Archaeological Excavations at Bawtry Masonic Hall, South Yorkshire, July 2010:

the cemetery of the medieval hospital of St Mary Magdalene

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Abstract

In July 2010 an excavation was undertaken in the car park of the Masonic hall at Bawtry, South Yorkshire as part of a field school run by the Department of Archaeology, University of Sheffield, with support from Wessex Archaeology (Sheffield). The Masonic hall was the chapel of the medieval hospital of Bawtry, and the principal aim of the field school was to throw new light on the hospital and on the cemetery that was associated with it, which had been identified during excavations in 2006 and 2007. During the 2010 excavation, eighteen graves were identified, and subsequent analysis of both the articulated and disarticulated skeletal remains identified a minimum number of fifty three individuals. It was demonstrated that the cemetery served a broad cross-section of the population, which was relatively healthy. A radiocarbon date is awaited from one of the skeletons, but at this stage all of the evidence indicates that the burials were all of later medieval date. A small number of medieval artefacts were recovered, including a 13th-century coin, a copper-alloy plate (of a type used in medieval medicinal cures for damaged or infected joints) and the copper-alloy ferrule from the end of a walking stick. The remains of a late medieval wall were encountered running eastwards from the east wall of the Masonic hall; this wall was either the remains of a boundary wall or of a building, and it appears to be perpetuated into the 19th century, when a wall in a similar location is depicted on images of the chapel.

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1. Introduction

This report discusses the results of an archaeological excavation conducted in Bawtry (South Yorkshire) as part of a student field school run by the Department of Archaeology, University of Sheffield, with the assistance of staff from Wessex Archaeology (Sheffield) in July 2010. An L-shaped trench was dug in the car park of the Masonic hall in Bawtry, along the south and east sides of the hall: the long sides of the trench measured 8.7m (west-east) and 7.7m (north-south), and it was 2.25m wide. This excavation is not the first archaeological investigation of the site and its immediate environs, as it follows desk-based assessment of the area in 2002 undertaken by Archaeological Research and Consultancy at the University of Sheffield (ARCUS), archaeological evaluation in 2003 by Pre-Construct Archaeology, and excavation by ARCUS in 2005. A watching brief by ARCUS in 2006 uncovered the remains of three human skeletons just beyond the limits of the car park of the Masonic hall. A further excavation was conducted in 2007 under the direction of Christie Cox (ArchaeoTeam), but only limited information about this excavation was available to the authors at the time of writing. The 2010 excavation was supervised by Lauren McIntyre (University of Sheffield), with Project Management support from Richard O'Neill (Wessex Archaeology), and Dr Dawn Hadley (University of Sheffield) was Director of the field school. Historical evidence suggested that burials found in this area are likely to be part of a graveyard associated with the medieval hospital and chapel of St Mary Magdalene (O'Neill and Jackson 2007: iii), and a single radiocarbon date acquired from one of the skeletons excavated in 2007 confirmed that deduction. The hospital chapel is thought to have occupied the site where the Masonic hall now stands, immediately to the west of the area where burials were excavated in 2006 and 2007 (O'Neill and Jackson 2007: iii). A licence (Licence No. 10-0098) for the removal of the remains was obtained from the Ministry of Justice, issued on June 23rd 2010 (Appendix A).

This report details the results of the excavation and incorporates the specialist reports on the human remains (by Lauren McIntyre), faunal remains (Dr Umberto Albarella), glass, metalwork, clay pipe (Dr Hugh Willmott), and brick (John Tibbles). A report on the ceramics will be undertaken shortly by Dr Chris Cumberpatch, and subject to a separate report, which will be incorporated into the planned publication of the excavations (McIntyre and Hadley forthcoming). Similarly, the results of the radiocarbon dating of a sample of human bone will be subject to a separate report and included in the forthcoming publication. The osteological analysis of the human skeletal remains from Bawtry aimed to analyse the complete archive of human skeletal material in order to provide preliminary reconstruction of the demography and state of health of the medieval population sample. Eighteen articulated skeletons were recorded and lifted or partially lifted from the site. These remains, together with the remains of a minimum of eleven adults and twenty four sub-adults identified among the disarticulated human material, were subject to an osteological assessment, the results of which are discussed in detail in this report. The report also includes a discussion of the significance of the site and its broader context.

