anterior surface of the metaphysis had another frilly fibrous nodule of bone, which also extended medially, effectively enclosing the anterior and posterior portions of the distal fibula shaft. The anterior articular margin of the tibia was porotic and seemingly slightly resorbed, a plaque like layer of microporotic overlay the medial articular surface, and the surface of the medial malleolus. Changes were also observed to the superior articular margins of the left talus. According to Wedel and Galloway (2014, 286) such fractures occur as a result of extreme rotational shearing as the body falls to the side contralateral to the injury.

A greater number of fractures appear to have been observed at Clarence Street and Newarke Street. Fractures of one ulna, one fibula, one rib, two spinal crush fractures, one metacarpal fracture, one nasal fracture, one cranial fracture, and one dislocated shoulder were observed at Newarke Street (Wakely and Carter 1996). Another fracture was observed in an individual's femur at Newarke Street (Jacklin and Chapman 2009), providing a crude prevalence rate of 3% of the population affected by fractures. Finally, one rib fracture, two vertebral end plate fractures, one humeral fracture, one femoral neck fracture and a peri-mortem head trauma were observed at Clarence Street (Waldron 2005). The evidence suggests that in comparison to the other Roman cemeteries in Leicester, the Oxford Street individuals showed very little evidence of fractures.

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). In skeletal remains the lesion manifests as a roughly circular, porous hollow in the joint surface.

SK 1 A.7 (old middle adult male) had osteochondritis dissecans on the antero-medial surface of the right tibial distal joint. The bone fragment had not reattached and the lesion appeared smooth and well-rounded. The frequency of osteochondritis dissecans on the distal tibia in the adult population was 5.9% (1/17 distal tibial articulations).

Skeleton 10 (young middle adult male) had two small depressed lesions on the proximal articular surface of the proximal phalanx for the left first metatarsal. The lesions penetrated the articular surface exposing the underlying trabecular bone. It is possible that they were the result of osteochondritis dissecans (or may have been developmental). The frequency of osteochondritis dissecans on the proximal articular surface of the proximal phalanx for first

metatarsal in the adult population was 12.5 % (1/ 8 proximal articulations of proximal phalanx for MT1).

Myositis Ossificans Traumatica

Myositis ossificans traumatica is caused by the avulsion of tendons or muscle attachments (Aufderheide and Rodríguez-Martín 1998, 26); severe trauma to muscular tissue can sometimes result in the ossification of the muscle tissue itself (Ortner 2003, 133). The most commonly observed sites are on the femur at the insertion of the extensors and abductors, the humerus at the insertion of *deltoid* and *pectoralis* (major and minor) (*ibid*). These traumatic lesions are most commonly seen in young adults (*ibid*, 134).

Skeleton 14 (mature adult male) had two irregular ossified nodules on the medial surface of his distal left fibula, possibly as a result the fracture, at the site of the interosseous ligament. A further spicule of bone was located on the distal shaft of his left femur at the insertion of *vastus intermedius* (responsible for extending the leg at the knee; Stone and Stone 1990,169) and the short head of *biceps* (flexes the leg at the knee joint, *ibid*,171).

Another mature adult male (Skeleton 8) had a large bony projection of lamellar bone, with rough rugged undefined margins, located on the medial margin of the upper third of the shaft, at the insertion of *vastus lateralis* (responsible for extending the leg at the knee joint; Stone and Stone 2006,179). The crude prevalence rate for *myositis ossificans traumatica* of the femur in the adult population, at Oxford and Newarke Street was 5.9% (1/17 adult femora present).

An alternative diagnosis might be an *osteochondroma*, however, although these benign tumours are most commonly seen on the femur and tibia, they are usually located on the metaphyses (growing ends of the long bones; Aufderheide and Rodríguez-Martín 1998, 381). Another alternative could be an ossified haematoma; haematomas can result from direct blunt force trauma or the tearing of muscle fibres, causing blood to collect and clot (Aufderheide and Rodríguez-Martín 1998, 27). If the damaged muscle is exercised too soon following the injury, the blood clot may ossify, producing a bony lump at the site of the haematoma.

Ossified Haematoma

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Skeleton 14 (mature adult male) had two palpable nodules on the posterior surface of the shaft of his left tibia; the first was located 115mm from the distal articulation and measured 5.5mm in diameter, while the second was 48mm superior of the first and measured 30mm superior-inferiorly and 12mm anteriorly-posteriorly. Both of the lesions had a smooth lamellar like appearance and may have been ossified haematomas.

Possible Trauma

Other lesions of unknown cause were observed, some of which may potentially be due to trauma. Skeleton 12 (mature adult male) exhibited alterations to four bones. It is possible that the lesions occurred in the same traumatic incident as the radial fracture described above, however, they were slightly more enigmatic in their appearance and could not confidently be classed as fractures, although some form of trauma was likely to have caused the alterations in the bones appearances.

The distal end of the right femur of Skeleton 12 exhibited degeneration of the articular surface; a groove had developed on the medial condyle, running from the patellar surface down the inferior surface of the condyle. The general appearance of the patellar surface of the articulation was also morphologically altered; having developed a topographic appearance with irregular but rounded surface morphology. The right proximal tibia articulation exhibited the same irregular surface morphology with associated osteoarthritis on the lateral condyle. It is possible that this was a condylar fracture. Complications that may arise from condylar fractures include the loss of blood supply to the fragments, which may 'lead to aseptic necrosis, collapse and a gross deformity. If the fragments are not repositioned exactly there will be a valgus or varus deformity, which may lead to osteoarthritis' (Dandy and Edwards 2003, 246).

The same individual also exhibited 'kissing' osteophytes (outgrowths of bone that form a joint) at the proximal ends of the lateral shafts of the right first and second metatarsals, superior to the articular facets, which were possibly trauma-related. Because the toes are susceptible to damage from dropped objects or being crushed, fractures to the region are not uncommon. Even today, they are frequently caused in industrial accidents (Dandy and Edwards 1998, 276). If the foot phalanges are fractured or crushed, then elevation of the foot for some days is required (*ibid*). Crushing injuries of the foot phalanges often cause persistent stiffness (*ibid*). In Skeleton 12, the florid osteophytic bone may have been in the process of fusing together, possibly as a result of a fracture or crushing injury.

INFECTIOUS DISEASE

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

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).

Very few sinuses were available for examination. Of the two non-adults three sinuses were available and all (100%) exhibited at least mild porotic or spicule bone formation within the maxillary antrum. Sinusitis was observed in two adults (33.3% of those with sinuses present to observe), and was only observed amongst the females (Table 14). These figures are much higher than the frequency of 1.8% given by Roberts and Cox (2003), but their figures are based on crude prevalence rates and so likely to be less accurate. Furthermore, the sample size here was small and as such will have affected the prevalence rates. It is possible that, at least in some cases, sinusitis was linked to dental caries or abscesses rather than to air quality in this population; Skeletons 1, 2, and 9 all exhibited poor dental health.

Table 14 Prevalence of maxillary sinusitis

Sex	Right Sinus			Left Sinus			Individuals		
	A	P	%	A	P	%	A	P	%
Males	0	1	0.0%	0	3	0.0%	0	3	0.0%
Females	1	2	50.0%	1	2	50.0%	2	3	66.6%
Juveniles	1	1	100%	2	2	100%	2	2	100%
Total	2	4	50.0%	3	6	50.0%	4	8	50.0%

A = affected (number of sinuses with sinusitis); P = present (number of sinuses present and observable)

Maxillary sinusitis was only recorded in three other individuals from Newarke Street (Wakely and Carter 1996), providing a crude prevalence rate of 8.3%. The average prevalence sinusitis reported by Roberts and Cox (2003) for the Roman period was of 1.3%.

Hypertrophic (Pulmonary) Arthropathy

Hypertrophic arthropathy is principally linked to cancer of the lungs, although cancer of other tissues and pleural and cardiac lesions may also initiate the condition (Ortner 2003, 354). Characteristic lesions of the condition include symmetrical new bone formation along the diaphyses of long bones, which is densest at the mid shaft and becomes less severe at the metaphyses. The bones most commonly affected include the radius, ulna, tibia and fibula, while less commonly involved are the femur, humerus, metacarpals and metatarsals (Aufderheide and Rodríguez-Martín 1998, 91). The ribs, clavicle and scapula, however, are only affected in the most advanced cases (*ibid*). In the early stages of the condition, bone deposition is fibrous (woven) which later remodels into florid lamellar bone (Ortner 2003, 354). In modern cases the bony lesions disappear once the primary cause has been removed (*ibid*).

A young middle adult female (Skeleton 9) exhibited lesions which may be attributable to hypertrophic pulmonary arthropathy, with symmetrical new bone formation affecting many of the limb bones, including the tibiae, where well remodelled lamellar bone and disorganised active woven bone were present on the medial and latero-posterior portions of the shaft. Bilateral periosteal reactions on the fibulae, consisting of well remodelled lamellar bone, were recorded along the shaft and disorganised active woven bone was present on the distal third of the right fibula. Bilateral new bone formation was also evident on the femora, exhibiting a combination of well-remodelled lamellar bone and disorganised woven bone along the length of the shafts. Skeleton 9 also exhibited bilateral disorganised woven bone on the proximal

humeral shafts, with well-remodelled lamellar bone on the left proximal shaft. Further disorganised woven bone was also present on the left ischium and porotic plaque like vascularised bone was present on the right calcaneus around the sustentaculum sulcus.

The same skeleton also suffered from a chronic lung infection, with localised patches of disorganised woven bone on the pleural surface of four right ribs. While in modern populations lung cancer is thought to be the main cause of hypertrophic pulmonary arthropathy, in pre-antibiotic populations chronic lung disease may have contributed to a greater number of cases than today (Mays *et al* 2002). This may be pertinent with regards to Skeleton 9, who exhibited evidence of a chronic lung infection, which may have led to the development of the disease.

Other conditions which may be worth considering when attempting a differential diagnosis are fluorosis and hypervitaminosis. Fluorosis, caused by increased fluoride levels in the body stimulates osteoblastic activity, resulting in new bone deposition (Aufderheide and Rodríguez-Martín 1998, 317). Fluorosis may develop in individuals exposed to the industrial processing of ore or indirectly through the drinking of contaminated water (*ibid*). The bony lesions are similar appearance to hypertrophic pulmonary arthropathy, fluorosis has a predilection for the axial skeleton, which was also the case in Skeleton 9. Hypervitaminosis also shares a similar pattern of lesions, however; it is an unlikely cause, being stimulated by an overdose of Vitamin A.

Endocranial Bone Formation

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

Endocranial bone formation was observed in four adults and two juveniles; the lesions exhibited on one of the juvenile crania (Skeleton 7) may relate to a specific aetiology and have been discussed elsewhere with regards to scurvy. The second juvenile, Skeleton 2 (2-3 years old), had porotic plaque-like bone with vascular impression on the occipital (Plate 5). The endocranial lesions were located within the

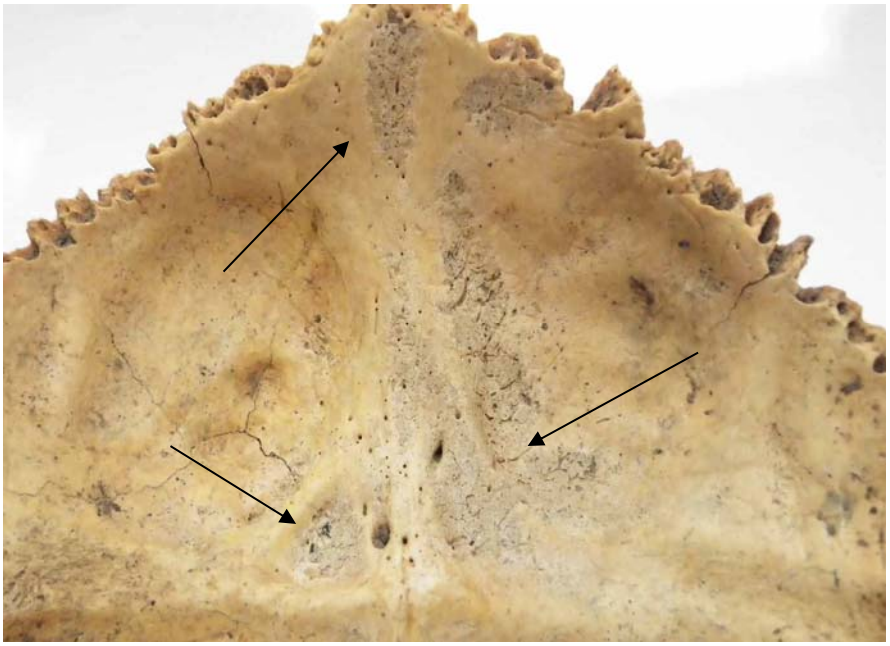


Plate 5 Endocranial lesions in occipital, Sk 2

left cerebral fossa, sagittal sulcus and the cruciform eminence.

Skeleton 6 (young adult male) exhibited porotic and disorganised new bone formation on the endocranial surface of frontal bone, located within the most anterior portion of the sagittal sulcus.

Skeleton 10 (young middle adult male) exhibited endocranial periosteal reactions on the occipital frontal and both parietals in the form of plaque-like porotic bone with vascular impressions. The new bone on the occipital was located on the cruciform eminence transverse and sagittal sulcus, and appeared to be chronic, with a mixture of active and remodelled bone; vascular impressions also filled the left cerebral fossa. Bilateral new bone formation was evident in the sagittal sulcus of the parietals, which deviated from the sagittal sulcus in the frontal into the left frontal lobe.

Analysis of Skeleton 11 (mature adult female) revealed endocranial periosteal lesions on the frontal and parietals, within the sagittal sulcus, which consisted of porotic plaque-like bone with vascular impressions.

The last of the adults to exhibit endocranial lesions was Skeleton 12 (mature adult male). The new bone formation was located on the frontal within the posterior two thirds of the sagittal sulcus.

It would appear that at Oxford and Newarke Street males were more likely to be affected by endocranial lesions (60% of observable crania affected) than females (33.3% of observable crania affected). The frequency of involvement of the frontal bone was 57.1% in the adults (4/7 of frontal bones present). Bone formation on the inner surfaces of the parietals was bilateral when observed, and occurred in 26.7% of adult parietal bones (4/15). Finally, bone formation of the occipital occurred in 12.5% of the adult population (1/8 occipital bones present).
With regards to the juvenile population, if Skeleton 7 is ignored, lesions were only observed on the occipital (50% 1/2 observable occipitals).

The high prevalence of the endocranial periosteal reactions at Oxford Street was unexpected. The exact cause of the majority of lesions was not certain, however, it is possible that, in the case of Skeleton 9, the lesions were linked to hypertrophic pulmonary arthropathy, discussed above. In the other instances, meningitis, tuberculoid meningitis, trauma or other causes may be responsible for the lesions.

One other individual from Newarke Street (Jacklin and Chapman 2009), a 5-7 year old, revealed endocranial lesions, providing a crude prevalence rat of 6% of the population.

Periosteal Inflammatory Lesions

An inflammation within the periosteum, a sheath of tissue that surrounds all bones, affects the surface of the bone, and is called periostitis (Ortner 2003). As with osteitis, the inflammation may be due to infection, but other causes are possible, including low-grade trauma, and chronic ulceration. The latter two changes are particularly common in the shaft of the tibia (Roberts and Manchester 1995; Ortner 2003). Initially, disorganised woven bone (active infection) is laid down on the surface of the bone, which later is remodelled into lamellar bone and

incorporated into the bone cortex (Ortner 2003).

Such lesions are commonly observed in archaeological populations, particularly on the tibiae, and although they may have been associated with a specific disease in life, it is almost always impossible to diagnose this from the bones alone. The prevalence of periostitis has frequently been used as a general measure of stress in past populations (Ortner 2003).

Periosteal reactions were observed in the leg bones of three adults; two males and one female, or 23.1% of the adult population with observable lower limbs (Table 7). This figure is much higher than the mean prevalence of periosteal reactions in Roman Britain (6.7 %, Roberts and Cox 2003).

Table 15 Prevalence of periostitis in the adult population

Bone	Frequency (Bone)	Frequency (Individual)	Skeletons
Tibia	3/16 (18.8%)	3/9 (33.3%)	4 (ma f), 10 (yma m), 14 (ma m)
Fibula	0/13 (0.0%)	0/8 (0.0%)	-
Femur	4/17 (23.5%)	2/9(22.2%)	10 (yma m), 14 (ma m)

Periosteal reactions were also recorded on the right medial calcaneal surface of Skeleton 5 (young middle adult male) and had a dense lamellar-like appearance. It appears that the infection had healed before the individual's death.

As is normally the case in archaeological populations, periosteal reactions of the tibia were most frequently observed, with one quarter of adults affected (see Table 7). Periosteal reactions of the femur were also observed, however, the fibula was not affected. In Skeletons 4 and 10, the lesions manifested as porotic disorganised woven bone, indicating that the inflammation was active at the time of death. Skeleton 10 (young middle adult, male) also exhibited a small patch of well remodelled lamellar bone on the posterior-lateral border of the right tibial mid shaft, suggesting that the infection had been longstanding. Skeleton 14 had well remodelled, striated lamellar bone across the entire surfaces of his left, right femora shafts, and his right tibia shaft, suggesting the inflammation was no longer active. Prolific new bone formation was also observed amongst the remains of Skeleton 9 (female, young middle adult), however, the lesions may have had a specific aetiology and as such the individual has been excluded from the periosteal prevalence calculations. Further discussion of Skeleton 9 can be found above.

At Newarke Street 7% of the population were affected by periosteal reactions (Jacklin and Chapman 2009).

Scalp Inflammation

Signs of inflammation were seen on the ectocranial surface of Skeleton 10 (young middle adult male). Porotic disorganised lesions on the external surface of the frontal and the antero-medial portions of both parietals; the lesions did not extend onto the lateral portions of the parietals forming a clear border (Plate 6), which was probably caused by the insertion of the *temporalis* muscle. Such lesions could be caused by psoriasis, dermatitis or a head-lice infestation; all of which would cause the individual to scratch the affected area and could lead to the breaking of the skin, allowing infection to enter.

Plate 6 Ectocranial periosteal reaction, L parietal, Sk 10, young middle adult

Tuberculosis

The first published evidence for tuberculosis in Britain comes from the Roman period, affecting 0.2% of individuals, and individuals with tuberculosis of this date have been found in Dorset, Hampshire, Gloucestershire and Lincolnshire (Roberts and Cox 2003). Roberts and Cox (*ibid*) suggest that increased trade with the continent may have been responsible for its introduction to Britain. Santos and Roberts (2001) state that the earliest known individual with the disease in Britain dates to the fourth century AD.

Gastrointestinal tuberculosis is caused by *Mycobacterium bovis* and is contracted through the intake of meat or milk from infected cattle, thus transmitting the infection to the human gut (Roberts and Cox 2003, 119), though less commonly the disease can be transmitted through droplet infection (Roberts and Manchester 2005, 187). The initial stage is largely asymptomatic (Aufderheide and Rodríguez-Martín 1998, 119), but can be fatal. The secondary stage of the infection can be due to re-infection with the bacilli, or through bacilli being released from a dormant primary lesion (*ibid*, 120).

Vertebral and rib lesions thought to be the result of *Mycobacterium bovis* were evident in the remains of Skeleton 4 (middle adult female). It is likely that this individual shows lesions from the secondary stage of the disease and thus had a good immune response to the primary stage of the disease; otherwise, she would probably have died quickly before skeletal lesions would have occurred. As bovine tuberculosis frequently affected children in the past, it is possible that this individual suffered from tuberculosis since childhood. It is probable that the infection

eventually proved fatal in this individual: '*Untreated cases carry about 50% mortality after 5 years, about one-half of which is due to tuberculous infections of tissues other than the bone. Additional deaths occur secondary to the complications of paralysis of the trunk and legs (paraplegia), respiratory dysfunction…and others. Prior to available, effective treatment about one-third to one-half of patients with skeletal Tuberculous vertebritis underwent spontaneous healing, the rate being influenced by nutritional, socio-economic and hygienic factors…The remainder commonly lived sometimes for decades with their chronic but active disease, often deformed, and sometimes with multiple, perpetually draining sinuses while others suffered on with paralysed legs.*' (Aufderheide and Rodríguez-Martín 1998, 123-124).