2. Site Location and Use

An L-shaped trench was dug in the eastern area of the car park of the Masonic hall in Bawtry, with the hall situated to the immediate north-west of the excavated area: the long sides of the trench measured 8.7m (west-east) and 7.7m (north-south), and it was 2.25m wide. The trench was positioned at the south-east corner of the hall, so that the west-east section of the trench ran parallel to the south facing elevation of the hall, and the north-south section of the trench ran parallel to the east facing elevation of the hall. The northern extent of the trench to the east of the hall partially overlapped the trench from the 2007 excavation (which was identified initially on the basis of modifications to the tarmac visible at ground level and

substantiated subsequently by the presence of blue tarpaulin covering the excavated area), in order to examine archaeological deposits that were not investigated during this earlier excavation and to facilitate, at some future point, the drawing together of the results from the two excavations.

The Masonic hall in Bawtry is located at the junction of Tickhill Road (A631) and Pemberton Grove, on the west edge of the town. The site is centred on grid reference SK 65017 93049 (Figures 1 and 2). The solid geology of the Bawtry area is Bunter Pebble Beds of the Permo-Triassic overlying Coal Measures (O'Neill and Jackson 2007: 1). The drift geology is glacial sand and gravel with an area of older river gravel (O'Neill and Jackson 2007: 1).

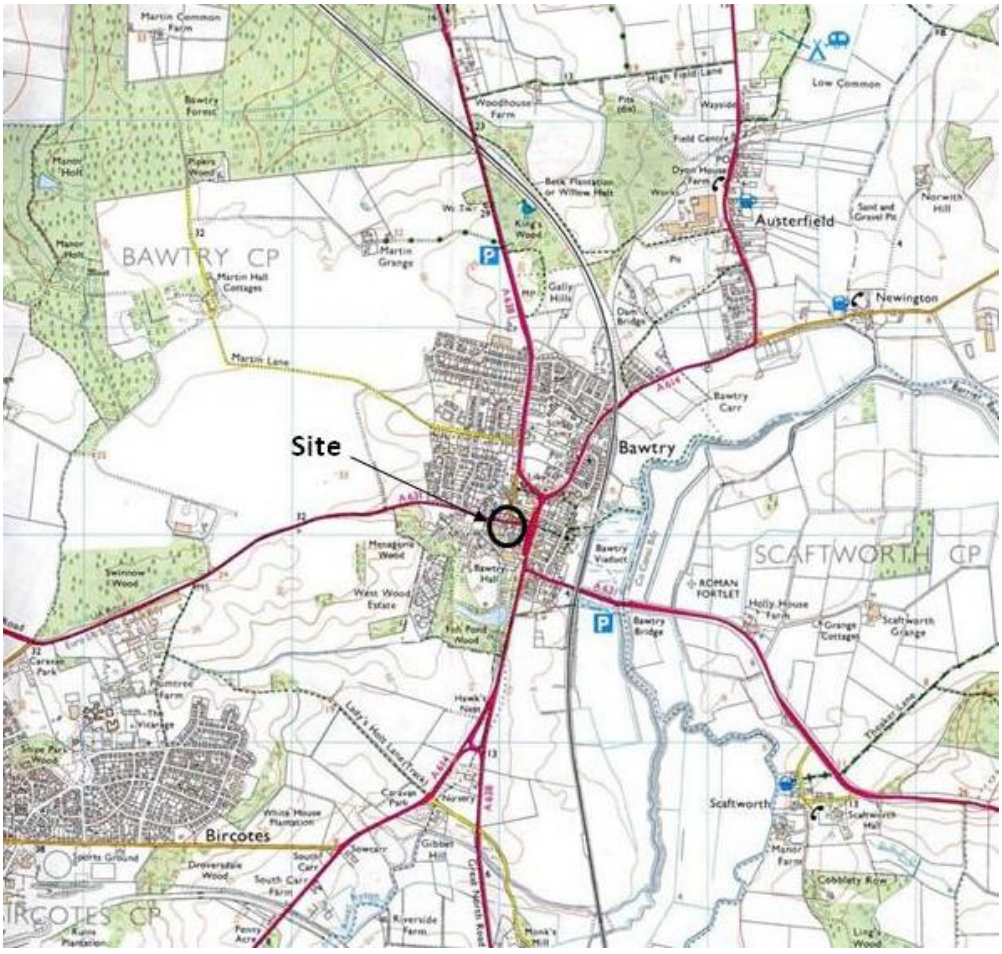

Figure 1 – Site Location (Ordnance Survey, 2006, Sheet 279, 1: 25,000)