Skeletal involvement only occurs in a small percentage of individuals with tuberculosis (Santos and Roberts 2001 cite skeletal involvement in 1-9% of cases) and archaeological examples are relatively uncommon.

The most common region of the spinal column to be affected is the first lumbar vertebra, with the frequency decreasing with the distance on either side of it. The lower spine is the chief focal point in skeletal tuberculosis at all ages. The part of the vertebra involved is nearly always the vertebral body, most commonly it is the anterior portion that is involved. Even when lytic destruction is widespread, extension into the vertebral arches is uncommon (Ortner 2003, 230-231).

Plate 7 Pott's spine, 90° anterior angulation of the spine, Sk 4, posterior view

Vertebral and rib lesions thought to be the result of *Mycobacterium tuberculosis* were evident within the remains of Skeleton 4 (middle adult female). Alterations to the woman's spine were extensive; the second and third lumbar vertebrae were fused at the intervertebral space and articular facets, with well remodelled lamellar bone, although largely destroyed by taphonomy. The vertebral bodies appear to have undergone a degree of collapse; the combined height of the vertebral bodies of the second and third lumbar vertebrae was 32.4mm, whereas the height of the vertebral body of the fourth lumbar vertebra, which appeared unaffected, was 30.1mm. A lytic lesion penetrated the lateral body of second lumbar vertebra. Further fusion of vertebral bodies occurred between the first lumbar and twelfth thoracic vertebrae at the intervertebral space and articular facets; the bodies were fused together with porotic new bone in the process of remodelling. The body of the twelfth thoracic vertebra had been almost entirely destroyed, with irregular spicules of bone projecting from the left and right lateral portions of the remaining body. A pseudo articulation had developed on the spinous process of the twelfth thoracic vertebra, where it articulated with the spinous process of the eleventh thoracic vertebra. The articular facets have also extended

as a result of the extensive degeneration of the eleventh thoracic vertebra's body. The superior articular facets had extended onto the lamina of the twelfth thoracic vertebra where osteoarthritis (OA) had developed in the pseudo articulations. The body of the eleventh thoracic vertebra had been entirely destroyed, some of the right pedicle remained, although this had a very gnarled appearance and the left pedicle was almost entirely eroded. Another pseudo articulation on the lamina/spinous processes where the tenth thoracic vertebra spinous process would rest, both superior articular facets have undergone remodelling, the transverse processes have been subsumed into the articulations, possibly in an attempt to stabilise the spine. The superior and medial portions of the transverse process have developed superiorly and laterally to create an arch shaped articulation.

Due to the destruction of the eleventh thoracic vertebra's body the neural arch has rotated anteriorly 90 degrees, causing a 90 degree anterior angulation in the spine (Plates 7 and 8). Further fusion exhibited higher up in the spinal column was observed between the tenth and ninth thoracic vertebrae, which had fused at the intervertebral space and articular facets. The anterior and lateral surfaces of the vertebral bodies exhibited disorganised, hyper-porotic new bone with vascular impressions which created a rugged and uneven appearance. The inferior articular facets of the tenth thoracic vertebra had a posterior-lateral extension to their margins with associated moderate degenerative joint disease (DJD).

The seventh and sixth thoracic vertebrae were also fused between the intervertebral space and articular facets. The sixth thoracic vertebra was wedge shaped in appearance with an anterior body height of 8.1mm and a posterior vertebral body height of 21.0mm. The bodies were fused together with well remodelled, smooth, lamellar bone, which was indistinguishable from the rest of the vertebral body surface. The anterior body of the seventh thoracic vertebra appears to have developed osteophytic lipping; the osteophyte was indistinguishable from the rest of the body, not a typical osteophyte, possibly more of a syndesmophy. The left lateral portion of the body of the fourth thoracic vertebra exhibits a large lytic lesion. The edges of the lesion had begun to remodel. The third thoracic vertebra exhibited dense lamellar like well remodelled bone on the lateral portions of the body.

Plate 8 Pott's spine, 90^{o} anterior angulation of the spine, Sk 4, anterior view

Associated lesions were also evident on the ribs, the anterior surface of the left and right vertebral ends of the fourth to tenth ribs of well remodelled lamellar bone.

The prolific destruction of the woman's spine would have undoubtedly been de-habilitating. '*The tuberculosis victims of antiquity must have suffered the lingering ill health, the gnawing and unassuaged bone pain of infective involvement and the extreme emaciation of advanced tuberculosis.*' (Roberts and Manchester 2005, 192). Further consequences of the disease were suggested by Luk (1999) to include '*Weakness, numbness or paralysis of the lower limbs and unsteady gait, with loss of urinary control*.' The woman would have probably required care at

least in the later stages of her life, indeed the advanced state of the disease within the spine suggests she survived for some time in a heavily deformed state.

The incomplete and taphonomically altered remains of a second individual, Skeleton 5 (young middle adult male), also exhibited possible tuberculoid changes to their spine. Fusion of the fourth and fifth lumbar vertebrae had occurred at the superior and inferior articular facets, while the joint space appeared to be preserved. Ligamentous ossification along the right lateral side of the pedicle appeared to involve the zygaphopysial joint, with smooth lamellar bone extending from the fourth and fifth lumbar vertebrae. When the two lumbar vertebrae were articulated with the first sacral vertebra, a degree of posterior and left lateral deviation of spine was observed. Due to the fact that very little of the spinal column of Skeleton 5 survived, it was not possible to definitively say whether or not the individual was also suffering from a tuberculoid infection caused by *Mycobacterium bovis.*

Alternative diagnoses for the young male could include a developmental defect, causing the failure of the neural arches to separate; or alternatively trauma, resulting in a crush fracture; or ankylosing spondylitis, a disorder which involves the calcification of ligamentous connective tissue and is seen in '*the spine, sacroiliac and peripheral major joints*'(Aufderheide and Rodríguez-Martín 1998, 102).

Only six adults and one of the juveniles had the bodies of the tenth thoracic to second lumbar vertebra and at least some ribs present, giving a minimum prevalence for tuberculosis of 14.1% (1/7) in the population. If Skeleton 5 is included, the frequency of tuberculosis within the population rises to 25% (2/8).

One individual recovered from previous excavations at Newarke Street (Wakely and Carter 1996) was also thought to have tuberculosis, providing a crude prevalence rate of 2.6% (1/38) of the population.

DEGENERATIVE JOINT DISEASE

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

Plate 9 Central osteophyte on proximal R femoral articulation, Sk 1

2005).

Degenerative Joint Disease

Degenerative joint disease of the extra spinal joints did not follow the same distribution or frequency of joints affected as osteoarthritis (discussed below). The most commonly affected joint by DJD, in both females and males was the hip (88.2%; Plate 9), followed by the shoulder in females (71.4%) and knee and ankle in males (55.6%), the latter being frequently affected as one another. Although similar joints were affected in males and females, only males exhibited degenerative changes in their knee and ankle (Table 16).

Table 16 Prevalence of degenerative joint disease in the extra-spinal joints (joints affected)

Bone	Female			Male			Total		
	With DJD	N	%	With DJD	N	%	With DJD	N	%
TMJ	0	7	0.0%	0	5	0.0%	0	12	0.0%
Shoulder	5	7	71.4%	7	11	63.6%	12	18	66.6%
Elbow	2	7	28.6%	3	11	27.3%	5	18	27.8%
Wrist	2	6	33.3%	3	9	33.3%	5	15	33.3%
Hip	8	10	80%	7	11	63.6%	15	21	71.4%
Knee	0	8	0.0%	5	11	45.5%	5	19	26.3%
Ankle	0	9	0.0%	6	11	54.5%	6	20	30.0%

TMJ = temporomandibular joint; Shoulder = gleno-humeral joint; Elbow = distal humerus, proximal radius and proximal ulna; Wrist = distal radius, scaphoid and lunate; Hip = acetabulum and proximal femur; Knee = distal femur, patella and proximal tibia; Ankle = distal tibia and talus

Spinal degenerative changes were generally more common in adult females than males. A greater proportion of females exhibited degenerative changes in the cervical and thoracic regions (Table 17), whereas adult males were more likely to suffer from spinal DJD in the lumbar and sacral region.

Table 17 Prevalence of DJD of the vertebral articulations

Sex	Cervical Facets			Thoracic Facets			Lumbar Facets			Sacral Facets			Total Facets		
	With DJD	N	%	With DJD	N	%	With DJD	N	%	With DJD	N	%	With DJD	N	%
Female	3	98	3.1%	29	176	16.5%	12	103	11.7%	4	9	44.4%	48	386	12.4%
Male	8	98	8.2%	9	150	6.0%	16	72	22.2%	4	9	44.4%	37	329	11.2%
Total	**4**	**169**	**2.4%**	**37**	**302**	**12.3%**	**22**	**155**	**14.2%**	**8**	**17**	**47.1%**	**85**	**715**	**11.9%**

Overall, 11.9% (85/715) of vertebral apophyseal facets (joints between the vertebrae) were affected by DJD, with the highest prevalence seen in the sacral facets (47.1%), followed by the lumbar facets (14.2%) and thoracic facets (12.3%) with the lowest prevalence in the cervical facets (2.4%; see Table 9).

Spinal facet DJD was more prevalent in females (12.4 %) than in males (11.2%); this did not

corresponded with the distribution of osteoarthritis in the population, discussed below (see Table 17).

Although thirteen adults (six females, seven males) had some preserved vertebral bodies, only one adult had a complete spine (1 female), comprising the bodies of six cervical vertebrae (C1 was excluded as it does not have a body), twelve thoracic vertebrae, five lumbar vertebrae and the body of the first sacral vertebra. Most spines were incomplete, which, combined with the post-mortem fragmentation and erosion in some spines, made it difficult to identify specific vertebrae. For the purposes of calculating prevalence rates, any unidentified vertebral bodies that were present were counted, provided they could be identified to vertebra type (i.e. cervical, thoracic, lumbar or sacral). In total, 174 vertebral bodies were present (excluding the first cervical and including the first sacral), which gave an average of 10.9 vertebral bodies per skeleton (under half of the expected 24). The sacral vertebrae were the best represented, with an average of 0.6 vertebrae per individual (66% of the expected number) lumbar vertebrae were second best represented, with an average of 2.4 (half of the expected five) vertebrae per individual and the thoracic and cervical vertebrae were the least well represented (just under half of the expected twelve and six respectively). The male spines were less well preserved with on average 8.3 vertebral bodies per individual (66 vertebrae of eight individuals) compared to the 15.4 average number of bodies per female skeleton (108 vertebrae of seven individuals).

The overall frequency of vertebral bodies affected by degenerative changes was 35.6% (Table 18). Overall, the lumbar vertebrae (lower back) were most frequently affected (52.6%), followed by the thoracic (trunk) vertebrae, although the overwhelming majority of lumbar vertebrae affected were male. The least affected areas of the spine were the cervical (neck) vertebrae (Table 10), although the frequency was again heavily influenced by the male population. Overall, males were more frequently affected in all regions of the spine, but DJD in the sacral spine was exclusively a male affliction.

Table 18 Prevalence of DJD of the vertebral bodies

Sex	Cervical Bodies			Thoracic Bodies			Lumbar Bodies			Sacral Bodies			Total Bodies		
	With DJD	N	%	With DJD	N	%	With DJD	N	%	With DJD	N	%	With DJD	N	%
Female	2	21	9.5%	20	61	32.8%	8	21	38.1%	0	5	0.0%	30	108	27.7%
Male	7	24	29.2%	11	20	55.5%	12	17	70.6%	2	5	40.0%	32	66	48.5%
Total	**9**	**45**	**20.0%**	**31**	**81**	**38.3%**	**20**	**38**	**52.6%**	**2**	**10**	**20.0%**	**62**	**174**	**35.6%**

N = Number of vertebrae with at least one body surface present

Prevalence rates for DJD and OA were combined at Newarke Street (Wakely and Carter 1996), while at Clarence Street and in the 2009 publication for Newarke Street the criteria of classification for DJD were not defined (Waldron 2005; Jacklin and Chapman 2009), preventing comparative analysis.

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). OA is frequently associated with increasing age, but can be the result of mechanical stress and other factors, including lifestyle, food acquisition and preparation, social status, sex and general health and body weight (Larsen 1997; Roberts and Manchester 2005). OA was recorded as present when at least three of the features associated with OA were present (e.g. osteophytes , porosity, joint contour change); eburnation, even if occurring alone, was always considered to be indicative of OA (Roberts and Manchester 2005).

Thirteen adults had vertebral apophyseal facets preserved (7 females and 6 males). All unidentified facets (i.e. those which could not be identified to a specific vertebra) were still counted if they could be identified to a vertebra type (i.e. cervical, thoracic, lumbar or sacral). A normal skeleton would have 98 vertebral articular facets. However, the mean number of facets per skeleton at Oxford and Newarke Street was just over half of the norm (44.7). Male skeletons were less well preserved, with an average of 41.1 facets per skeleton compared to the female average of 55.1 per skeleton.

Overall, 3.1% (22/715) of apophyseal facets were affected by osteoarthritis, with the highest prevalence seen in the sacral facets (22.2%), followed by cervical (4.1%) and lumbar facets (2.9%), with the lowest prevalence in the thoracic facets (1.8%; Table 19). Osteoarthritis in the thoracic facets affected more females than males, although males exhibited a higher frequency of spinal OA overall. Roberts and Cox (2003, 145) calculated that on average 7.1% of the population were affected by spinal osteoarthritis during the Roman period. This figure is over twice the frequency observed at Oxford Street.

Table 19 Prevalence of osteoarthritis in the spine (facets affected)

Sex	Cervical Facets			Thoracic Facets			Lumbar Facets			Sacral Facets			Total Facets		
	With OA	N	%	With OA	N	%	With OA	N	%	With OA	N	%	With OA	N	%
Female	2	98	2.1%	4	176	2.3%	1	103	1.0%	2	9	22.2%	9	386	2.3%
Male	5	98	5.1%	2	150	1.3%	4	72	5.6%	2	9	22.2%	13	329	4.0%
Total	**7**	**169**	**4.1%**	**6**	**326**	**1.8%**	**5**	**175**	**2.9%**	**4**	**18**	**22.2%**	**22**	**715**	**3.1%**

N = Number of facets present

A total of thirteen extra-spinal joints (i.e. joints other than those in the spine, discussed above) were affected by osteoarthritis. Males were exclusively affected, due at least in some part to the greater number of males surviving into mature adulthood. Due to time constraints it was not possible to calculate the frequency of osteoarthritis individually for all extra-spinal joints (i.e. joints other than those in the spine, discussed above). However, the prevalence of OA in a selection of major joints is provided in Table 20.

Table 20 Prevalence of osteoarthritis in the extra-spinal joints (joints affected)

Bone	Female			Male			Total		
	With OA	N	%	With OA	N	%	With OA	N	%

TMJ	0	7	0.0%	0	5	0.0%	0	12	0.0%
Shoulder	0	7	0.0%	1	11	9.1%	1	18	5.6%
Elbow	0	7	0.0%	0	11	0.0%	0	18	0.0%
Wrist	0	6	0.0%	3	9	33.3%	3	15	20.0%
Hip	0	10	0.0%	3	11	27.3%	3	21	14.3%
Knee	0	8	0.0%	3	11	27.3%	3	19	15.8%
Ankle	0	9	0.0%	3	11	27.3%	3	20	15.0%

TMJ = temporomandibular joint; Shoulder = gleno-humeral joint; Elbow = distal humerus, proximal radius and proximal ulna; Wrist = distal radius, scaphoid and lunate; Hip = acetabulum and proximal femur; Knee = distal femur, patella and proximal tibia; Ankle = distal tibia and talus

The joint most frequently affected by OA was the wrist (see Table 20. The joints of the hip, knee, and ankle exhibited a slightly lower prevalence of osteoarthritis at around 27.3%.

The hips and knees, being the weight-bearing joints of the lower limb, frequently develop OA in modern populations (Roberts and Manchester 2005), with over 50% of those over 60 years of age may suffer from degeneration of the hips (Aufderheide and Rodríguez-Martín 1998). Degenerative changes in the ankle are usually associated with trauma (*ibid*).

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 were observed in 13.8% of vertebral bodies, most frequently in the lumbar spine, where 28.9% of bodies were affected. The only other region of the spine to be affected was the thoracic vertebrae, with 16.0% of bodies affected (Table 21). No Schmorl's nodes were observed amongst the cervical or the first sacral vertebrae. Overall, men appeared to be affected more than women with 15.2% of male vertebrae expressing lesions, compared to 13.0% of females. Differences in the regions of the spine affected between the sexes were observed; males tended to be more frequently affected in the thoracic region, while females tended to be affected in the lumbar region of the spine, suggesting different activities being carried out by males and females.

Table 21 Prevalence of Schmorl's nodes (vertebrae)

Sex	Cervical Bodies			Thoracic Bodies			Lumbar Bodies			Sacral Bodies			Total Bodies		
	With SN	N	%	With SN	N	%	With SN	N	%	With SN	N	%	With SN	N	%
Female	0	21	0.0%	7	61	11.5%	7	21	33.3%	0	5	0.0%	14	108	13.0%
Male	0	24	0.0%	6	20	30.0%	4	17	23.5%	0	5	0.0%	10	66	15.2%
Total	**0**	**45**	**0.0%**	**13**	**81**	**16.0%**	**11**	**38**	**28.9%**	**0**	**10**	**0.0%**	**24**	**174**	**13.8%**

Roberts and Cox (2003, 145) calculate that on average 17.7% of the population were affected by Schmorl's' nodes during the Roman period. This is moderately higher than the prevalence rates observed at Oxford Street.

DISH (Diffuse Idiopathic Skeletal Hyperostosis)

Diffuse *idiopathic* skeletal *hyperostosis* (diffuse skeletal growth of unknown cause), also known as DISH, is characterised by additional bone formation at the attachment sites of muscle and ligaments, as well as on the right side of the spinal bodies. The spinal osteophyte formation often causes fusion of a number of vertebrae, and takes a candle wax-like appearance. Although osteoarthritis and DISH are often observed in the same skeleton, they are not associated (Rogers and Waldron 2001, 359).

DISH has been associated with excessive calorie intake, diabetes, obesity and ageing, but other theories suggest that DISH may be a response to skeletal stress, with ossified muscle and ligament attachments and extra bone formation at the spine to support a large figure and a deteriorating skeleton (Arriaza 1993, 275). Greater prevalence rates of DISH have been found in monastic populations (Rogers 2000, 171), which could be due to the fact that this condition is more common in males, or older age groups, or may be related to the better nutrition of monks compared with other populations.

One individual with Possible DISH was identified in the population from Oxford and Newarke Street the (16.6% 1/6 of the adult population with observable spines). Skeleton 8 (mature adult male) exhibited ossification of the anterior longitudinal ligament (Plate 10), causing the fusion of the ninth to eleventh thoracic vertebrae, through a long, continuous, flowing syndesmophyte localised to the right lateral portion of the vertebral bodies. Further kissing, osteophytes between the seventh and eighth and eighth and ninth thoracic vertebrae were at the point of fusing. The articular facets and joint spaces were remained preserved.

Plate 10 Fusion of anterior longitudinal ligament, SK 8

General bone forming activity was also identified throughout the skeleton, with the ossification of rib cartilage, and further florid new bone on internal surface of the body of the sternum, which may represent the ossification of pleura. Numerous enthesopathies (bony outgrowths at the soft-tissue attachment sites) were also noted throughout the skeleton, including the right radial interosseus border for *flexor digitorum profundus* and radial tuberosity for *biceps*, attachments for *flexor digitorum profundus* on the left and right ulna, *brachialis* and *supinator* on the right ulna. The joint capsule of the right os coxa appears to have partially ossified. The ischio-femoral ligament, transverse ligament, reflected

head of *rectus femoris* and right and left pectineal ligament, on both pelves also appear to be very well developed. The soleal line on the left and right tibia and patellar ligament of the left tibia, and *quadriceps* tendon of the right patella were also very rugged. Roberts and Manchester recommend that 'fusion of four contiguous vertebrae is necessary for a diagnosis' (2005, 160).

Skeleton 8 also exhibited what appeared to be the partial ossification of *vastus lateralis* on the left femur, while it is possible that this was a symptom of DISH, it is discussed in further detail above.

Symptoms of DISH largely consist of back stiffness; more severe effects, such as compression of the spinal cord or paraplegia are only found in few extreme cases (Rogers and Waldron 2001, 361).

An individual recovered from Clarence Street (Waldron 2005), a mature adult male, was also diagnosed with DISH. While these changes all indicate a probable diagnosis of DISH (Aufderheide and Rodríguez-Martín 1998).

MISCELLANEOUS PATHOLOGY

A number of lesions were observed that either did not fit into the categories discussed above, or were ambiguous in terms of what caused them. Unfortunately, time constraints meant that it was not possible to present a full description of all lesions here (see Appendix A), but particular conditions have been addressed. Further research would be required into all these conditions, including the ones discussed below, as only a cursory consideration has been possible.

Rib Deformity

Three lower right ribs, possibly seventh to ninth, belonging to Skeleton 11 (a mature adult female) were not the usual shape (Plate 11). The curvature of the affected ribs was compressed laterally, so the ribs did not curve outwards to the side as far as would be expected; instead they exhibited a tight angle, which caused them to deviate medially and posteriorly to a greater degree than normal and, the ribs also tended to deviate downwards from the angle.

Plate 11 Flattening of the lateral projection of the right ribs, at the angle, Sk 11

The shape changes could have been the result of well remodelled rib fractures, although no evidence of a bony callus was observed in any of the three ribs. Osteomalacia can lead to reduced curvature and anterior projection of the ribs (Ortner 2003, 399), and is worth bearing in mind, especially considering the individuals sex and age, however; in the case of Skeleton 11 the ribs appeared to be curving inwards rather than projecting anteriorly. If osteomalacia were the cause, then associated deformities would be expected in the spine. Skeleton 11 did exhibit a crush fracture in the vertebral body of the eleventh thoracic vertebra, creating a wedge shape appearance, however, spinal manifestations of the disease usually include flattening of the vertebrae, "…and display accentuated cupping of the endplates…"(*ibid*). Such alterations were not observed in the vertebrae of Skeleton 11. Other conditions to consider would include *pectus carinatum* ('pigeon chest') (Groves *et al* 2003) or the binding of the chest. Unfortunately, the woman's left ribs did not survive well enough to determine whether or not the deformity was bilateral, which would be expected, had the chest been tightly bound.

It was not possible to calculate a prevalence rate for rib deformity at Oxford and Newarke Street due to the high proportion of individuals with badly fragmented, incomplete ribs too poorly preserved to assess shape.

Humeral Bowing

Two adults from Oxford and Newarke Street both exhibited bowing of the humerus; Skeleton 10 (young middle adult male) exhibited asymmetry between the humeri; the right bone was 14mm longer than the left. The left humerus also revealed a degree of torsion in the proximal shaft, where there appeared to be antero-posterior bending within the shaft. Skeleton 12 (mature adult male) also exhibited degree of torsion in the proximal two thirds of the left humerus. The shaft appeared to have revolved antero-medially, with a degree of anterior posterior bowing in the proximal third.

Possible causes for bowing deformation of long bones, including congenital anomalies and greenstick (young bone) fractures. Stuart-Macadam *et al* (1998), suggest that some bowing deformities are due to childhood trauma which, in an adult with a less supple bone structure, would have fractured the long bone. This condition, also termed 'acute plastic bowing deformity', can also be associated with inflammatory bone formation, which was not seen at Oxford Street.

CONCLUSION

A wide range of pathological conditions were observed in the Oxford Street population, especially considering the relatively small size of the sample. Relatively minor congenital conditions were observed, including accessory ribs in a young middle adult female, as well as cleft neural arches in the sacrum two young middle adult males.

Evidence for nutritional and environmental childhood stresses were observed, with *cribra orbitalia* affecting half of the observable population. Skeletal changes exhibited in the skeleton of a juvenile may have been caused by scurvy (vitamin C deficiency). While these skeletal lesions were indicative of dietary deficiencies and environmental hardships, one mature adult

male, exhibited lesions associated with dietary excess or possibly Type II diabetes in the form of spinal fusion, probably caused by DISH, suggesting high social status.

Three individuals had suffered traumatic injury to the skeleton, including one mature adult female with a crushed vertebra, possibly as the result of a fall. A mature adult male had fractured his forearm in a traumatic incident, which may have also involved the possible fracture of their knee, traumatic muscular damage to his thigh and damage to the foot. Another mature adult male had healed fractures to his distal fibula and tibia, as well as soft tissue damage to the back of his thigh and ankle.

Over half the adults had signs of infectious disease, in some cases associated with other conditions. Infections of the upper respiratory tract (in the form of sinusitis) affected over half of the observable population, although exclusively females and juveniles. Tuberculosis was also suspected; the remains of one middle adult female exhibited lesions consistent with the bovine strain of the disease, while the incomplete remains of a young middle adult male also revealed possible tuberculoid changes. In the case of the male the diagnosis is tentative, and DNA testing is suggested to verify or refute the presence of the disease. One individual, a young middle adult male, possibly had signs of scalp infection. Inflammation of the inside of the skull affected twice as many males as females, and was also present amongst the remains of one juvenile. This could have been caused by an infection such as meningitis or tuberculosis, as a result of poor nutrition, trauma or may be due to a neoplastic disease.

Two males, a young middle adult and a mature adult, exhibited changes to their proximal humeral shafts. It is possible that the changes to the morphology of the bone were activity related, or possibly associated with trauma in childhood. Alternatively, they could have shared a developmental anomaly. Another individual, a mature adult female had three laterally flattened right ribs, which could have been the result of binding the chest or possibly osteomalacia.

Joint disease was extremely common in both males and females; it is likely that habitual activities had contributed to the high prevalence of the condition. Males and females were affected by degenerative changes to the hip, while females were more susceptible to DJD in the shoulder and spine, and men were more frequently affected in the knees and ankles. In some cases joint disease was associated with, and often secondary to injuries. Males showed a greater prevalence of spinal osteoarthritis. That the people in this group led an active physical life is further attested by presence of Schmorl's nodes, which were more prevalent in males, although the distribution of lesions were unique to each sex, possibly inferring that different types of activities caused these lesions.

DENTAL HEALTH

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

A total of fourteen individuals had jaws and or teeth preserved, twelve of whom were adults and two were non-adults. Prevalence rates for individuals have been calculated as a percentage of tooth positions affected, where appropriate (e.g. AMTL, abscesses), and as a percentage of teeth affected (e.g. caries, calculus). In total there were 300 tooth positions (49 non-adult, 140

male, 113 female) and 270 teeth (47 non-adults, 124 male, 99 female). Overall, 18 teeth had been lost post-mortem (6%), ten from males and eight from females.

A total of 28 teeth were deciduous and these mostly belonged to Skeleton 2 (juvenile). Skeleton 1 (juvenile) had 28 teeth, nine of which were deciduous and nineteen were permanent.

CALCULUS

Calculus (mineralised dental plaque) is commonly observed in archaeological populations whose dental hygiene was not as rigorous as it is today. If plaque is not removed from the teeth effectively (or on a regular basis) then these plaque deposits mineralise and form concretions of calculus on the tooth crowns or roots (if these are exposed), along the line of the gums. Mineralisation of plaque can also be common when the diet is high in protein (Roberts and Manchester 1995; Hillson 1996).

All individuals with teeth (100%) had accumulations of calculus on their teeth, with 195 (72.2%) teeth affected (Plate 12). The proportion of teeth with calculus was similar for males (81.5% of teeth) and females (83.8%). Considering their young age, calculus was also prevalent in the non-adults, with 40.4% of non-adult teeth affected and Skeleton 1 (9-12 year old juvenile) even had moderately thick deposits on their teeth.

Plate 12 Thick calculus deposits on left lower and upper premolars and molars, Sk 10

The prevalence rates of calculus seen at Oxford Street were considerably higher than those given for the Roman period in Britain (26.8% of individuals, 43.4% of teeth, Roberts and Cox 2003), although it is possible that the latter figures do not include data on individuals with small amounts of calculus.

Dental calculus was not recorded at Newarke Street (Jacklin and Chapman 2009; Wakely and Carter 1996). Dental pathology was not commented on at Clarence Street (Waldron 2005)

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.

One juvenile (50% of non-adults) and five adults (41.6% of adults with teeth) had carious lesions in one or more teeth, with cavities seen in sixteen teeth (5.9%), which is a slightly lower-than-average prevalence rate for the period (7.5%, Roberts and Cox 2003). Caries prevalence increased with age, but caries were also observed in a juvenile (Skeleton 1) and young adult male (Skeleton 6).

Sugars in the Romano-British diet would have come predominantly from fruits and berries, as well as honey, but there is some evidence that dried fruits (an additional source of sugar) were imported during this period (Moore and Corbett 1973) and these sugars would have helped to contribute to the formation of cavities.

Male teeth had a considerably higher caries prevalence (at 10.5%) than female teeth (2.0%), or non-adults (2.1%). This disparity is interesting, as in most populations a higher caries prevalence is seen in females. However, at Horncastle in Lincolnshire (Caffell and Holst 2008) a similar pattern was observed to that at Oxford Street. It is possible that males had greater access to cariogenic foods (perhaps including luxury imported dried fruits) than females. Alternatively, females could have consumed more foods that discouraged the development of cavities, such as dairy products (Herod 1991). However, other factors may be influencing the prevalence rate: the lone young-adult male exhibited particularly poor dental health considering his relatively young age and in such a small sample this will have had a relatively large impact on the overall figures. Although dental caries were relatively uncommon in children in early populations, cavities were also observed amongst the Horncastle children, with 12.5% of individuals affected (Caffell and Holst 2008).

Wakely and Carter reported a frequency of 10.1% of dental caries at Newarke Street (1996), while 20% of the individuals studied at Newarke Street by Jacklin and Chapman (2009) were affected by two or more caries.

ABSCESSES

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. Abscesses can form as a result of dental caries, heavy wear of the teeth, damage to the teeth, or periodontal disease (Roberts and Manchester 1995).

Only three of the adults had developed a dental abscesses (21.4%), with three tooth positions affected (1%). This was lower than the Romano-British prevalence of 3.9% given by Roberts and Cox (2003).

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.

Half of the adults had experienced ante-mortem tooth loss, which had affected three females (50.0%) and four males (75.0%). Overall 5.0% of the teeth were lost ante-mortem, which is considerably lower than the Roman average of 14.1% reported by Roberts and Cox (2003). The usual increase in ante-mortem tooth loss with age was observed. A higher percentage of male tooth positions had experienced AMTL (7.9%) compared to females (3.5%).

Given the low prevalence rate of both dental caries and abscesses, these seem likely to have been two of the major contributing factors to AMTL in this population. Another possible contributor, periodontal disease, was also observed. Nine adults showed resorption of the alveolar bone surrounding the teeth (64.3%).

Ante-mortem tooth loss was not recorded by Jacklin and Chapman at Newarke Street (2009). According to Wakely and Carter, 20% of teeth been lost ante-mortem at the earlier Newarke Street excavation (1996).

DENTAL ENAMEL HYPOPLASIA

Dental enamel hypoplasia (DEH) is the presence of lines, grooves or pits on the surface of the tooth crown, which occur 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).

Six of the adults (42.9%) and one non-adult (50.0%) showed some evidence of DEH, predominantly manifesting as faint lines in the teeth, with 33 teeth (12.2%) affected. This figure was slightly higher than the 9.1% of Roman teeth reported by Roberts and Cox (2003). DEH was most frequent in the teeth from young middle adults. The presence of DEH has been associated with a lower life-expectancy in adults, perhaps suggesting that these individuals continued to experience stress beyond childhood (Lewis 2007). However, the prevalence rates have probably been influenced by the fact that there were only two young middle adults in this sample.

DEH affected males far more than females, with 7.1% of female teeth and three (50.0%) of the females affected, compared to 16.9% of male teeth and three (50.0%) males. This could either imply that males suffered more from poor nutrition and disease during childhood than females, or that females who suffered stress in childhood were less likely to survive into adulthood.

Enamel hypoplasia was also observed in five juvenile teeth, all belonging to Skeleton 1 (9-12 years old), with a prevalence rate of 10.6%.

Only one individual (5% of the observable population) exhibited dental enamel hypoplasia at Newarke Street (Jacklin and Chapman 2009).

DENTAL TRAUMA

Injuries to the teeth and surrounding tissues are relatively common in modern populations

(Glendor *et al.* 2007, 224), and the causes cited include violence, sporting activities, traffic accidents, falls, rough play, use of teeth as a tool, and biting hard objects (*ibid*, 228-229). In modern populations most dental injuries occur before the age of twenty, and they are more common amongst boys than girls (*ibid*, 226); the causes range from falls, sports, fighting and abuse (*ibid*, 228-233).

Small enamel chips were observed in three individuals (21.4%), with seven (2.6%) teeth affected. A total of 2.0% of female teeth and 4.0% of male teeth were affected by chipping. Upper teeth in general were more likely than lower teeth to display enamel chips, particularly the incisors. Enamel chips are not frequently reported. They were observed in the Horncastle population, where they affected eleven adults (84.6%) and 14.4% of the teeth (Caffell and Holst 2008, 50-51).

DENTAL ANOMALIES

Two adults (14.3%, 2/14 of the adult population), one females and one male, had teeth that were either congenitally absent or had failed to erupt. Nine teeth in total were affected (3.0% of all tooth positions present), most of which were third molars. Skeleton 11 (mature adult female) was missing her two lower third molars, and three of her second premolars (only the lower right was present) were also absent, leading to the retention of the left lower deciduous second molar. Skeleton 4 (middle adult female) also lacked all four of her third molars.

The third molars are the teeth most prone to congenital absence, impaction and variation in the timing of eruption, and Hillson (1996) has reported that up to a third of individuals may display congenital absence of the third molars. The figure for Oxford and Newarke Street was within this range, although it cannot be ascertained whether these teeth really were absent, or whether they had become impacted or been delayed in eruption.

Skeleton 9 (young middle adult female) exhibited a possible deformation on the buccal/distal portion of the mandibular right third molar crown, which may have been the result of a developmental defect of the enamel. Skeleton 10 (young middle adult male) exhibited mild v-shaped wear was evident on the occlusal surface of the right central maxillary incisor; this unusual wear may have resulted from a habitual activity.

CONCLUSION

Overall, the dental health of the individuals from Oxford Street was slightly better than the Roman average, with the exception of a high prevalence rate of dental calculus (mineralised plaque concretions). The poor oral hygiene of the older juvenile (Skeleton 1) and a young male adult (Skeleton 6) were unexpected, as dental health tends to become worse with increasing age. The fact that female dental health was better than that of the males, particularly with regards to caries was also unusual, as females usually have more cavities than males.

FUNERARY PRACTICE

The skeletons from Oxford and Newarke Street were recovered from an organised, formally laid out cemetery. Burial position within graves varied, with the majority of burials laid out in

supine extended positions (75%) and orientated west to east, with their heads to the west (65%; see Table 1). However, not all of the burials complied with this order; two, while aligned in the same direction, lay with their heads to the east (Skeletons 1 and 6). Skeleton 2 (juvenile) had been decapitated and was orientated north to south, with the skull placed by the feet at the south end of the grave. An old middle adult female has also been placed in a north-south orientation and prone position. Skeleton 9 lay in a grave orientated northwest to southeast, with the head at the north-western end. Skeleton 7 was also afforded an unusual burial rite. This juvenile was believed by the excavator to consist solely of a skull interred in a box (Table 22).

Table 22 Summary of funerary results

Sk No	Age	Sex	Orientation	Position	Arm Position	Decapitation	Grave Goods	Coffin
1.A7	36-45 years	Male	West to east	Extended supine	Not present	Simple	Two granite rocks, on south edge of grave	-
1	9-12 years	-	East to west	Extended supine, right upper leg disturbed	Right hand on pelvis, left hand on chest, close to left shoulder	Simple, (nails found in fill may suggest coffined)	Tile and residual pottery fragments	Coffin
2	2-3 years	-	North to south (head south at feet)	Slightly flexed on left side, head on feet	Left hand on pelvis, right hand not present	Possibly coffined	Nene valley and grey ware broken pots at feet	Coffin
3	18+	Female?	West to east	Uncertain (only partial skull remains)	Not present	Simple	None	-
4	26-45 years	Female	West to east	Extended supine	Almost between knees	Coffined with stone packing around head of grave	Two rings on left hand, quern stone fragment used as packing, iron object beneath skull	Coffin with stone packing

5	26-35 years	Male	West to east	Extended supine	Right hand on right femur, left hand on left femur	Coffined with stone packing between the coffin and the grave cut	None	Coffin with stone packing
6	18-25 years	Male	East to west, head looking south	On left side	Not present	Coffined	Copper alloy disc above head (SF15) copper alloy object beneath head (SF 18) pottery in backfill	Coffin
7	1-3 years	-	Unclear (skull fragments only)	Unclear (skull only)	Not present	Coffined skull only, found in a much larger grave, nails around skull suggest skull in a box	Pottery in backfill	Skull in box
8	46+ years	Male	West to east	Extended supine	Left hand on right pelvis, right hand under left arm	Simple, possibly coffined but no nails recovered, stone packing around the edge of the cut.	Residual pottery and tile	Coffin with stone packing
9	26-35 years	Female	Northwest to southeast	Extended supine	By the individual's side	Coffined	Hair pins near skull (SF22), hobnails near feet (SF19), residual pottery fragments in backfill	Coffin
10	26-35 years	Male	West to east	Extended prone	Right hand underneath right pelvis,	Coffined	Bent pin on right shoulder	Coffin

					left hand by side of left pelvis		(SF16) Bronze buckle (SF17) location unclear	
11	46+ years	Female	West to east (head looking north)	Extended, torso and skull on left side	Both hands on individuals left side adjacent to the chest	Simple, possibly coffined	Coin in pelvis (SF24)	Coffin
12	46+ years	Male	West to east (head looking south)	Extended supine	Arms folded, left hand on right pelvis, right hand on left pelvis	Coffined	Copper alloy hair pin (SF26) could belong to Sk 12 or Sk13	Coffin
13	26-35 years	Female	West to east	Extended supine	Left hand next to individuals left side right hand on right pelvis	Coffined	Copper alloy hair pin (SF26) could belong to Sk 13 or Sk12	Coffin
14	46+ years	Male	West to east	Extended supine	Right arm flexed at elbow, hand on pelvis	Simple	-	-
15A	36-45 years	Female	South-north	Prone	-	Simple	-	-
15B	18+ years	Male	-	-	-	-	-	-
16	2-4 years	-	West-east	Extended supine		Simple	-	-
17	18+ years	-	West-east	Extended supine	Both arms flexed at the elbow, hands on pelvis	Simple	-	-
18	18+	Female	West-east	Extended supine	-	Simple	-	-

Three skeletons (15%; Skeletons 2, 6 and 11) lay on their left side, while Skeletons 10 and 15A was interred in a prone extended position (10%).

Most of the burials contained grave goods. The grave of Skeleton 2 (a decapitated juvenile 2-3 years old) contained two pottery vessels by the feet of the child (one grey ware and one Nene valley ware vessel). Skeleton 4 (middle adult female) had two rings on her left hand, one of which was believed to bear a Christian inscription. Skeleton 11 (mature adult female) was buried with a coin in the pelvic region. Skeleton 10 (young middle adult male) had a bent copper alloy pin on his right shoulder and a bronze buckle. Skeleton 6 (young adult male) was interred with two enigmatic copper alloy objects placed by their head. Skeletons 9 (young middle adult female) and 12 (mature adult male) or 13 (young middle adult female) were buried with hair pins, while Skeleton 9 also had hob nails by her feet.