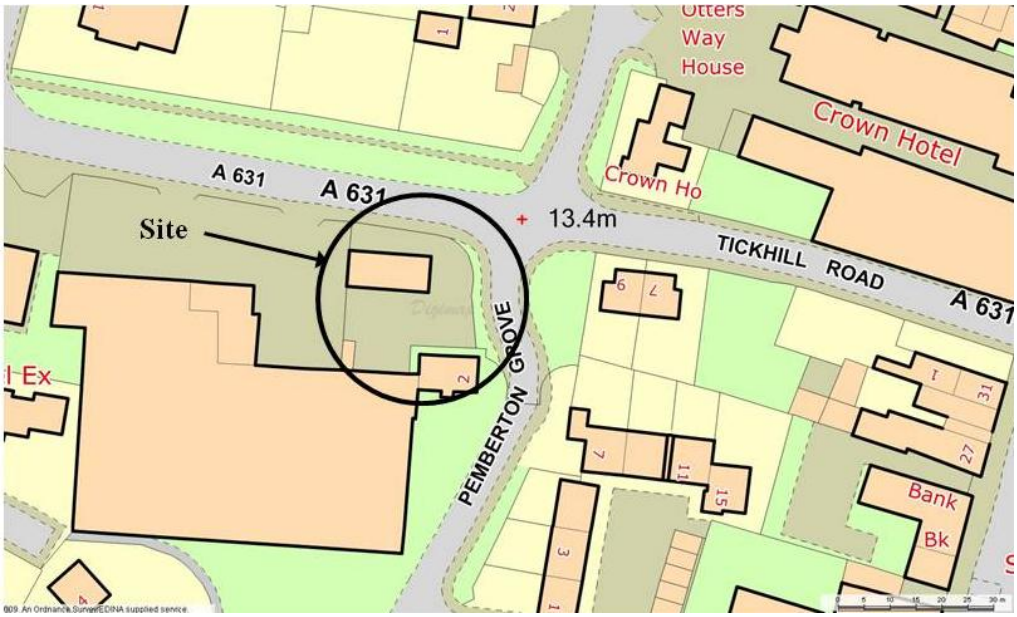

Figure 2 – Site Location (1:500) (Wessex Archaeology, 2010)

3. Archaeological Background

Previous archaeological research had highlighted the potential for uncovering medieval remains during the 2010 excavations. An archaeological desk-based assessment of the area adjacent to the Masonic hall was undertaken by ARCUS in 2002, prior to development of land surrounding the 18th-century Bawtry Hall, located to the south of the Masonic hall. This report concluded that any development in this area had potential for the disturbance and destruction of significant archaeological deposits, such as evidence of early landscapes, and medieval buildings associated with the medieval hospital of the town (Jefferson 2002: 4). Bawtry and its surrounding area were found to contain extensive remains of late prehistoric and early Roman field systems and settlements, Roman forts, and a Roman road, which was one of the main routes north from London to York (Jefferson 2002: 4; Page 1906: 239). Another ancient routeway from Nottingham – Stone Street – also passed through Bawtry (Page 1906: 297). Furthermore, Bawtry was identified as a significant medieval town and inland port (Jefferson 2002: 4). Medieval remains have been excavated at various locations in Bawtry, including a bridge on oak piles, and structural remains at 16-20 Church Street, while

the market cross and timber-framed buildings on Market Place and Church Street may be of medieval date (Jefferson 2002: 16; Cumberpatch and Dunkley 1996).