At Clarence Street all 91 burials appear to have been orientated east to west, in extended supine positions, with only two possible deliberate inclusions of grave goods (in both cases corroded Cu alloy objects; Gardner 2005) Burials excavated at Newarke Street in 2002 (Derrick 2009) also followed a similar pattern with west to east orientations, and grave goods were equally sparse. Only two individuals had been buried with grave goods; one skeleton had an animal tooth placed in each hand and two horn cores close to their head. A second individual had been interred with a lead object, which may have been a talisman (*ibid,* 78). Burials excavated from Newarke Street in 1993 also conformed to a similar pattern (Cooper and Buckley 1996).

It would appear that the burials from the current cemetery exhibit a greater mixture of burial rites. The reasons for this are unclear.

DECAPITATION

Skeleton 2, a two to three year old juvenile, had the skull placed by its feet. Removal of the skull and placement of it in another part of the grave is not uncommon in the Roman period.

Quensel-von-Kalben (2000, 218-219) carried out a study of ten British Roman cemeteries. Of these, three contained individuals that had been decapitated; the prevalence of decapitated individuals in these cemeteries varied from 1% to 7%. The decapitations occurred in all cases in urban cemeteries that dated to the late 3rd and to the 4th century AD (*ibid*). Clarke (1979, 374), however, observed that decapitated skeletons could also be found in isolated graves and suggested that they were, in fact, more common in rural cemeteries.

Clarke (1979) examined the available data from Roman cemeteries at the time of his publication for evidence of decapitations. He found numerous examples, which were widely distributed throughout southern England, East Anglia, the Midlands and western England, although he does not list any examples in the southwest. Recent work at Driffield Terrace in York (Caffell and Holst 2012) has shown that decapitation can also occur in the northeast of England. In fact, 70.8% of skeletons from this cemetery were decapitated (*ibid*).

The majority of decapitated individuals in Roman cemeteries were adults of both sexes and all ages, although a small number of decapitated children have also been found (Merrifield 1987, 72).

In some cases, cut marks are obvious on the vertebrae of the neck. Occasionally, these cut marks are noted on the front of the neck, suggesting that the head was removed once the person was dead (Taylor 2003, 19). Clarke (1979, 415) found that all skulls at Lankhills, Winchester, had been removed from the front, with a careful cut using a knife, severing the windpipe and jugular vein. It has been suggested that such a cut could only be carried out after death (Taylor 2003).

At Driffield Terrace in York, the cut marks were most common on the cervical vertebrae (neck), particularly C4 to C6, but cuts to the neck could be associated with cuts to the mandible, temporal bones (part of the skull around the ear), scapulae, clavicles and first ribs (Caffell and Holst 2012). In most instances one to two vertebrae were affected. The majority of these cuts were delivered from the back of the victim, with only a small number being delivered from the front of side of the victim.

In other instances, no such evidence for beheading can be observed (Melikian 2004, *pers. comm.*; Barber and Bowsher 2000, 89) and it is presumed that the head was removed after the body was at least partly decomposed (Taylor 2003, 18). In some cases, the skull was removed while some of the vertebrae and the mandible were still attached (*ibid*). In other cases, as at Watling Street, the skull of a male was removed after decomposition without the mandible and placed on his chest (Mackinder 2000, 15). It is now thought that graves were often kept open for some time after disposal of the dead person to allow mourners to be able to visit the corpse (Barber and Bowsher 2000, 310). It is possible that the skull was only removed after the body had been viewed and was therefore partly decomposed.

In common with many other Roman decapitation burials, the dismembered skull from Leicester was placed by the feet of the skeleton. Clarke (1979, 373-374) also found that the majority of skulls were placed by or over the feet, or between the knees.

Interpretations for Roman decapitations have ranged from criminal execution to religious or superstitious motives. Execution of criminals through decapitation was a punishment in the Roman Empire, although it was apparently reserved for Roman citizens – the better rank of criminal (Taylor 2003, 19). At Lankhills, Winchester, a decapitated man with his skull placed on his knees had been buried above an empty coffin. This was interpreted as a substitute for a proper burial of the individual whose body could apparently not be recovered (Merrifield 1987, 67). It has also been suggested that individuals were decapitated, so that their recently deceased family members or leader could be provided with their dependents or relatives (Clarke 1979, 415). Other instances of decapitation have been interpreted as the dead person not being able to sever to links with the world of the living (*ibid*, 71) and this may clarify why the decapitation was sometimes carried out after decomposition. This might also be explained by the belief that the soul was thought to live in the head and the decapitation was a ritual separation of the body, which might have ensured that the individual could not return (*ibid*, 74-76). The position of the head between the legs has been interpreted as a possible rebirth ritual, with the head 'being born' (Robinson 1997, *pers. comm.*).

Removal of the skull in non-adults is relatively rare in a Roman context. However, the skull of a six year old from the Roman cemetery at America Street, London, had been placed onto the knees of an articulated eleven year old juvenile (Melikian 2004, *pers. comm.*). At Ashchurch, Gloucestershire, the skull of a thirteen to fifteen year old adolescent (Skeleton 705) had been placed by the feet, in this instance upside down.

Decapitation burials were not observed at the earlier Newarke Street excavation (Cooper and Buckley 1996 and Derrick 2009), nor at Clarence Street (Gardner 2005).

HOBNAIL BOOTS

Of the nine individuals with surviving feet two appeared to be wearing hobnail shoes, and one of these is a tentative assumption based on the number of iron nails found with the bones of the feet during analysis, belonging to Skeleton 13. The individuals were both adult females, Skeleton 13 was located in Trench 3, approximately two metres south of the civil war ditch and Skeleton 9 was located in Trench 2 immediately adjacent to a Roman northwest-southeast ditch. In ten Roman cemeteries studied by Quensel-von-Kalben (2000, 218-219), eight contained individuals with hobnails. Of these, the prevalence of individuals with hobnails varied from 1% to 33%. The highest percentages were found in urban cemeteries that dated to the fourth century (*ibid*).

It is thought that the dead were provided with or wore their shoes so that they were equipped for their journey into the underworld (Wardle 2000, 29). At Cirencester, a probable hob nail shoe makers was located at one of the cemeteries, suggesting that they might have been making the shoes especially for burial (Salway 1981, 705-706). This theory might be possible to test at Leicester, if the nails are examined for wear.

At Leicester, it appears that the hob nail shoes were not worn in all cases, however, they do not appear to have been restricted to the male population. In other cemeteries, women and children often wore lighter footwear, which was not nailed (Barber and Bowsher 2000, 137). However, this may not have been the case at Leicester. Apart from the shoes, there is little surviving evidence in most cemeteries that the dead were dressed. The accompaniment of a bronze buckle, however, with Skeleton 10 would suggest that this individual, at least, was clothed. Further evidence of adornment was noted in two of the female burials (Skeleton 9 and 13), from which hair pins were recovered.

Hobnails were not observed at any of the sites used for comparative analysis (Cooper and Buckley 1996; Derrick 2009; Gardner 2005).

PRONE BURIAL

According to Philpott (1991), prone burials were more common in rural or small town cemeteries, particularly in the fourth century, although earlier prone burials do exist. Prone burial may be used to signify ‘outcast’ status and theses burials were often located at the periphery of an ordered cemetery. The term ‘outcast’ is difficult to apply to Skeleton 10, a young adult male, who to all intense and purposes had been treated no differently from the other interments, save for the fact that he had been placed in his coffin face down. In all other respects, his burial ritual seems to have been no different to that of some of the other interments in the cemetery. The burial of the old middle adult female (Skeleton 15A) did appear to be slightly set apart from the formal row of burials formed by Skeletons 14, 16 and 18.

COFFINS

Extended coffin inhumations appeared in increasing numbers throughout much of Roman

Britain in the third century AD (Philpott 1991). Coffins were found with several skeletons (Skeletons 1, 2, 4, 6, 7, 9, 10 and 13), and the quantity and location of the nails in many graves suggested burial within a coffin. Further possible coffined burials were inferred by the size and shape of the grave (Skeletons 5, 8 11 and 12). These possible coffin burials included four females, five males and all three juveniles (see Table 14).).

At Clarence Street 31 burials, or 31% of the population were identified as having been buried in coffins (Gardner 2005). A total of fourteen individuals, or 46.7 % of the population, could be positively identified as having been placed in a coffin at Newarke Street (Derrick 2009), and a further 21 (55.3%) coffined burials were identified at earlier excavations at Newarke Street (Cooper and Buckley 1996)

CONCLUSION

Burial practice at Oxford and Newarke Street appears to exhibit characteristics of both pagan and more typical Romano-British the fourth century AD practices. The cemetery appeared to be arranged in relatively orderly rows, with little intercutting, individuals were predominantly interred east to west, extended and supine, although there were a few notable exceptions. The majority of individuals appeared to have been buried in coffins. Males and females were distributed throughout the excavated area, and there was no noticeable difference between the sexes in terms of funerary ritual. Foetuses and neonates were conspicuous in their absence and were most likely buried elsewhere. Grave goods were abundant, accompanying both sexes and the young and old.

DISCUSSION AND SUMMARY

The osteological analysis of the skeletal remains from Oxford and Newarke Street has provided a glimpse into the lives of the people buried there. Fourteen individuals were recovered from the cemetery, although many were incomplete and suffered from moderate fragmentation, which limited the amount of information possible to retrieve. Nevertheless, it has been possible to reconstruct a surprising amount concerning the lives of these people and the use of the cemetery.

The cemetery population primarily consisted of adults, a higher proportion of males reached older adulthood, compared to females. Both men and women were identified among the adults, and although there was a slightly higher percentage of men, the sample was too small for this to be statistically significant. Only four children were present, all of whom were juveniles (the youngest of which was 1-3 years old, and the oldest 9-12 years old). No evidence for infants or neonates was found. Children, particularly infants and neonates, are usually under-represented in the archaeological record despite the fact that mortality must have been high (Lewis 2007), and children under two years are not often found buried in Roman cemeteries prior to the fourth century AD (Watts 1989).

Like many other Roman cemeteries, the Oxford Street graves were ordered in rows and many of the graves respected the presence of earlier burials, which may imply that the location of the graves was marked in some way, or simply that the mounds of soil covering the burials were still visible when later graves were dug.

The majority, but not all, burials were laid out in supine extended positions and orientated west to east, with the heads to the west. Although not all of the burials complied with this order, two lay with their heads to the east. One individual, a juvenile, had been decapitated and was orientated north to south, with the skull at their feet and with two pottery vessels. Evidence for decapitation was not observed at the comparative cemeteries in Leicester. Another juvenile burial appeared to consist of only a skull, which may have been interred in a box.

There was no noticeable difference in grave location, orientation or burial position between the men and the women. Coffins were commonly used in Roman Leicester. At Oxford Street, they appear to have been provided for men, women and children alike. Grave goods were widely distributed amongst the individuals interred at Oxford Street, unlike the other Roman cemeteries in Leicester. A middle adult woman wore two rings, one believed to bear a Christian inscription. It is worthy of note that the woman was suffering from the advanced stages of tuberculosis when she died, and would have required considerable care. The small size of the sample meant that comparisons between sexes and ages, in terms of burial rite, were not significant. However, the prone burial of a young middle adult male does appear to distinguish him from the majority of the individuals at the cemetery; although in all other ways it was comparable with other burials from the cemetery. The other prone burial appeared to be slightly isolated from the formal row of burials to the northwest.

It is possible that further child burials within the cemetery were concentrated within an area not discovered during the excavations. It is not clear how much of the cemetery itself has been excavated, and partial excavation may account for some of the biases in age and sex observed.

A wide range of pathological conditions were observed amongst the Oxford Street population, especially considering the relatively small size of the sample. A small number of minor congenital anomalies were present, affecting two young middle adult males with *spina bifida occulta* and one young middle adult female with accessory lumbar ribs.

Evidence for childhood stress were observed, with *cribra orbitalia* affecting half of the population and suggesting at a lack of vitamin B_{12}. Further indicators of stress were preserved in the tooth enamel of a number of individuals, such lesions may indicate dietary, environmental or physical stress. New bone formation along the cranial vault margins of a juvenile may have been caused by scurvy (Vitamin C deficiency), which suggests the individual endured a considerable period where an adequate supply of fresh fruits and vegetables or marine fish was unavailable. Such skeletal manifestations infer dietary hardships and suggest that the majority of individuals were experiencing at least periods of inadequate nutrition. One mature adult male, however, appeared to have enjoyed dietary excess. Skeletal lesions probably consistent with DISH were evident in the individual's spine. The disease is associated with excessive calorie intake, Type II diabetes, obesity and advanced age. The potential access to an abundance of food, may intimate that the individual was of a higher social status or ranking than the majority of the population from Oxford Street, though his grave did not contain any grave goods.

Traumatic incidents also affected the lives of three individuals; one mature adult female had a crushed vertebra, possibly as the result of a fall onto their feet or bottom. Such an injury would have caused pain, and probably reduced the individual's mobility for at least a short period after the incident, and stiffness of the back may have been a long term consequence. A mature adult male had a fractured forearm, probably in a traumatic incident, which may also have

caused damage to his knee, ankle and involved soft tissue damage to his thigh. Changes observed in the knee revealed osteoarthritis, suggesting the individual continued to use the joint after the trauma. Another mature adult male had fractured his left ankle and appeared to have associated soft tissue damage.

Infectious disease was common; sinusitis affected over half of the observable population, although it appears that only women and children were affected. Tuberculosis was also observed in the remains of one middle adult female. The advanced state of the disease would have meant that the woman would have required care. The degree of spinal destruction that she endured suggests she survived for some time with the spine bent forward at a right angle. The incomplete skeleton of a young middle adult male also revealed possible tuberculoid changes, which could only be tentatively diagnosed. The high prevalence of inflammatory lesions on the inside of the skull could have been caused by an infection such as meningitis; interestingly, the incidence of these lesions in males was twice as high as females. A young middle adult female exhibited lesions which may be attributable to hypertrophic pulmonary arthropathy; principally linked to cancer or infection of the lungs

Joint disease was extremely common; and it is likely that habitual activities contributed to the high prevalence of the condition. Joint disease affected both sexes equally in the hips, although women appeared to be more susceptible to DJD in the shoulder and spine, while men were more commonly affected in the knees and ankles. However, men were more likely to develop spinal osteoarthritis, possibly due to males having greater longevity and thus being more likely to develop the condition. Schmorl's nodes were more prevalent in males, although the distribution of lesions differed between the sexes, possibly inferring that different types of activities caused them.

The general dental health of the individuals from Oxford Street was slightly better than the Roman average, with the exception of a high prevalence rate of dental calculus. Surprisingly, female dental health was better than that of the males, particularly with regards to caries.

Overall, the high frequency of metabolic disease and infection amongst the Oxford Street population suggests that poor nutrition and illness was common. However, the women were of average height for the period and men only slightly shorter, which could suggest the limited impact on their adult stature.

Considering the relatively small sample size, this group of skeletons displays a considerable quantity of pathological conditions, some of which, such as the severe tuberculosis, are rarely observed in other Roman populations.

Radiocarbon Dating – compiled by John Thomas

Eight samples of human bone from were submitted for radiocarbon dating to the Scottish

Universities Environmental Research Centre (SUERC) in 2016. The material came from eight separate skeletons recovered during both phases of excavation at 28 Newarke Street. Skeletons 2, 4, 10 and 12 were recovered from Area 3, Skeleton 9 was from Area 2 and Skeletons 14, 15 and 18 were recovered from Area 4. The samples were chosen from burials that reflected the broad range of funerary data to provide a representative sample spanning the lifespan of the cemetery.

Table 23 Summary of funerary data for Radiocarbon dating samples

Skeleton	Grave	Sex	Age Group	Age	Orientation	Position	Coffin/Grave goods
Skeleton 2	[3048]	-	Juvenile	2-3	NNW-SSE	on lhs, slightly flexed, decapitated	?/Y
Skeleton 4	[3054]	Female	Mid-Adult	26-45	ENE-WSW	supine	Y/Y
Skeleton 9		Female	Mid-Adult	26-35	NNW-SSE	supine	Y/Y
Skeleton 10	[3085]	Male	Mid-Adult	26-35	ENE-WSW	prone	Y/Y
Skeleton 12	[3090]	Male	Adult	46+	ENE-WSW	prone	Y/Y
Skeleton 14		Male	Adult	46+			
Skeleton 15		Female	Older Mid-Adult	36-45			
Skeleton 18		Female	Adult	18+			

The samples were pre-treated following a modified Longin (1971) method. They were then combusted to carbon dioxide (Vadeputte *et al* 1996), graphitised (Slota *et al* 1987) and measured by accelerator mass spectrometry (AMS) (Xu *et al* 2004).

The radiocarbon results in Table 24 are quoted in accordance with the international standard known as the Trondheim Convention (Stuiver and Kra 1986). These are conventional radiocarbon ages (Stuiver and Polach 1977). The ^{14}C age is quoted in conventional years BP (before AD 1950). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standards, background standards and random machine error.

The calibrated date range in Table 24 has been calculated using the maximum intercept method (Stuiver and Reimer 1986), the calibration curve of Reimer *et al* (2009) and the computer programme OxCal 4.1 (Bronk Ramsey 2009). Terrestrial samples are calibrated using the IntCal09 curve while marine samples are calibrated using the Marine09 curve. The graphical distribution of the calibration results (Figure 18) is derived from the probability method (Stuiver and Reimer 1993).

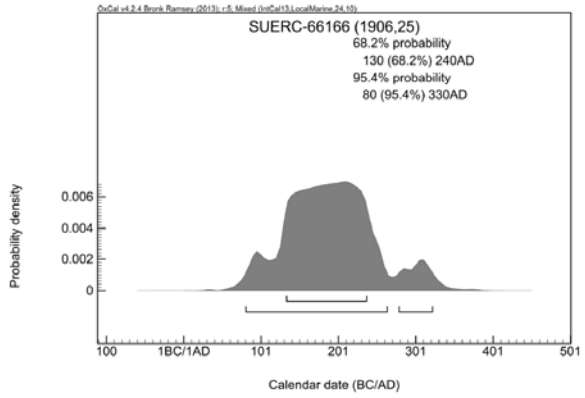
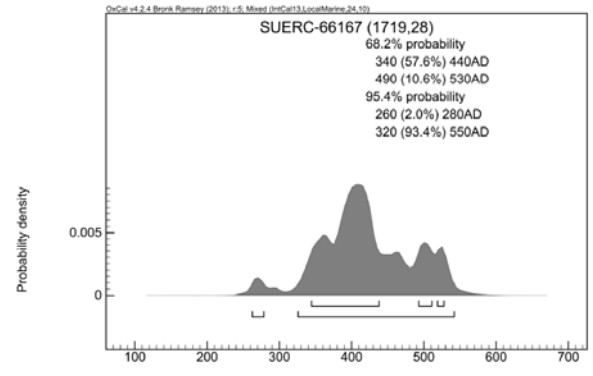


Table 24 Radiocarbon results from 28 Newarke Street excavations

Lab ID	Sample ID	Material		δ 13C (0/00) relative to VPDB	δ 15C (0/00) relative to air	C:N	Radiocarbon age (BP)	Calibrated date (95% confidence)
SUERC-66166	Sample 1 (SK 9)	Human R. rib		-19.0	11.9	3.3	1906 ± 25	cal AD 80-330
SUERC-66167	Sample 2 (SK 4)	Human R. rib		-19.0	10.8	3.2	1719 ± 28	cal AD 260-550
SUERC-66168	Sample 3 (SK 10)	Human R. rib	-19.5	10.6	3.3	1744 ± 26	cal AD 230-510	
SUERC-66169	Sample 4 (SK 12)	Human L. rib	-19.7	10.4	3.3	1720 ± 30	cal AD 240-510	
SUERC-66170	Sample 5 (SK 2)	Human L. rib	-19.6	12.4	3.2	1823 ± 28	cal AD 130-380	
SUERC-66171	Sample 6 (SK 15)	Human L. rib	-20.6	10.9	3.3	1758 ± 30	cal AD 176-384	
SUERC66-172	Sample 7 (SK 18)	Human R. femur	-20.2	11.0	3.3	1791 ± 26	cal AD 135-326	
SUERC-66176	Sample 8 (SK 14)	Human R. rib	-16.9	10.6	3.2	1747 ± 30	cal AD 360-600	



Sample 2

Sample 4

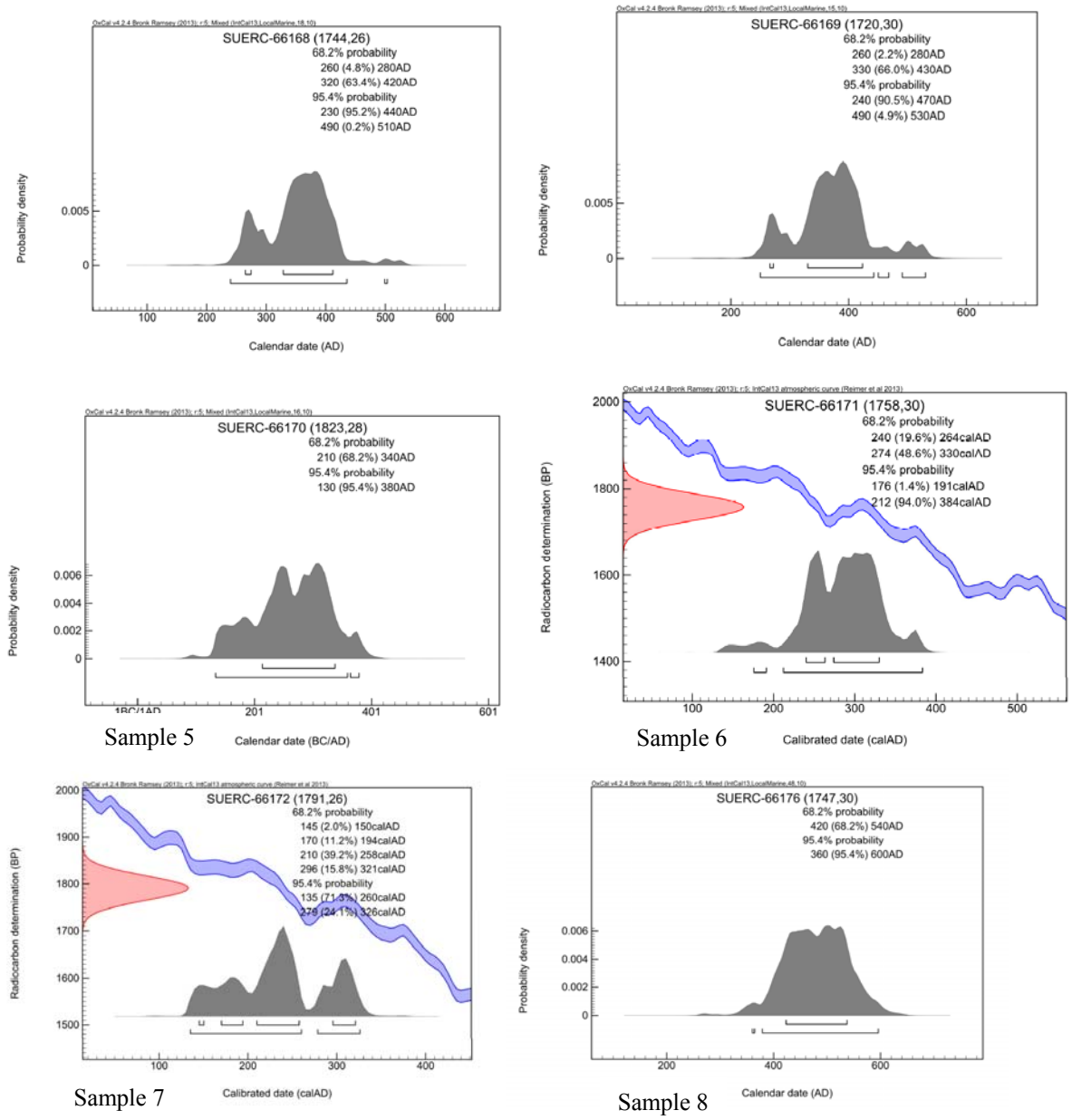


Figure 18 Radiocarbon dating calibration plots

The Animal Bones – Rachel Small

Introduction

This report presents the study of a small animal bone assemblage recovered during an excavation at Oxford Street, Leicester in 2015. The site was located in the southern suburb of the Roman/medieval walled town. A total of 163 specimens were collected by hand and 54 fragments from environmental samples. The animal bones were retrieved from seventeen contexts relating to a variety of features (pits, ditches, corn-dryers/malting kilns, graves, gullies and a linear feature) which dated from the Roman to post-medieval periods.

Method

Identification to element and species was attempted on all specimens using the University of Leicester's bone laboratory reference collection. Distinction between sheep and goat was attempted on the elements listed in Boessneck (1969) and differentiation between horse and donkey on the folds of the teeth according to Davis (1980). Age according to epiphyseal fusion followed Reitz and Wing (2008, 72). Recording of mandibular sheep/goat tooth eruption and wear followed Grant (1982) and age categories were assigned following Hambleton (1999). Other measurements of teeth and bones followed von den Driesch (1976) and Davis (1992). Taphonomic alterations including butchery, burning, gnawing and preservation were recorded and Harland et al's (2003) four point scale was used to score the latter. Regarding quantification, joining fragments were re-assembled and the resulting specimen counted as one. Articulating skeletons were also counted as one (although a record of the original number of fragments was retained).

Results – hand collected bone

Most (80.37%) of the animal bones were of a 'good' preservation, lacking a fresh appearance but solid with only localised flaking (Harland et al 2003). Smaller numbers were classed as 'excellent' (1.84%), 'fair' (15.95%) and 'poor' (1.84%). There was no apparent difference between specimens from different periods or feature types. Root etching and weathering was present on bones. Small areas of singeing and the adherence of vitrified material were also noted and this suggests the bones were once located near to a heat source (pers. comm. Addison 2016). Overall, it was possible to identify approximately one third of the specimens (36.2%) to element and species. Below the results are presented by period (phases are grouped together due to the small assemblage size).

Roman (1st to 3rd century)

A large proportion of the assemblage (63.8%) was dated to the Roman period. The animal bone was retrieved from the fills of ditches (91 specimens), graves (6 specimens) and gullies (7 specimens). The bones retrieved from the graves are unlikely to have been deliberately deposited and probably represent bones associated with earlier activities, which became incorporated into the grave with backfilling. There was no apparent difference between the features or period sub-phases.

Cattle bones (table 23) were most common and a range of skeletal elements from this species was represented (skull, pelvis, humerus, tibia, metapodial and calcaneus). A smaller number of sheep/goat, equid and dog bones were also present. It was possible to identify an equid molar as horse.

Table 25 number of specimens for each context and period. Key: GR – grave; G – gully; D – ditch; P – pit; C/M – corn-dryer/malting kiln; K/C – kiln/corn-dryer; L – linear; R – Roman; M – medieval; PM – post-medieval.

Context	**Roman**								**Medieval**								**Post-med?**	**TOTAL**
	504	**506**	**507**	**510**	**516**	**525**	**529**	**Total**	**505**	**512**	**513**	**514**	**526**	**530**	**533**	**Total**	**515**	
Feature description	GR	GR	D	D	G	G	G		P	P	C/M	C/M	P	K/C	C/M		L	

Date	R	R	R	R	R	R	R		M	M	M	M	M	M	M		PM?	
Cattle	2	1	2	21				**26**					1			**1**	1	**28**
Sheep									1							**1**		**1**
Sheep/goat	2			3				**5**	1	1						**2**		**7**
Pig									2		1	2		1		**6**	1	**7**
Horse				1				**1**										**1**
Equid			5	2				**7**				1				**1**		**8**
Goose											1					**1**		**1**
Cat										1		1				**2**		**2**
Dog				1				**1**				1				**1**		**2**
Mole									1							**1**		**1**
Human											1					**1**		**1**
Medium mammal	1			2	3			**6**		1	4	6			1	**12**	1	**19**
Large mammal			3	44	1	1	2	**51**	3	1	9	1	1			**15**	3	**69**
Medium/large mammal			2	4				**6**	1				1			**2**		**8**
Small mammal/ bird											2		1			**3**		**3**
Large bird											1					**1**		**1**
Indeterminate			1					**1**			3					**3**		**4**
TOTAL	**5**	**1**	**13**	**78**	**4**	**1**	**2**	**104**	**9**	**4**	**22**	**12**	**4**	**1**	**1**	**53**	**6**	**163**

A sheep/goat second molar in wear stage 12a was present and this suggests the animal died at a minimum age of 1 year. It was also possible to obtain ageing data (table 24) for sheep/goat and cattle specimens based on epiphyseal fusion. From this data, it seems probable that juveniles and adults were present for both species.

Table 26: age at death of animals based on epiphyseal fusion.

Context	**Cut**	**Date**	**Feature description**	**Element**	**Taxon**	**Proximal fusion**	**Distal fusion**	**Age (in months) at death**
505	401	Late medieval	Pit	Scapula	Sheep		Fused	≥6
512	405	Medieval	Pit	Radius	Sheep/goat	Fused		≥3
515	408	Post-med?	Short linear feature	Phalanx 1	Cattle	Fused		≥18
504	400	Roman	Grave	Tibia	Sheep/goat		Fusing	15 – 24

505	401	Late medieval	Pit	Tibia	Sheep/goat		Fusing	15 – 24
510	404	Roman	Re-cut of ditch	Humerus	Cattle		Fused	≥12
510	404	Roman	Re-cut of ditch	Metapodial	Cattle		Fused	≥24
510	404	Roman	Re-cut of ditch	Tibia	Cattle		Unfused	≤30

Five (4.8%) of the specimens showed signs of carnivore gnawing and ten (9.6%) had butchery marks (table 4). This included cut marks representative of de-fleshing the carcass, for example on the mid-shaft of a tibia (504, 510). Cut marks associated with skinning were also identified - many incisions were present on the side of a sheep/goat metatarsal (510). Chop marks were recorded and an interesting example was a cattle metatarsal that had been split down the middle perhaps for marrow extraction (510). Two cattle horn cores (510) displayed saw marks at their base and perhaps they were removed for working. Sawing became a dominant butchery practise in the post-medieval period; it was favoured because it allowed for standardisation (Landon 1996, 64). Examples of sawing are rarely found in material from earlier phases and therefore it is likely that the material from context 510 is intrusive.

Medieval (12th – 16th century)

In total 53 specimens (32.5%) were dated to the medieval period. Most of the animal bones came from the backfills of corn-dryer/malting kilns (36); only a small number were retrieved from pit fills (17). The bones are unlikely to be associated with the use phase of this feature but with its backfilling. There was no apparent difference between the features or period sub-phases.
Compared to the Roman period, a wider range of species was identified and included cattle, sheep/goat (it was possible to identify a scapula from 505 as sheep), pig, equid, goose, cat, dog and mole. A fragment of a human fourth metacarpal was found in context 513.

Jennifer Browning recorded the mole specimen from context 505 and noted that most of a skeleton was represented, including cranium, mandibles, atlas, axis, cervical vertebrae, ribs, forelimbs (scapulae, humeri, unae and radii), innominate, femori and a single tibia. However, the extremities were not recovered. The skeleton was clearly articulated and may well have been intrusive within the deposit as moles are well known for their burrowing activity.

It was possible to obtain ageing data from epiphyseal fusion for sheep/goat specimens (table 24). A sheep/goat radius from context 405 had an unusually deep ulna facet and bowing of the shaft. (Measurements were taken from this bone and others were appropriate - see table 27). A large mammal thoracic vertebra from context 514 also showed signs of pathological abnormality – a small nodular bone growth on the body.

Taphonomic alterations identified included chop marks on three specimens (505, 513), fragments of large mammal rib and vertebrae; these probably occurred during disarticulation of the carcass. Saw marks were exhibited on a long bone epiphysis from context 505 (15th - 16th c. in date) and like the horn cores discussed above this specimen could possibly be intrusive. Carnivore gnawing was noted on four specimens (7.5%) and a large mammal long bone shaft from context 526 had copper staining.

Undated, possibly post-medieval

No pottery dating evidence was retrieved from a short linear feature (515) but it was thought to be post-medieval in date. Six animal bone specimens were recovered from it and it was possible to identify a pig femur and a cattle first phalanx. The latter was complete and the proximal end was fused suggesting that at death the animal was a minimum of 18 months of age. Two specimens dating to this period exhibited signs of carnivore gnawing.

Results – bone from samples

Fifty-four fragments were recovered from the coarse fractions (>4mm) of sample residues (table 25). (No specimens were present in the flot and the fine fractions (<4mm) were not sorted.) The specimens were very small fragmentary pieces of large and medium mammal bone. The elements represented included: pieces of rib, skull, scapula, long bone shaft and tooth. It was not possible to identify any of these to species level.

Table 27: animal bone present in the coarse fractions of samples.

Sample	Context	Feature description	No. specimens	Notes
1	535		28	Rib, skull and long bone fragments of medium and large mammals
3	513		11	Medium mammal fragments including a tooth root
5	535		1	Large mammal long bone shaft fragment
6	531		7	Medium mammal fragments including a piece of scapula
7	530		7	Medium mammal fragments including a piece of skull

Comparison to other excavations

In 2013, three trenches were excavated at the site, revealing activity from the Roman to modern period. Similar features to the 2015 excavation were encountered including ditches, graves, pits and a potential oven. The hand recovered bone assemblage was analysed by Browning (2014).

The faunal assemblage from 2013 was much larger than the one under study, totalling 1,241 fragments. It was of a similar preservation to the material considered in this report - the majority of specimens were classified as ‘good’ (67%). Gnawing was again only seen on a small number of bones but the proportion did increase over time (from 1 – 4%). Burnt bones (scorched and calcined) were present but rare (Browning 2014, 108).

In the 2013 assemblage cattle and sheep/goat were found in roughly equal proportions and this was consistent throughout the phases (Browning 2014, 109). This is different to the 2015 material, where cattle predominated but this may be a bias from the small assemblage size. At other southern city sites such as Bonners Lane, cattle bones predominated in Roman times and sheep in later periods (Baxter 2004).

No wild species were recovered from the 2015 assemblage. This could be due to the small assemblage size; it has been proven that there was a strong correlation between larger

assemblage sizes and greater species diversity (Browning 2014, 109). Wild species were recovered from the 2013 assemblage but in small numbers suggesting their dietary input was limited. Species included fallow deer, red deer, rabbit, hare and swan (Browning 2014, 110).

A small number of cod bones were hand recovered in 2013 (Browning 2014, 110); no fish remains were recovered in 2015. Fine fractions from environmental samples were not considered for either site, and this probably has led to an underestimation of the marine/freshwater dietary input. Targeted sampling at Bonners Lane led to the collection of a large fish assemblage - herring, carp family, perch and eel were the most abundant species represented (Nicholson 2004).

Too few bones were present in the 2013 and 2015 assemblage to permit statistical analysis of carcass representation. However, both had a tendency for the most robust elements (which preserve the best) to be most common - metapodials, loose teeth and more durable limb bones such as the tibia, humerus and radius. At Bonners Lane, it appears that all parts of cattle, sheep/goat and pig carcasses were eaten (Baxter 2004).

The 2013 Oxford Street assemblage had insufficient numbers for statistical analyses of age profiles from epiphyseal fusion and mandibular wear stages. However, it was suggested that immature and mature cattle and sheep/goats were both slaughtered (similar to the 2015 material). It was also proposed that pigs were slaughtered as sub-adults for meat (Browning 2014, 111).

At Bonners Lane, the majority of cattle lived to maturity in the Roman period which is indicative of their use for breeding, milking or as draught animals before slaughter for beef. There was an emphasis on sheep/goats under three years of age in the Roman period, suggested they were primarily exploited for meat. Pigs were killed at the immature stage. In the post-medieval period this changed and there was a tendency towards older sheep and therefore wool production (Baxter 2004).

Butchery marks, indicative of a range of activities were prevalent amongst the medieval and post-medieval specimens in the 2013 assemblage. Cleaver marks (chop) were most common. Systematic butchery was seen on vertebrae and ribs (sagittal and transverse splitting) indicative of portioning the carcass into joints for consumption. Similar to the 2015 assemblage, there was evidence for small scale horn working (Browning 2014, 113).

It is believed that specialised workshops developed in the southern area of the town in the medieval and early post medieval periods. Excavations at Bonners Lane and De Montfort Street (Browning 2010), which produced the largest faunal assemblages in the area, indicated tawyering, dye works, grain processing and pig keeping activities, in addition to street-frontage occupation.

Conclusion

In conclusion, the assemblage under study has similarities to both the 2013 Oxford Street excavations and other excavations in the southern part of the city such as Bonners Lane. The Roman, medieval and post-medieval faunal material under investigation primarily represents disposal of household waste, predominantly from butchery and consumption but also including craft waste from small scale activities in the form of horn core fragments.

Regarding rubbish disposal, only a small number of the Oxford Street specimens were gnawed and preservation was generally 'good' suggesting few bones were available to scavengers and that waste was fairly rapidly disposed of in pits, gullies and ditches. The presence of singeing and adherence of vitrified material does suggest that at some point the bones were near to a heat source.

There are signs of later disturbance to the contexts under consideration in this report: (505) a medieval pit fill, and (510) a Roman re-cut of a ditch, include intrusive material - a mole skeleton and specimens that had been sawn (the latter is suggestive of post-medieval material). It is possible that this was also true of other contexts. This is not unusual for an urban excavation which includes many intercutting features.

The assemblage from 2013 and 2015 was too small in size to permit statistical analysis, for example, of age at a death or skeletal representation. However, it was possible to make general comments about the nature of the activity at the site, rubbish disposal, diet and animal husbandry strategies. The data has added to the body of knowledge for the southern part of the Roman and medieval town that has been collected over the past 25 years and it can hopefully form part of future studies on a larger scale.

Table 28: descriptions of specimens which showed signs of butchery.

Context	Cut	Date	Feature description	Element	Taxon	Butchery type	Butchery location
504	400	Roman	Grave	Tibia	Sheep/ goat	Cut marks	On the mid-shaft
505	401	Late medieval	Pit	Rib	Large mammal	Chop	Through the body – portioning
505	401	Late medieval	Pit	Long bone epiphysis	Large mammal	Saw	Femur/humerus?
510	404	Roman	Re-cut of ditch	Horn core	Cattle	Saw?	Though the base of the horn
510	404	Roman	Re-cut of ditch	Horn core	Cattle	Saw	Though the base of the horn
510	404	Roman	Re-cut of ditch	Frontal	Large mammal	Chop	Cattle and associated with the removal of horn?
510	404	Roman	Re-cut of ditch	Metatarsal	Sheep/ goat	Cut	Many fine cut marks down the side of the bone
510	404	Roman	Re-cut of ditch	Metatarsal	Cattle	Chop	Mid-shaft split (sagittal plane)
510	404	Roman	Re-cut of ditch	Indent.	Large mammal	Cut	
510	404	Roman	Re-cut of ditch	Tibia	Cattle	Possible cut mark	On the mid-shaft
513	406	Medieval	Corn-dryer/ malting kiln	Rib	Large mammal	Chop	Through the body – portioning
513	406	Medieval	Corn-dryer/ malting kiln	Vertebrae	Large mammal	Chop	Through the body
516	409	Roman	Gully	Indent.	Large mammal	Chop	
529	416	Roman	Gully	Long bone shaft	Large mammal	Chop	Through the mid-shaft

Table 29: bone and tooth measurements in millimetres.

Context	Cut	Date	Feature description	Element	Taxon	GL	BP	BD	DD	SD	A	B	3
504	400	Roman	Grave	Tibia	Sheep/goat			27.3					
507	403	Roman	Ditch	Third/ premolar mandibular	Equid								
510	404	Roman	Re-cut of ditch	Radius	Equid			57.96					
510	404	Roman	Re-cut of ditch	Molar mandibular	Horse								
510	404	Roman	Re-cut of ditch	Metapodial	Cattle	56.12					26.24	26.9	27.21
510	404	Roman	Re-cut of ditch	Tibia	Dog					12.56			
512	405	Medieval	Pit	Radius	Sheep/goat		126.42						
514	407	Medieval	Corn-dryer/ malting kiln	Tibia	Cat	93.53		11.82		5.02			
515	408	Post-med?	Short linear feature	Phalanx 1	Cattle	51.94	27.22	24.04	18.14				
526	413	Medieval	Pit	Metapodial	Cattle			42.63			18.92	21.5	23.7

The Plant Remains and other environmental evidence - Anita Radini & Rachel Small

Introduction

During the excavation at Oxford Street, environmental samples were taken for the recovery of plant from one medieval kiln/corn-drier feature dated originally to the 12th/13th century. This was re-used in two different phases. Samples were therefore taken to investigate potential use of the kiln.