An archaeological evaluation and buildings appraisal was conducted in 2003 by Pre-Construct Archaeology, revealing potential medieval deposits in three out of five trenches located to the east, south, and south-west of the Masonic hall in the grounds of Bawtry Hall (Pre-Construct Archaeology 2003). These deposits included five post-holes (one of which contained pottery dating to the 13th to 14th centuries), a small pit, and two soils of probable medieval date (Pre-Construct Archaeology 2003). Several post-medieval features and deposits were also recorded (Pre-Construct Archaeology 2003).

Archaeological excavation of two large open areas to the south and south-east of the Masonic hall by ARCUS in 2005 found residual medieval pottery within later contexts, as well as several cut features and deposits dated to the late post-medieval and modern periods (Chan 2006).

A watching brief of a small area to the east of the retaining wall of the car park of the Masonic hall was undertaken by ARCUS in 2006 (O'Neill and Jackson 2007). Three graves containing human skeletal remains were found at the north end of the excavated area. These graves were dated tentatively to the medieval period (O'Neill and Jackson 2007: 6). Two later animal burials were also recovered, as well as evidence of post-medieval activity, including the insertion of a lead water pipe (O'Neill and Jackson 2007: 7).

Excavation of a large area to the immediate east of the Masonic hall, within the car park, was undertaken in 2007 by Christie Cox of ArchaeoTeam. Several inhumation burials were

excavated and recovered. Further detailed information about this excavation and the associated burials was not available at the time of writing, although it is believed (following discussion with the excavator) that c.8 skeletons were excavated and removed from the site for analysis, but that other burials were identified during the excavation and left *in situ*. In the light of the present report, it is clearly a matter of priority that the results of the 2007 excavation are reported to modern standards and made available for comparison with the results of the 2006 watching brief and 2010 field school.

4. Project Aims

The aims of the 2010 excavation were as follows:

- To identify, record and exhume exposed human remains in accordance with the Ministry of Justice licence;
- To provide an assessment of the significance of the archaeology present;
- To ascertain whether, and if so the extent to which, the medieval cemetery continued to the south of its known location (i.e. to the east of the Masonic Hall);
- To provide an insight into the demography, health and lifestyle of people living in medieval Bawtry, and to contribute further to our knowledge of medieval populations in South Yorkshire;
- To increase the archaeological potential and scientific value of available data from human skeletal remains excavated previously from this cemetery;
- To place the cemetery in its broader historical context;
- To present the site to the general public via publication and the website of the Department of Archaeology, University of Sheffield

5. Methodology

All archaeological fieldwork was carried out in accordance with the Ministry of Justice burial licence, with guidelines issued by the Institute of Field Archaeologists (IFA 1999) and with current industry best practice (e.g. in accordance with the British Association for Biological Anthropology and Osteoarchaeology (BABAO) *Code of Ethics* (2008) and the Church of England/English Heritage *Guidance for Best Practice for Treatment of Human Remains Excavated from Christian Burial Grounds in England* (2005)). The location of the trench is indicated in Figure 3.

Figure 3 – Trench Location (Wessex Archaeology, 2010)

5.1 Recording

A full written, drawn and photographic record of all archaeological features and deposits was maintained during the course of the excavation. All archaeological features were recorded to the Wessex Archaeology standard recording system. Plans and sections were drawn as appropriate, with general plans being drawn at 1:20 and plans of human skeletal remains at

1:10. A comprehensive photographic record was made on digital, and 35mm black and white and colour slide formats. Each context was described in full on a *pro forma* context record sheet in accordance with Wessex Archaeology context record conventions. A single context recording system was used, and each context was given a unique number.

Individual articulated skeletons were ascribed a unique number, related to their grave contexts in the site archive. Individual *pro forma* skeleton record sheets were filled out for each inhumation to document the *in situ* conditions of preservation and the surviving extent of the skeletal remains. No discrete grave cuts were visible as the graveyard soil and grave fills were too homogenous, but arbitrary cuts used for the purpose of excavation were planned by hand. Skeletal remains were geo-rectified using an 8 megapixel digital camera. Tags were geo-referenced with a Leica TCRP1205 and a Leica Viva GNSS GPS unit.