Materials and Methods

Samples were taken from 2 different phases of the kiln: later Phase of use [406] and earlier phase of use [407], as shown in Table 28.

Table 30: Selected environmental samples

Sample	Context	Feature	Volume
1	513	Kiln, [406]	6
2	517	Kiln, [406]	3
3	513	Kiln, [406]	3
4	528	Kiln, [406]	2
5	535	Kiln, [407]	2
6	531	Kiln, [407]	2
7	530	Kiln, [407]	2
8	533	Kiln, [407]	2

The bulk of the sample above 4 litre was sieved in a York tank with 0.5mm mesh and flotation into a 0.3mm mesh sieve. Residues were all air dried and separated on a 4mm mesh riddle and the coarse fraction (CF) over 4mm was sorted for all remains and finds. The whole residue was examined with a stereo-microscope at magnifications of x20 to x40. The remaining samples were bucket flotted into a 0.3 mm mesh to maximise the recovery of debris.

Following the same approaches taken in the previous report (Radini, 2014), two lines of evidence were investigated:

1) The plant macro-remains, which were retrieved in all the samples.
2) The analysis was also complemented by preliminary analysis of the species of charcoal to identify the wood used for fuel during various human activities.

All flots and coarse residues, where necessary, from the samples were scanned noting the species present and counted. The results of the analysis are represented in Table 2. The presence of root and rootlets was also recorded. Morphological criteria were used for the identification of plant species, based on modern reference material and seed identification manuals (e.g. Berggren 1981; Anderberg 1994; Cappers and Bekker 2013). Plants nomenclature follow Stace (1991).

The best preserved charcoal fragments were observed at different magnifications, between x10

to x40 and grouped according to their morphology/type. The best preserved fragments of each type were then fractured to obtain the correct sections that allow the viewing of anatomical features needed for their identification. These were examined using an incident-light microscope at up to x400 magnification. Identifications were made following anatomical keys by Schweingruber (1990), and modern reference material.

Results and discussion

The most common form of preservation found was by charring. Charred plant remains were found in all samples examined. Some uncharred seeds that were not mineralized or waterlogged were also recovered, mainly represented by modern weed seeds and seeds of elder (*Sambucus nigra L.)*, the latter found often uncharred on archaeological sites and some arable weeds. The archaeological origin of these remains is uncertain, and their presence is therefore recorded under one category of 'uncharred seeds', will not be discussed further. A large amount of elder seeds was also found in previous work on site.

In its overall the assemblage is very consistent across all samples, with low amount of remains and low diversity among samples.

The cereal assemblage was dominated by wheat (*Triticum* sp.), but in low amount. Although the identification of wheat grains is problematic, the better preserved grains were consistent with free-threshing wheat (*Triticum aestivum/turgidum*). Previous work on site suggested bread wheat (*T. aestivum*) was the main type of wheat on site (Radini, 2014). This is consistent with other sites of the same periods in the city (e.g. Monckton 2015; Radini 2009). Unlike in other area of site, there were no remains of barley found in the samples.

Table 31 Overall presence and relative abundance of plant remains recovered from the site

Sample	CGr	L	Arb/Dst	UnC	Chr	Md Rt
1	7	4	5	X	xx	x
2	8	5	6	X	xx	X
3	3	13	11	X	xxx	Xx
4	4	12	2	X	xx	X
5	6	2	3	X	x	X
6	13	12	12	X	xxx	Xx
7	5	4	12	X	xx	X
8	6	12	13	X	xx	X

CGr=charred plant remains; Cl=legumes; Arb/Dst=arable and disturbed ground; UnCl=unclassified; Chr=charcoal and charcoal flecks; Md Rt=modern root fragments; x=present; xx=common

All samples were found to have remains that were identified as edible species of *Vicia faba* var. *minuta* (field bean) in sample and as *Vicia/Pisum* (beans/peas) where the hilum, necessary for identification to species level, was not visible. Three samples from the previous excavation on site had a low amount of legumes as well indicating they were processed on site. Small legumes have been recorded in medieval Leicester in several excavations and evidence of the practice of drying them was recently found at the site of Freeschool Lane (Radini 2009).

All samples had variable and low amount of species described under the category of arable and disturbed ground such as goosefoots (*Chenopodium* spp.), sheep sorrel (*Rumex* cf. *acetosella* L.), and for flavouring brassicas/cabbages (*Brassica* spp. and Brassicaceae), also found in previous excavations on site. Such remains were also found in previous work on site (Radini, 2014). Although the above species are normally considered weeds of crops, they may have been collected for their edible leaves. The seeds are very small and the surfaces of the seeds did not survive well so further identification was not possible.

Charcoal

The majority of the charcoal was preserved in very small fragments and flecks. The most common taxa identified were oak (*Quercus* spp.) and hazel (*Corylus avellana* L.). Oak and hazel would represent the best fuel for both domestic and industrial activities as they burn at a high and constant temperature and would be an ideal fuel for a kiln.

Other remains

A certain degree of soil disturbance is suggested by a large amount of root and rootlets fragments, which were retrieved from all samples. Earthworm egg capsula were also present in all samples. Such remains too are indicative of soil disturbance.

Conclusion

Overall the plant assemblage from Oxford St. was remarkably consistent across the samples. The low diversity of plant remains, the amount of crops of cereal and legumes points to the feature to be used as drying kiln. The archaeobotanical assemblage from Oxford Street and its associated finds assessed during the analysis have provided useful information regarding the history of crop exploitation, providing further evidence of the practice of drying legumes, crops with normally lower archaeological visibility then cereals.

Discussion

The Archaeological Sequence

In contrast to the previous areas excavated in 2013 this part of the development site had suffered more modern disturbance, particularly from building foundations and a network of drains. Despite this, archaeological remains survived well across the site and the evidence recovered was complementary to the results of the earlier work from this and surrounding projects.

Roman

Roman remains related principally to boundary and burial features, probably reflecting three broad phases of activity between the later 1st century and the 4th/5th century.

Late 1st – early 2nd century

The earliest evidence for Roman activity in Area 4 was represented by a sequence of narrow gullies running along the eastern edge of the site in a NW-SE direction. They probably reflect the lines of property boundaries associated with early Roman occupation on the southern edge of the town. All three lay close to one another suggesting different phases of the same boundary line although truncation had removed any evidence for inter-relationships. Stratigraphically these were the earliest archaeological remains revealed during the excavations, and were associated with pottery dating to the late 1st – 2nd century AD.

The early Roman gullies form part of a broader network of similar features occurring mostly to the north and east of the present site. Associated evidence from the previous work on this site (Thomas 2014) and other nearby excavations indicate that this early phase of land allotment was fairly consistent and related to small-scale domestic and agricultural activity. At the Elfed Thomas site to the east, a recut ditched boundary on a NE-SW alignment appeared to form the southern limit to an area containing fragmentary evidence for domestic activity consisting of structural remains and pits, including a well-preserved cess pit. The spatial organisation of these remains suggested that they lay within a 'backyard' location behind properties existing further to the north (Cooper 1996, 8-9).

Similar evidence for early Roman occupation was revealed during excavations on the opposite side of Newarke Street (Derrick 2009, 67). Here, domestic activity was characterised by remains of cobbled surfaces, make-up layers and pits, one containing charred plant remains and animal bones, situated within a network of gullies/ditches. These boundaries also lay on a NW-SE orientation, illustrating continuity of alignment with the boundary pattern to the south. All of these boundaries share alignment with the direction of the *Tripontium* Road as it enters the town and it seems likely that they represent a series of domestic/agricultural plots laid out alongside it. The position and alignment of the *Tripontium* Road were originally confirmed by excavations at Bonners Lane in 1993-94 where the roadway was characterised by a *c.*11.5m – 16.6m wide metalled surface bordered by roadside ditches at (Finn 2004). Since then further sections of the road have been revealed to the south at Grange Lane (Thomas 2010) and closer to towns south gate beneath Oxford Street (Morris 2010). The collective evidence from these excavations suggests that the *Tripontium* Road was formalised during the late 1st – early 2nd century, corresponding with the evidence for broadly contemporary roadside activity defined by plot boundaries on the same alignment.

Excavations to the west of the current project have revealed contemporary activity characterised by a series of ditches defining plots or paddocks on the western side of the *Tripontium* Road (Morris 2010, 110). The impression here was one of a dispersed landscape

with a general lack of domestic activity or material culture, perhaps indicating an agricultural focus.

2nd – 3rd Century

A large ditch on the western edge of Area 4 provided evidence for Roman activity in the 2nd-3rd century. This forms part of a substantial NW-SE landscape boundary also revealed in Trench 2 from the 2013 excavation (Thomas 2013) and during excavations to the north and south of the site. This large ditch evidently had a long history of use, originating in the 2nd century and perhaps replacing the gullied boundary system before going out of use by the later 3rd or early 4th century (based on coin evidence from Trench 2), indicating it held an important position in the landscape of the south suburb. A boundary ditch with similar characteristics and orientation has been revealed at other nearby excavations indicating the presence of a significant 2nd/3rd century land division running parallel with the *Tripontium* Road, and probably marking the eastward limit of plots situated adjacent to the road.

Figure 19: The 2nd-3rd century ditch in relation to other known contemporary boundaries

To the north a short section of this boundary was revealed during excavations at 21-33 Newarke Street, where it was seen as part of a reorganisation of the site during the mid-late 2nd century (Derrick 2009, 70). A longer section of ditch was observed some 80m south of the present site during excavations at York Road and Oxford Street (Gossip 1999a, 1999b). This feature had a similar profile and contained a pottery assemblage dating between the 1st-3rd centuries, as well as a 4th century coin from the final layer of silting.

Human remains of two individuals (a male and female) had been buried in the top of the boundary ditch after it had been infilled. The female was more fully represented than the male skeleton but both sets of remains had been disturbed by later activity so it is unclear if this was originally a double burial. Other burials discovered in 2013 from Trench 2 were also associated with the ditch, both lying adjacent to the boundaries western edge suggesting they were broadly contemporary as they had been laid out in respect of its alignment. One contained a complete female adult inhumation (SK09) while the second contained disarticulated remains of a child (SK07), both apparently buried in coffins. Radiocarbon dating of SK09 produced a 2nd/3rd century date which supports the association between the ditch and the burials. Both burials appear to represent pagan tradition due to their orientation and the presence of grave goods, and contrast sharply with the burial evidence recovered from Roman cemetery excavations at the Elfed Thomas site (Cooper 1996) and at 21-33 Newarke Street (Derrick 2009) where the evidence overwhelmingly supported a Christian burial tradition with east-west oriented, supine inhumations containing no grave goods.

Similarities may be found however, at the York Road and Oxford Street excavations to the south, where a number of burials were located to the west of what appears to have been a prominent boundary feature (Gossip 1999a, 1999b). These burials did not appear to have been formally organised and lay on a variety of alignments, some in respect of the boundary and others a short distance from it. Grave goods were also present in these graves, in the form of pottery vessels and hobnail boots laid near the feet. Another human sized grave contained only the burial of a dog.

One burial (SK 17) at 21-33 Newarke Street was also buried adjacent to the large boundary ditch on a NE-SW alignment (Derrick 2009, 97) and was also truncated by a later, east-west grave. The graves associated with the large boundary ditch may belong to a pagan tradition of peripheral burials located at the rear of domestic plots, as the York Road/Oxford Street examples also appear to reflect. The burial in the top of the infilled ditch indicates that the 'boundary burial' tradition persisted for a short time even after the ditch had gone out of use

3rd-4th Century

In contrast to the burials associated with the boundary ditch, evidence from the eastern edge of the excavation indicated an entirely different tradition. Although badly disturbed the row of 5 inhumations on this side of the site retained enough evidence to discern a consistent burial tradition consisting of a West-East orientation with the head facing East, with coffined, supine burials and a distinct lack of grave goods. Another burial discovered to the south during the evaluation of the site in 2007 (Parker and Jarvis 2007) had similar characteristics and was probably part of the same row of graves. Radiocarbon dating of two burials from this group (SK 14 & SK 18) indicates use of the cemetery between the 3rd and later 4th or possibly early 5th century. These burials show a marked degree of organisation, having much more in common with those excavated directly to the east at the Elfed Thomas site, and appear to have been part of the westernmost row of burials associated with this area of the cemetery. Their orientation precisely reflects that of the large boundary ditch, indicating its influence in the organisation of the cemetery. The boundary may have defined the cemeteries western edge or delimited an area for a particular burial tradition.

All of the burials recorded during the 2013 excavation lay to the west of the boundary ditch and were associated with a variety of burial characteristics, many of which differed to those on the eastern side of the boundary. The radiocarbon dating of 4 of the burials however indicates

a broadly similar date range for their interment. The burials in this area were superficially similar to those recorded at the Elfed Thomas site and at 21-33 Newarke Street, being formally laid out in rows and, with one exception, adopting a NE-SW alignment. Although almost all of the graves were oriented in the same way as the nearby Christian burials, two of the bodies faced west rather than east, and another had been buried in a prone position. Whilst this may have been accidental during burial, other factors suggest different attitudes in this part of the cemetery.

Many of the burials contained grave goods, which contrasts sharply with the other nearby cemetery evidence where associated finds were absent. Finds from the burials included hair pins and a buckle, while one individual had been buried with two finger rings and a comb beneath her head. Evidence from two graves indicates the use of heirlooms as grave goods. Grave goods are also recorded as accompanying burials found during the construction of Allen House (Dare 1927, 33-57) suggesting this tradition was more widespread than just the current group and may have been a characteristic of this part of the cemetery, or this particular phase of its use.

It is possible that some of the apparent differences in burial tradition reflect differing dates for the burials but most of the available dating evidence suggests that many are broadly contemporary, suggesting that pagan, as well as Christian rites were observed concurrently. Excavations of a Roman cemetery at Ashton, Northamptonshire identified two contemporary areas of a cemetery that apparently catered for Christian and non-Christian beliefs (Watts 1991). More locally it is clear from other cemetery excavations in different parts of Leicester that pagan traditions were observed in the later Roman period (Cooper 1998, Mathew Morris *pers comm*).

Figure 20: Roman burials from the excavations in the context of surrounding cemetery evidence (ditches in grey and Civil War ditch open)

Medieval

Evidence for medieval activity in Trench 4 was limited to two pits and a long-lived grain drying kiln representing use of the area between the 12th-16th centuries. These features were probably located in the backyard plots of properties fronting onto the medieval Southgates Street (now Oxford Street) and given the distance of Trench 4 from the frontage it perhaps should not be surprising that activity was low key.

In contrast the 2013 excavations revealed much more evidence for medieval pitting, particularly in Trench 1 that was closest to the Southgates Street frontage. These pits appeared to be organised in linear rows projecting back from the medieval street frontage. The evidence fits with similar medieval activity on the western side of Oxford Street (Morris 2010) and accords with the documented presence of burgesses and peasant tenants living outside the South Gate of Leicester since *c.*1200 (Courtney 1998).

The corn-drier provides useful evidence for domestic craft activities and in addition to the nearby bread oven from the 2013 excavation (Thomas 2014). Corn-driers area fairly common discoveries in Leicester. Another similar feature was found nearby on the western side of Southgates Street although the drying floor of this structure had not survived (Morris 2010). Other recently excavated examples have been recorded during excavations at Vaughan Way (Gnanaratnam 2009, 35) and Freeschool Lane (Coward and Speed 2009, 113). In all cases the main purpose of the structure appears to have been the drying of grain.

The medieval features add to similarly dated evidence from a number of excavations in the area for domestic and craft activity on either side of Southgate Street (Gossip 1999a, 1999b, Finn 2004, Morris 2010). Much of this evidence reflects backyard activity although associated structural remains have been revealed at the junction of Oxford Street and York Road (Gossip 1999a, 19-20). Limited medieval remains from excavations to the north and west of the present site (Derrick 2009, Cooper 1996 respectively) appear to indicate a fall off of activity moving away from Southgate Street, perhaps indicating a lack of settlement away from the main throroughfares.

Figure 21: The medieval features across the site

Post-medieval

The large ditch crossing the northern end of Trench 4 was a continuation of a 17th century ditch originally discovered during the 2013 excavations (Thomas 2013, 30). The ditch probably formed part of the towns Civil War defences, lengths of which have also been found on other excavations in the area. Excavated evidence from the town's south suburb has gradually pieced together archaeological evidence for the two documented phases of large-scale defensive earthworks that were erected at this time, following clearance of buildings and plots to make way for them. Most recently a *c.*37m length of Civil War ditch was uncovered during excavations at De Montfort University, running along what would have been the western frontage of Southgates Street (Morris 2010, 94-5). The ditch on the present excavations probably relates to this phase of the defences, which although not closely dated, are thought to represent the second phase earthworks (Neil Finn *pers comm*). Full excavation

of this new section of ditch was not thought necessary but importantly the new information from Trench 4 has helped to confirm its orientation. This newly recognised section of Leicester's Civil War defences can now be assessed more usefully in relation to the wider pattern of known defensive features from this period.

Following the backfilling of the ditch a building was constructed along the frontage of Hangman's Lane (Newarke Street). The western gable end of this structure was revealed during the 2013 excavations and it was clear that it had made use of re-cycled materials, possibly accumulated during the pre-Civil War clearance of the south suburb. Unfortunately only slight remains of the building survived in Trench 4, consisting of a cobbled floor section and low stone wall, both of which had been damaged by modern drains. The function of this building is difficult to discuss based on the available evidence, but it does appear to have related to the re-establishment of occupation in the south suburb following the Civil War. A building in a similar location is depicted on the 1741 Roberts map of the town but it is unclear if it is an accurate representation of the one revealed in the excavation.

Conclusion

The second phase excavation at 28 Newarke Street has added considerable new information to that previously recovered during the earlier phase of work in 2013. Importantly the position of Area 4 provides a bridging point between this site and earlier neighbouring excavations which enables the findings of the project to be more readily synthesised. The project results not only add to those of the earlier work on the site but have built upon findings from a growing number of sites in the area which, between them, have shown the great potential for archaeological survival in the area.

Perhaps most importantly the excavations have revealed more about life and death on the southern edge of the Roman town, both before and after the town wall was established. The results of this and other nearby excavations have revealed consistent evidence for domestic activity within a network of plot boundaries. Although this evidence is fragmentary the suggestion is that this southern edge of the early town plan was actively occupied during the later 1st – early 2nd century although the full nature of this occupation is not clear. From what has been revealed in the area a mixture of low-level domestic and horticultural or agricultural activity seems likely. What is clear is that the plots containing this activity were aligned on the NE-SW orientation of the Tripontium Road which evidently had a strong influence on the development of the settlement plan from an early stage.

The Tripontium Road continued to influence the development of the area into the 2nd/3rd century when a major landscape boundary was created. This was a long-lived boundary of at least two phases that ran parallel and approximately 60m west of the Tripontium Road. It probably marked the limits of plots coming away from the road but may also have delimited the boundary of the town's southern cemetery which existed to the east of the ditch. Several burials were aligned on the ditch and appear to conform to pagan burial traditions. These probably were what is known as 'backyard' or 'boundary' burials of people who lived in properties fronting onto the Tripontium Road.

Previous excavations to the east and north of the present site had recorded details of a 4th century cemetery that had characteristics associated with a Christian burial tradition. New information gathered during the present excavation has added to this picture, with the discovery

of a new row of East-West aligned burials on the eastern edge of Area 4. These appear to represent the westernmost row of burials in the formal cemetery recorded at the Elfed Thomas site. A gap between this row and the edge of the boundary ditch may indicate the presence of a bank on the eastern side of the boundary. Interestingly the NE-SW orientation of the burials is also clearly influenced by the general layout of the areas boundaries. The overall trend of orientation across the archaeological excavations in this area contrasts sharply with the orientation of Newarke Street which has previously been suggested to be a fossilised Roman street (Cooper 1996, Derrick 2009). The new evidence from the present project indicates that this suggestion is probably incorrect and that the line of Newarke Street must be a more recent development in the local townscape.

Burials on the western side of the boundary show a very different picture, including a range of burial characteristics that appear to follow pagan traditions. These included prone and decapitated burials and a range of grave goods, contrasting sharply with previously excavated burials within the cemetery. Despite the contrasting traditions, many of the burials from this site follow the same orientation and spatial arrangement as the Christian burials. Radiocarbon dating has also shown a broadly similar date range for the burials on either side of the ditch. This may indicate that certain areas of the cemetery area were allocated to different social groups or beliefs.

Information relating to the medieval and post medieval use of the south suburb has also provided complementary evidence to that recovered from nearby excavations at De Montfort University to illustrate the growth and decline of medieval activity close to the towns South Gate. Later evidence has added information on the defensive earthworks relating to the towns Civil War defences, revealing a previously unrecognised alignment. Information relating to the re-occupation of the south suburb following the Civil War has also been added.

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Appendix 1: OASIS Information

INFORMATION REQUIRED	EXAMPLE
Project Name	16-26 Oxford Street/28 Newarke Street, Leicester
Project Type	Archaeological Excavation
Project Manager	Vicki Score/John Thomas
Project Supervisor	John Thomas
Previous	DBA, Evaluation, Phase 1 Excavation
Current Land Use	Car Park (disused warehouse)
Development Type	Residential (Student Flats)
Reason for Investigation	NPPF (Section 12)
Position in the Planning Process	As a condition
Site Co ordinates	SK 585 040
Start/end dates of field work	March-April 2015
Archive Recipient	Leicester City Museum
Study Area *	0.1ha

Appendix 2: OSTEOLOGICAL AND PALAEOPATHOLOGICAL CATALOGUE

Skeleton Number	**1.A7**
Preservation	Good surface preservation, with moderate erosion to humerus, ulna and femur
Completeness	30%
Age	36-45 years
Sex	Male
Stature	163.3cm ± 2.99cm
Pathology	Degenerative joint disease(DJD) in the right shoulder ,elbow, hip, knee, ankle and foot Possible OD on the right tibial distal articulation on the antero-medial surface. Generally robust; muscle excavation on right ulna at the attachment for supinator, right humerus attachment for deltoid, latissimus dorsi, lateral head of triceps, right patella for part of the quadriceps tendon. Possible fracture to the right MT5 or could just be pronounced attachments for fourth palmar interosseus and opponens digiti minimi. Moderate DJD in the right shoulder and wrist, hip knee and ankle
Dental Health	No teeth present

Skeleton Number	**1**
Preservation	Moderate. Skull and vertebrae in good condition; Ribs in moderate condition; Limb bones moderate to poor, with flaky surfaces on many of the long bones. Moderate fragmentation of skull and ribs
Completeness	90%
Age	9-12, juvenile
Sex	-
Stature	-
Non-Metric Traits	Mastoid foramen extrasutural (bilateral)
Pathology	Bilateral *cribra orbitalia* in the middle intermediate sectors exhibiting small and large isolated foramina. Mild maxillary sinusitis in the left maxillary antrum (right not present). Mild periosteal reaction on the external surface of left maxilla, located immediately superior to deciduous second molar on the external alveolar process, inferior to the zygomatic process, consists of disorganised porotic new active bone. Anomaly; small spicule of bone on the right frontal, inferior to the supra orbital notch on medial surface of orbit, consists of dense bone; unsure aetiology.
Dental Health	26/28 teeth present, calculus on 18/28 teeth present, caries affected 1/28 teeth 1 small caries was present on the distal surface of the right maxillary canine at the junction of the root and the cusp, enamel hypoplasia affected 5/28 teeth, lines and grooves were evident on the maxillary anterior teeth and the right maxillary molar and right mandibular molar.

	Right Dentition								Left Dentition							
Present	-	E	P	PM	P	P	PM	P	P	P	P	P	P	P	E	-
Calculus	-	-	Sm	-	-	Sb	-	Fb	Fb	Fb	-	-	Sb	Fb	-	-
DEH	-	G	-	-	-	L	-	-	L	G	L	-	-	-	-	-

Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	1	1	1	1	1	-	2	2	1	-	4	-	1	-	-
Maxilla	-	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**C**	**D**	**E**	**6**	**7**	-
Mandible	-	**7**	**6**	**E**	**D**	**C**	**2**	**1**	**1**	**2**	**C**	**D**	**E**	**6**	**7**	-
Present	-	E	P	P	P	P	P	P	P	P	P	P	P	P	E	-
Calculus	-	-	Fdl	Slb	Mb Sl	Mb	Fl	Smd Ml	Sbm d Ml	Fm	Sl	Sl	Sm	Fd	-	-
DEH	-	-	-	-	-	L	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	1	4	4	3	1	2	2	1	3	5	5	1	-	-

Skeleton Number	**2**
Preservation	Good, some erosion to lower limbs
Completeness	90%
Age	2-3 years, juvenile
Sex	-
Stature	-
Non-Metric Traits	Double anterior condylar canal (left), Bridging of supraorbital notch (right), Accessory infraorbital foramen (bilateral)
Pathology	Endocranial lesions on the occipital within the left cerebral fossa, sagittal sulcus and the cruciform eminence, consists of porotic plaque like bone with vascular impressions, measures 43.6mm a/p by 27.7mm m/l. New bone formation is also present on the external surface of the left ascending ramus, the new bone is porotic and plaque like and is located immediately inferior to the mandibular notch, measuring 4.5mm x 8.4mm. Bilateral new bone formation is also present on the internal surface of both ascending ramus, anterior to the mandibular foramen left measures 18.4mm x 8.1mm right measures 12.2mm x 8.5mm. Further new bone formation is evident on the right side of the sphenoid, infero-lateral to the hypopyseal fossa, consists of a small patch of porotic woven bone measuring 4.1mm x 4.0mm. Hyper-porotic pinhole porotic bone is evident bilaterally on the posterior surface of both maxilla, inferior to the zygomatic process, covering the entire surface. Pinhole porotic plaque like bone is also evident bilaterally in the inferior orbital surfaces of the maxilla on the anterior margin, left measures 12mm x 3.6mm and right measures 12.6mm x 4.1mm
Dental Health	19/20 teeth present, 1/20 lost post mortem (a right mandibular central incisor). 1/19 teeth affected by calculus, flecks on the mesial surface of left maxillary central incisor.

	Right Dentition								Left dentition							
Present	-	-	-	P	P	P	P	P	P	P	P	P	P	-	-	-
Calculus	-	-	-	-	-	-	-	-	Fm	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	1	1	1	1	2	2	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	PM	P	P	P	P	P	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	1	1	1	1	-	2	1	1	1	1	-	-	-

Skeleton Number	**3**
Preservation	Good, taphonomic damage to spinous process
Completeness	5%
Age	18+ years, adult, however the individual is probably considerably older
Sex	Female?
Stature	-
Non-Metric Traits	Transverse foramen bipartite (bilateral)
Pathology	Osteoarthritis on left superior articular facet of C7 and mild DJD within C5 & 6 and T1
Dental Health	12/14 teeth present, 2/14 lost post mortem, a further 20 positions not present. Mild periodontal disease evident, slight alveolar resorption on the left mandible. 10/12 teeth affected by calculus, slight to moderate deposits, largely on the lingual and buccal surfaces. 2/12 teeth affected by enamel hypoplasia, two lower anterior teeth exhibit lines.

	Right Dentition								Left dentition							
Present	-	-	-	-	-	-	-	-	P	-	-	-	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	Mb	-	-	-	-	-	-	-
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	-	-	-	-	-	PM	PM	P	P	P	P	P	P	P	P	P
Calculus	-	-	-	-	-	-	-	Hl	Mbl	Mbl	Sl	Sl	Smd	Slb	Fb Ml	Sb Ml
DEH	-	-	-	-	-	-	-	-	-	L	L	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	4	5	3	2	2	2	3	3	2

Skeleton Number	**4**
Preservation	Poor, loss of surface detail on lower limbs
Completeness	80%
Age	26-45 years, middle adult
Sex	Female

Stature	159.4 ± 4.30cm
Non-Metric Traits	Mastoid foramen extrasutural (right), Precondylar tubercle, Accessory lesser palatine foramen (right), lateral tibial squatting facet (left)
Pathology	Very mild *cribra orbitalia* in the right anterior intermediate portion of the orbit, exhibiting pinhole porosity. Maxillary sinusitis evident in the left and right maxillary antrum. Mild DJD in the cervical and upper thoracic spine, right wrist, and both hips. Osteoarthritis in the lower lumber spine, sacrum and distal right radius. Tuberculoid lesions within the spine; fusion of L2 and L3 at the intervertebral space and articular facets, the vertebral bodies appear to have undergone a degree of collapse. Bodies fused with well remodelled lamellar bone, although largely destroyed by taphonomy. A lytic lesion penetrates the lateral body of L2. Fusion of L1 and T12 fusion occurs at the body and articular facets, bodies fused using porotic new bone in the process of remodelling. Body of T12 has been almost entirely destroyed , with irregular spicules of bone projecting from the left and right. A pseudo articulation had developed on the spinous process of T12, where it articulates with T11, the articular facets have also extended, due to the extensive degeneration of T11's body, the superior articular facets have extended onto the lamina of T12 where OA has developed in the pseudo articulations. The body of T11 has been entirely destroyed by some of the right pedicle remains, although has a very gnarled appearance and the left pedicle is almost entirely eroded. Osteoarthritis on left superior articular facet of C7 and mild DJD within C5 and 6 and T1
Dental Health	28/32 teeth present, 4/32 congenitally absent. No evidence of periodontal disease. 23/28 teeth affected by calculus, slight to moderate deposits, largely on the lingual and buccal surfaces of anterior teeth, with heavy deposits on the posterior teeth

	Right Dentition								Left dentition							
Present	CA	P	P	P	P	P	P	P	P	P	P	P	P	P	P	CA
Calculus	-	Mb	Ml	-	-	-	-	-	Sb	Fl	Fl	Fbl	Sl	Mbl	Hbd	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	4	4	3	3	5	6	4	4	4	3	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	CA	P	P	P	P	P	P	P	P	P	P	P	P	P	P	CA
Calculus	-	Sdm	MlSb	Sl Mb	Sl	Smd	Sl	Sl	Sml	Sml	Fb Ml	Ml Fb	Hl Fb	Hbl	Hbol	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	3	3	2	2	3	4	4	4	4	3	2	2	3	3	-

Skeleton Number	**5**
Preservation	Moderate; detail of limb bones largely eroded, upper body more affected than lower
Completeness	80%
Age	26-35 based on teeth only
Sex	Male

Stature	179.8 ± 2.99cm
Non-Metric Traits	Mastoid foramen extrasutural (left); precondylar tubercle, double atlas facet (bilateral), septal aperture (left), peroneal tubercle (right), double anterior calcaneal facet (right)
Pathology	Spina bifida occulta, S1 open. DJD in the left wrist, right hip and left ankle. Fusion of L4 and L5, both left and right inferior articular facets of L4 have fused to left and right superior facets of L5. Possible ligamentous ossification along the right lateral side of the pedicle involving the zygaphopysial joint, the joint space between the vertebral bodies does not appear to have been affected. When L4 and 5 are articulated with S1 there is a degree of posterior and left lateral deviation of spine Calcaneus extremely rugged topography of plantar and lateral surfaces- attachment for long plantar ligament and bifurcate ligament, muscles *digitorum brevis* and *flexor accessorious.* Entire surface of medial side exhibits periosteal reaction , well remodelled dense lamellar like appearance (not active) MSM's generally robust
Dental Health	30/32 teeth present, 2/32 teeth lost ante mortem, calculus on 27/30 teeth present, heavy to moderate deposits on posterior dentition, enamel hypoplasia affected 13/30 teeth, lines evident on the anterior teeth. Periodontal disease evident with moderate alveolar resorption on maxilla and mandible

	Right Dentition								Left Dentition							
Present	P	P	P	P	P	P	P	P	P	P	P	P	P	AM	P	P
Calculus	S/Ml	Sb	Mb	Sb	Fb	Mb	Fb	-	-	-	Mb	Fb	-	Ml	Sl Mb	Hbd
DEH	-	-	-	-	-	L	L	L	L	L	L	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	3	4	4	3	3	3	2	3	3	2	3	3	-	4	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	AM	P	P
Calculus	M/Hbl	M/Hbl	M/Hbl	Sl	Sl	Sl	Sl	Sl	Sl	Fl	Fb	Sl	Sl	-	Mb Hl	Mb
DEH	-	-	L	-	L	L	L	-	L	L	L	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	4	4	4	2	2	4	4	4	4	3	3	3	3	-	4	3

Skeleton Number	**6**
Preservation	Good to excellent, ribs exhibit some flaking and erosion
Completeness	15-20%
Age	18-25
Sex	Male
Stature	-
Non-Metric Traits	Cranial traits; parietal foramen (bilateral), foramen of Huschke (bilateral), mastoid foramen extrasutural (bilateral); precondylar tubercle; bridging of supraorbital notch (left) accessory supraorbital foramen (right)

	Post cranial traits; posterior atlas bridging (left)
Pathology	Mild *cribra orbitalia*, antero-lateral and central intermediate sectors exhibit vascular impressions. Porotic and disorganised new bone formation on the endocranial surface of frontal bone, lesion measures 40.7mm (A/P) x 19.0mm (M/L) Located within the most anterior portion of the sagittal sulcus MSM's generally robust.
Dental Health	12/32 teeth present, 2/32 teeth lost ante mortem, 18/32 positions not present. Calculus on 12/12 teeth present, slight to moderate deposits on lower dentition, tended to be below the cusp/ root junction, 3 caries were present on 2/12 teeth; 1 small caries on the buccal surface of the left mandibular canine below the cusp root junction, another small caries on the mesial cusp of the 1st mandibular molar and the distal cusp of the same tooth. Chipping on medial edge of left lateral incisor and distal edge of central incisor. Moderate periodontal disease.

	Right Dentition								Left Dentition							
Present	-	-	-	-	-	-	-	-	P	P	P	P	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	Fl	Fl	Fl	Fl	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	4	4	5	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	-	-	-	-	-	-	P	P	P	P	P	P	P	P	AM	M
Calculus	-	-	-	-	-	-	Sb	Sb	Mb	Mb	Sl	Sl	Sl	Ml	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	Sm Md	-	-
Wear	-	-	-	-	-	-	5	5	5	5	5	4	4	3	-	-

Skeleton Number	**7**
Preservation	Good surface preservation, with moderate fragmentation
Completeness	<10%
Age	1-3 years
Sex	-
Stature	-
Pathology	Ectocranial new bone formation around the sutural margins of the right temporal, occipital, left and right parietal frontal and four non identifiable fragments, consists of porotic plaque like bone. Endocranial new bone formation on the frontal bone, along the frontal crest also consists of porotic plaque like bone
Dental Health	No teeth present

Skeleton Number	**8**
Preservation	Moderate, taphonomic damage to vertebral bodies, and epiphyses of upper limbs heavily damaged
Completeness	75%

Age	46+ Mature Adult
Sex	Male
Stature	164.4 ± 2.99cm cm
Non-Metric Traits	Post cranial traits; acetabular crease (left), femoral plaque (right), Exostosis in Trochanteric Fossa (right), Peroneal tubercle (right), double anterior calcaneal facet (bilateral), double inferior talar facet (bilateral), Os Trigonum (right)
Pathology	Bilateral DJD on the manubrium hamates, proximal femurs, distal tibias, distal fibular, and calcaneus, left distal radius, right lunate1 Schmorl's node on inferior body of T8 S1 exhibits what may be a peri-mortem fracture to the spinous process of S1,With no evidence of remodelling, the diagonal breaks run superiorly medially to inferiorly laterally, inferior to the right articular facet and slightly through the left facet round into the pedicle Bifid spinous process of S, left lamina partially overlies right Possible DISH; fusion of anterior longitudinal ligament of T11-9, with kissing osteophytes between T9-8 and T8-7, ossification localised to the right lateral portion of the vertebral bodies. The articular facets and joint spaces were preserved. General bone forming activity, ossification of rib cartilage, sternum also exhibits florid new bone on internal surface of the body, either rib cartilage/ pleura/ transverses thoracis, pronounced development of right radial interosseus border for flexor digitorum profundus and radial tuberosity for biceps, attachments for flexor digitorum profundus on the left and right ulna, brachialis and supinator on the right ulna. The joint capsule of the right Os coxa appears to have partially ossified, the ischiofemoral ligament, transverse ligament, reflected head of rectus femoris and right and left pectineal ligament also appear to be very well developed. The soleal line on the left and right tibia and patella ligament of the left tibia, quadriceps tendon of the right patella are also very rugged. Possible ossification of vastus lateralis on the left femur, possibly myositis ossificans or an ossified haematoma, lesion consists of lamellar bone, with rough rugged undefined margins measuring 54.1mm x 17.1mm, located on the medial margin of the upper third of the shaft. Possible new bone formation on a number of limbs, doesn't appear to be consistent in appearance with woven bone, periosteal reaction or lamellar bone; plaque like linear like striations evident on medial and lateral surfaces of the left and right tibial shafts, most densely located on the distal third and the distal two thirds of the anterior surface of the femoral shafts, bone striations also present on the lateral surface of the pubis and medial surface of left and right ischium.
Dental Health	No teeth present

Skeleton Number	**9**
Preservation	Good, some loss of surface detail and erosion around the epiphyses. Slight fragmentation, most long bones broken, more heavy in the ribs
Completeness	95%
Age	26-35 years
Sex	Female
Stature	158.8 ± 3.55cm
Non-Metric Traits	Cranial traits; Ossicle in Lambdoid (bilateral), Foramen of Huschke (bilateral), Mastoid foramen extrasutural (bilateral), posterior condylar canal open (right), double anterior condylar canal (bilateral), Mandibular torus (bilateral), bridging of supraorbital notch (bilateral) Post cranial traits; double atlas facet (right), suprascapular foramen (left), Septal aperture (right), Acetabular crease (right), Allen's fossa (bilateral), Poirier's facet (left), Hypotrochanteric fossa (right), Exostosis in trochanteric fossa

	(bilateral), Third trochanter (left), Medial tibial squatting facet (right), Double anterior calcaneal facet (left), Double inferior talar facet (left)
Pathology	Lumbar ribs (bilateral). Mild DJD within mid thoracic vertebrae, both shoulders and left arm. Two Schmorl's nodes on T12 and one on L1. Bilateral periosteal reaction on the tibiae, consists of well remodelled lamellar bone and disorganised active woven bone. Bilateral periosteal reaction on the fibulae, consists of well remodelled lamellar bone along the shaft and disorganised active woven bone on the distal third of the right fibula. Porotic plaque like vascularised bone present on the right calcaneus around the sustentaculum sulcus. Bilateral new bone formation on the femora, exhibiting a combination of well remodelled lamellar bone and disorganised woven bone. Disorganised woven bone on the left Ischium. Bilateral disorganised woven bone on the proximal humeral shafts, with well remodelled lamellar bone on the left proximal shaft. Localised patches of disorganised woven bone on the pleural surface of four right ribs. (Possibly Pulmonary Osteoarthropathy)
Dental Health	25/29 teeth present, 4/29 lost post mortem, a further 3 positions not present. Moderate periodontal disease evident, with moderate alveolar resorption on the mandible and maxilla. 25/25 teeth affected by calculus, slight to moderate deposits, largely on the lingual and buccal surfaces. 3/25 teeth affected by enamel hypoplasia, two lower and one maxillary anterior teeth exhibit lines. Chips to buccal surface of right maxillary canine and the distal inferior portion of the 1st premolar cusp. Another possible deformation was present on the buccal/distal portion of the mandibular right third molar cusp.

	Right Dentition								Left dentition							
Present	P	P	P	P	P	P	P	P	PM	PM	PM	P	PM	P	P	P
Calculus	Sb Sl	Sb Sl	Mb Fl	Sl Ml	Sb Sl	Mb Sl	Sl Mb	Mb	-	-	-	Ml	-	Mlb	Sb Fl	Sb Md
DEH	-	-	-	L	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	3	3	3	2	2	2	2	3	-	-	-	2	-	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	P	P	P	P	P	-
Calculus	Sbdl	Sb Ml	Ml Sm	Ml b	Mlb	Sl Mb	Sl Mb	-	-	Sb Ml	Mbl	Sm Ml	Sb Ml	Mbl	Sldb	-
DEH	-	-	-	-	-	L	-	-	-	-	L-	-	-	-	-	-
Caries	Sd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	3	4	4	3	2	2	2	-	-	2	2	2	2	4	4	-

Skeleton Number	**10**
Preservation	Poor, heavy erosion to the appendicular skeleton. Moderate fragmentation to the skull and ribs
Completeness	95%
Age	26-35 years, very varied age dental wear =17-25 years, auricular surface =40-45, and jugular growth plate is still un-fused = <34 years
Sex	Male
Stature	172 ± 2.99 cm

Non-Metric Traits	Cranial traits; Ossicle in lambdoid (bilateral), Mastoid foramen extrasutural (bilateral), Sutural mastoid foramen (left), Posterior condylar canal open (bilateral), Precondylar tubercle, Double anterior condylar canal (right), Open foramen spinosum (bilateral), Mandibular torus (left), Accessory supraorbital foramen (bilateral) Post cranial traits; Circumflex sulcus (bilateral), Poirier's facet (right), Femoral plaque (right) Hypotrochanteric fossa (left)
Pathology	Surface preservation is poor and may have destroyed some pathological lesions Eight Schmorl's nodes on five thoracic vertebrae out of twelve and one on one out of five lumbar vertebrae. Mild DJD in the cervical and upper thoracic vertebrae, the left arm and right hip. Endocranial new bone formation on occipital frontal and both parietals appears to be plaque like porotic bone with vascular impressions The new bone on the occipital is located on the cruciform eminence transverse and sagittal sulcus, appears to be chronic with a mixture of active and remodelled bone, vascular impressions also fill the left cerebral fossa. Bilateral new bone formation in the sagittal sulcus of the parietals. New bone formation deviates from the sagittal sulcus in the frontal into the left frontal lobe. Possible O.D on the proximal articular surface of the proximal phalanx for the left MT1, two areas of pitting are evident, could also be DJD. Spina Bifida Occulta present in S2,3 and 4 with mal-unification of the arch of S1 Asymmetry of transverse foramina of C6; the right is approximately three times bigger than the left. Bilateral new bone formation on the proximal femurs at the intertrochanteric line around the capsular ligament, consists of disorganised woven bone. Possible new bone formation on the anterior surface of the right femur, immediately superior to the articular surface, consists of disorganised woven bone. Possible patch of well remodelled lamellar bone on posterior lateral border of the mid shaft. New bone is also evident on the proximal end of the right humeral shaft, immediately inferior to the articular surface. Plaque like new bone formation on the antero-medial surface of the proximal end, around the capsular ligament. Ectocranial periosteal new bone formation on the parietals and frontal, located medially, reaction is not present where temporalis attaches. Possible scalp inflammation. Medio-anterior margin of the left mandibular condyle exhibits a spicule of bone continuous with the articular surface, may have affected movement of the joint and may relate to heavy calculus deposits. Asymmetry between the humeri; the right is 14 mm longer than the left. The left also exits a degree of torsion in the proximal shaft, where there appears to be antero-posterior bending within the shaft, possible healed fracture
Dental Health	31/31 teeth present, 1 position not present. Slight periodontal disease evident, with slight alveolar resorption on the right maxilla and mandible. 17/31 teeth affected by calculus, heavy deposits are restricted to the right maxillary and mandibular dentition, focused on all surfaces, surprisingly the left side of the dentition bears little to no calculus. Three caries present on 2/31 teeth, the right maxillary 1st premolar exhibited 1 large caries on the distal surface of the crown and a further small caries on the mesial margin at the interface between the cusp and root. 2/31 teeth affected by enamel hypoplasia, two lower anterior teeth exhibit grooves. An externally draining abscess was present on the apex of the right maxillary first premolar. Chipping was evident on the buccal surface of both maxillary central incisors, the right central incisor and the right canine. Mild v-shaped wear was evident on the occlusal surface of the right central maxillary incisor

	Right Dentition								Left dentition							
Present	P	P	P	P	P	P	P	P	P	P	-	P	P	P	P	P
Calculus	-	-	-	-	-	Fb	-	-	-	Fb	Hbl Mo	Hbl Mo	Hbl o	Hbl o	Hbl o	Hb Mb
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	Mm	-	Sm Lo	-	-	-	-	-	-	-	-	-	-	-

Wear	1	2	3	-	-	2	3	3	3	2	-	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	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Calculus	-	-	-	-	-	-	Fb	Fmd	Fm	Fb	Sb Ml	Hbl Mo	Hbl Mo	Hbl Mo	Hbl Mo	Ho m
DEH	-	-	-	-	-	G	-	-	-	-	G	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	1	2	-	-	2	3	3	3	3	3	2	2	1	1	1	1

Skeleton Number	**11**
Preservation	Moderate; some erosion of limb bones. Skull and ribs moderately fragmented
Completeness	90%
Age	46+ years
Sex	Female
Stature	159.6 ± 3.55cm
Non-Metric Traits	Parietal foramen (left), Double anterior condylar canal (right), Accessory infraorbital foramen (right), Accessory supraorbital foramen (right), transverse foramen bipartite (bilateral), suprascapular foramen (bilateral), Allen's fossa (left), Hypotrochanteric fossa (bilateral), Double anterior calcaneal facet (left), Double inferior talar facet (bilateral)
Pathology	Mild DJD in the spine, shoulders and hip. Wedge shaped vertebrae, T11 anterior height 22.9mm posterior height 29.5mm, possible crush fracture. Endocranial lesions on the frontal and parietal, within the sagittal sulcus consist of porotic plaque like bone with vascular impressions. Measures 30.3mm x2.5mm on the frontal and 50.1mm x 11.1mm on the parietal. Right lower ribs, possibly 9-7, exhibit an acute angulation at the angle of the rib.
Dental Health	26/32 teeth present, 5/32 congenitally absent, including three second premolars and two third molars. 1/32 teeth lost post-mortem, 2/32 teeth lost ante-mortem, both mandibular second molars. Retention of two deciduous teeth including left mandibular second molar and right maxillary canine. Moderate periodontal disease evident, with moderate alveolar resorption on the mandible and right maxilla and considerable resorption on the left maxilla. 7/32 teeth affected by calculus, slight to moderate deposits, largely on the lingual and buccal surfaces. 2/32 teeth affected by enamel hypoplasia, two maxillary central incisors exhibit grooves. 3/32 teeth affected by caries, two affecting the maxillary dentition, one so large it had destroyed the entire crown of the right maxillary first premolar and another located on the root, just below the cusp of the mandibular right second molar.

	Right Dentition								Left dentition							
Present	P	P	P	CA	P	P	P	P	P	PM	P	P	CA	P	P	P
Calculus	-	-	-	-	-	Mb	-	-	-	-	-	-	-	Mbl	Slb	Slb
DEH	-	-	-	-	-	-	-	G	G	-	-	-	-	-	-	-
Caries	-	Fb	-	-	L	-	-	-	-	-	-	-	-	-	-	-
Wear	2	2	2	-	2	2	2	3	3	-	2	3	-	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**	**E**	**6**	**7**	**8**

Present	CA AM UE	AM	P	P	P	P	P	P	P	P	P	P	P	P	AM	AM CA UE
Calculus	-	-	ML	-	-	-	-	-	-	-	-	-	Sl	Slb	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	Sl	-	-	-
Wear	-	-	2	2	2	2	2	3	3	2	2	2	4	4	-	-

Skeleton Number	**12**
Preservation	Poor; Good on upper body, very poor on lower body
Completeness	85%
Age	46+ years
Sex	Male
Stature	161.8 ± 2.99cm (Caucasian) or 165.8 ± 3.53cm (African)
Non-Metric Traits	Cranial traits; Parietal foramen (bilateral), Ossicle at the parietal notch (left), Mastoid foramen extrasutural (left), Incomplete foramen spinosum (bilateral), Palatine torus, Maxillary torus (bilateral), Accessory supraorbital foramen (bilateral), Anterior ethmoid foramen extrasutural (left) Suprascapular foramen (bilateral), Circumflex sulcus (left), Poirier's facet (right), Femoral plaque (left)Hypotrochanteric fossa (left), Third trochanter (left), Peroneal tubercle (left), double anterior calcaneal facet (bilateral), double inferior talar facet (bilateral)
Pathology	Well healed fracture to the right distal radius, appears to be a spinal fracture. Right femur distal end, degeneration of the articular end, a groove has developed on the medial condyle, running from the patella surface down the inferior surface of the condyle. The patella surface is also morphologically altered, having developed a topographic appearance, with irregular surface morphology with smooth edges; possibly related to trauma/ fracture of condyles, or developmental, osteoarthritis in the joint appears to be secondary. The right proximal tibia articulation exhibits the same irregular surface morphology, with associated osteoarthritis on the lateral condyle. Left mandible exhibits periosteal reaction associated with an abscess, consists of porotic plaque like bone 17mm x 15mm immediately inferior of the alveolar margin. Zygomas exhibit bilateral porotic new bone formation with vascular impressions along the zygomatic border from the masseteric origin to temporal process. Maxillae exhibit bilateral new bone formation, with periosteal reaction superior to the alveolar margin at the location of M2/3, medial and posterior to the zygomatic process, more severe on the right, probably related to the AM loss of second molars. Right first and second metatarsals exhibit kissing osteophytes at the proximal ends if the lateral shafts, superior to the articular facets, possibly trauma related. Extremely robust in upper limbs, humerus; pectoralis major, biceps and lateral lip of intra-trabecular groove, radius and ulna; supinator, biceps and brachialis. A degree of torsion is evident in the proximal two thirds of the left humerus, appears to have revolved antero-medially. There is also a degree of anterior posterior bowing in the proximal third, immediately inferior to the proximal epiphysis, bows out anteriorly, possibly a well healed fracture, same as skeleton 10. Endocranial new bone formation on frontal bone within posterior two thirds of the sagittal sulcus 34.4mm x 13.9mm

Dental Health	26/32 teeth present, 6/32 lost ante-mortem of M2s and M3s. Considerable periodontal disease evident, with severe alveolar resorption on the maxilla and mandible. 23/26 teeth affected by calculus, heavy deposition on the buccal surfaces of the anterior teeth, with only slight deposits on the lingual surfaces if these teeth. Four externally draining abscesses, three on the left and right maxilla, one on the left mandible. Five caries on four teeth, two large on the left maxillary M2 and left mandibular M1															
	Right Dentition								Left dentition							
Present	AM	AM	P	P	P	P	P	P	P	P	P	P	P	AM	P	AM
Calculus	-	-	Mdb Hl	Mlb	Hb Sl	Fl Hb	Hb	Hb Sl	Hb Sl	Hb	Sbl	Mb Sl	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	Md	-	Lo	-
Wear	-	-	4	4	4	3	4	4	4	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	AM	P	AM	P	P	P	P	P	P	P	P	P	P	P	P	P
Calculus	-	Hld Mlm	-	Mbl	Mb Sl	Mlb	Hb Ml	Hbl	Hb Sl	Mbl	Mml	Mbd	Fl	-	Sbl	Sbl
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	Ld	L?	-	-
Wear	-	4	-	4	4	3	3	5	4	3	3	4	4	-	4	4

Skeleton Number	**13**
Preservation	Moderate; damage to vertebral bodies and surface erosion on all bones
Completeness	70%
Age	26-35 years,
Sex	Female
Stature	158.2 ± 3.55cm
Non-Metric Traits	Suprascapular foramen (right), Femoral plaque (right), Exostosis in the Trochanteric fossa (left), Peroneal tubercle (right), Double anterior calcaneal facet (bilateral), Double inferior talar facet (bilateral)
Pathology	Three Schmorl's nodes on 2/9 thoracic vertebrae (one on T7 two on T8), three Schmorl's nodes on 3/5 lumbar vertebrae (one on L2, L3 and L4). DJD in spine, right shoulder, right and left hip. Right clavicle has a deep sulcus on the inferio-lateral surface, medial to the conoid tubercle and lateral to the subclavian sulcus; appears as if the bone has resorbed away from the coracoids process.
Dental Health	No teeth present

Skeleton Number	**14**
Preservation	Very good; some surface abrasion
Completeness	85%

Age	46+ years
Sex	Male
Stature	186.1 ± 2.99cm.
Non-Metric Traits	Cranial traits; Mastoid foramen extrasutural (right) Post cranial traits; Transverse foramen bipartite (left), Circumflex sulcus (right), Femoral plaque (bilateral) Hypotrochanteric fossa (right), Third trochanter (right), Lateral tibial squatting facet (right), Peroneal tubercle (right)
Pathology	DJD in cervical spine Schmorl's nodes in lumbar spine, both proximal humeri, the left distal tibia, the left distal fibula, the left talus, and the left navicular. Healed fracture to the distal left fibula, located 15mm superior of the epiphyses, the fracture appears to be oblique with posterior and inferior displacement of the proximal fragment, with 26mm of overlap. The posterior and anterior surfaces of the callus are smooth and well remodelled with dense lamellar bone, the medial surface had two irregular ossified nodules at the fracture site, possibly as a result of myositis ossificans traumatica. Abrasion of the callus reveals a honeycomb interior. No sign of new bone formation. Probable fracture and extensive soft tissue damage to the distal left tibia. The posterior-medial margin of the distal articulation appears as if it has been crushed and displaced superiorly and posteriorly. The posterior-lateral metaphyseal area consists of a large lobule of fibrous bone, which extended medially; the medial margin of the anterior surface of the metaphysis had another frilly fibrous nodule of bone, which extends medially enclosing the anterior and posterior portions of the distal fibula shaft. The anterior articular margin of the tibia is porotic and seemingly slightly resorbed, a plaque like layer of microporotic sits on the medial articular surface, and the surface of the medial malleolus. Striated well remodelled bone is evident along the entire shaft of the left tibia and both femora. On the distal third of the shaft of the left femur was a spicule of bone was located at the insertion of the short head of biceps and vastus intermedius, possibly the result of myositis ossificans traumatica. The left talus has porotic defined lips to the posterior and anterior articular margins, microporotic plaque like bone also on the medial malleolus articulation. The first coccygeal vertebrae had fused to the body of the sacrum, the neural arches of S5 appear to have fused with the lateral margins of the coccyx, although the cornua and the superior surface of the body remained unfused. The first sacral vertebra looks as if it is being expressed, the vertebral body sits higher than the ala and the neural arch of this vertebra remains distinct from the rest of the vertebrae, with its inferior articulating facet also appearing to be separate. The left tibia has two palpable nodules on the posterior surface of the shaft; the first is located 115mm from the distal articulation and measures 5.5mm in diameter the second is 48mm superior of the first and measures 30mm superior inferiorly and 12mm anteriorly posteriorly, with a smooth lamellar like appearance and may have been ossified haematomas.
Dental Health	19 teeth present, 19 tooth positions. Slight periodontal disease evident, on the maxilla and mandible. 16/19 teeth affected by calculus, flecks to slight deposits. One externally draining abscesses on the left maxilla, at the root of M1. Two caries on two teeth.

	Right Dentition								Left dentition							
Present	-	-	-	-	-	-	-	-	-	-	-	-	-	P	P	P
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	Fm	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	4	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	P	P	P	P	P	P	P	P
Calculus	-	Fm	Fbm Sl	Sl	Fb Sl	Fb Sl	Slb	Sl	Fb Sl	Sb Sl	Fb Sl	Slm	Sl	Sl	Sl	Sdl
DEH	-	-	-	-	-	G	G	G	G	G	G	-	-	-	-	-
Caries	-	Sb	-	-	-	-	-	-	-	-	-	-	Ld	-	-	Sb
Wear	3	3	4	3	3	4	4	5	5	4	4	2	2	4	2	2

Skeleton Number	**15A**
Preservation	Very good
Completeness	50%
Age	36-45, old middle adult
Sex	Female
Stature	-
Non-Metric Traits	Post cranial traits; Acetabular crease (left), Third trochanter (bilateral),
Pathology	Schmorl's nodes in lumbar spine DJD in thoracic spine
Dental Health	10 teeth present, 7 tooth positions. Slight periodontal disease on the mandible, 10/10 teeth affected by calculus, flecks to moderate deposits.

	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	P	P	P	-	-	P	P	-	-	-	P	-	P	P	P	P
Calculus	Sld	Fl	Ml	-	-	Slb	Fb Sm	-	-	-	Flm d	-	Sl	Ml Fb	Ml Fm	Sbd Fl
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	3	3	4	-	-	2	3	-	-	-	2	-	2	3	3	2

Skeleton Number	**15B**
Preservation	Poor;

Completeness	30%															
Age	18+ years, adult															
Sex	Male															
Stature	-															
Non-Metric Traits	Cranial traits; Mastoid foramen extrasutural (bilateral), double anterior condylar canal (right)															
Pathology	OA in the cervical spine. DJD in the thoracic and lumbar spine, and the left scapula															
Dental Health	6 teeth present, 10tooth positions, 3/10 teeth lost PM 1/10 lost AM, 6/6 teeth affected by calculus, 6Considerable periodontal disease evident, on the maxilla															
	Right Dentition								Left dentition							
Present	-	-	-	-	-	-	-	-	P	P	P	PM	P	AM	P	P
Calculus	-	-	-	-	-	-	-	-	Fm	Sl	Sl	-	Slm	-	Sm Hb Ml	Hdb Mlm
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	7	7	5	-	6	-	8	7
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	PM	PM	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	--	-	-	-	-	-	-	-	-	-	-	-	-	-

Skeleton Number	**16**
Preservation	Good
Completeness	30%
Age	2-4 years, young juvenile
Sex	-
Stature	-
Non-Metric Traits	Post cranial traits; Allen's fossa (bilateral), Hypotrochanteric fossa (bilateral)
Pathology	-
Dental Health	No teeth present

Skeleton Number	**17**
Preservation	Poor
Completeness	30%

Age	18+ years, adult
Sex	-
Stature	-
Non-Metric Traits	-
Pathology	-
Dental Health	No teeth present

Skeleton Number	**18**
Preservation	Moderate
Completeness	40%
Age	18+ years, adult
Sex	Female
Stature	-
Non-Metric Traits	Cranial traits; Mastoid foramen extrasutural (bilateral), double anterior condylar canal (right)
Pathology	OA in the cervical spine. DJD in the thoracic and lumbar spine, and the left scapula
Dental Health	0 teeth present, 8 tooth positions, 6/8 teeth lost PM, 2/8 lost AM,

	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	PM	AM	PM	PM	PM	PM	AM	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	--	-	-	-	-	-	-	-	-	-	-	-	-	-

KEY:

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

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

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

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

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

Appendix 3 CATALOGUE OF DISARTICULATED REMAINS

Context Type	Bones	Age	Sex	Other
Grave fill of Sk 19	L Ulna	Juv	-	Complete
	1st sacral vertebra	Juv	-	Complete
	R Frontal	Juv	-	Lateral orbit and part of suture
	LMT5	Juv	-	Proximal end and shaft
	Tibia	Juv	-	Proximal epiphyses
	L humerus	Adult	-	Distal and mid-shaft
	L zygoma	Adult	-	Complete
	1st cervical vertebra	Adult	-	Left superior and inferior articular facet
	L pubic bone	Adult	-	Superior part
	Radius	Adult	-	Mid shaft fragment cannot side
	Cranial vault	Adult	-	Fragment unidentifiable
	Metacarpal 4/5	Adult	-	Shaft only
	canine	Adult	-	Left mandibular wear grade 3, DEH
Grave fill of Sk 15	femur	Adult		Left mid-shaft

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