5.2 Excavation

The tarmac car park surface (1001), limestone hardcore (1002) and underlying red brick rubble (1003) were removed by machine under the supervision of the Project Manager from Wessex Archaeology. Three possible articulated inhumations were uncovered directly below rubble layer (1003), and temporarily covered with tarpaulin until investigation could begin. Three post-medieval lead pipes, a post-hole and one brick feature of initially unknown date (but see below, section 6.1.21) were also uncovered at this stage. The entire trench was cleaned by hand by site supervisors, and photographed after the preliminary clean.

The three post-medieval pipes were cleaned, photographed, recorded and left *in situ*. The post-hole was half-sectioned, photographed, recorded and later removed. The brick feature

was also cleaned, photographed, recorded and left *in situ*, though a single brick sample was taken for post-excavation analysis (section 6.1.21).

Areas of graveyard soil were thoroughly cleaned and examined for discrete grave cuts or evidence of articulated inhumations. If no evidence of these was observed, a small spit of soil was removed, and the area re-cleaned and examined. Articulated skeletons were carefully cleaned by hand, before full recording. Exhumation of each individual was carried out under a strict methodology: all skeletal elements were bagged separately according to anatomical divisions, with separate bags for the skull, vertebrae, ribs/axial skeleton, left and right arms, pelvis, and left and right legs. Each bag was labelled with the site code and name, skeleton number and skeletal division. Where possible, one litre soil samples were also taken from immediately around the skull, pelvis and feet of each articulated individual. Where parts of articulated individuals continued beyond the limit of excavation, only those elements situated within the trench boundary were lifted. Skeletal elements beyond the limit of excavation were left *in situ*. Once lifted, skeletons were removed from site for storage at the University of Sheffield (where they are still stored at the time of writing) and assessment by a qualified osteoarchaeologist.

5.3 Finds Collection Policy

All artefactual material was collected and bagged according to context number. Small finds were assigned a unique small finds number and fully recorded on a *pro forma* small finds record sheet. Small finds were also planned, photographed, and a three dimensional location point taken. All finds were then removed from site for storage at the University of Sheffield and assessment by an appropriate qualified specialist.

5.4 Archive

The archive consists of all primary written documents, plans, sections, photographs, artefacts and electronic data. This archive will be held by the Department of Archaeology, University of Sheffield, where it will be utilized in student training and as a resource for student projects. The human remains have been retained by the University of Sheffield in order that research may be undertaken on the collection over the next two years (see section 5.5), before reburial. The archive is being prepared by the project staff in accordance with the requirements specified in the English Heritage (1991) publication *Management of Archaeological Projects*, and in accordance with the UKIC (1990) *Guidelines for the Preparation of Excavation Archives for Long Term Storage*.

5.5 Reburial

As stated in the terms of the burial licence (Appendix A), the human skeletal remains will be reburied within two years of their exhumation.

6. Results of the Fieldwork

Three provisional phases of activity were identified. The context inventory is in Appendix B. Osteological assessment of the human remains can be found in Section 8. Commentary on the various finds from the excavation appears throughout the report according to context. As noted above, reports on the ceramics and radiocarbon dating will be subject to subsequent reports and incorporated in the planned publication (McIntyre and Hadley forthcoming).

6.1 Phase 1

The earliest deposits in Trench 1 were graveyard soils (1006), (1013), (1017) and (1021). Natural geology was not observed in any part of the trench. These contexts were very similar

in colour and texture (see descriptions below), and are likely to be the same soil layer. Different context numbers were assigned because the trench was split into three main areas separated by baulks containing post-medieval features that could not be removed (see Phase 2). Contexts (1006), (1013) and (1017) were at approximately the same level, and contained a total of sixteen discrete burials (context (1021) was positioned between two post-medieval features and was not excavated). Throughout the following discussion each burial is assumed to have belonged to an individual grave, even though a grave cut could not be discerned. In cases where two sets of human remains were recovered in one location it was, therefore, difficult to be sure whether they represented a single burial event and single grave. Descriptions of the 'grave fill' in the following discussion refer to the soil in the immediate vicinity of the burial, which is presumed to have filled the grave. However, it is important to note that in the absence of clear grave cuts the artefactual evidence recovered from the immediate vicinity of individual burials cannot be used to provide reliable dating evidence for the burial concerned.

6.1.1 Graveyard Soil (1006)

Graveyard soil (1006) was located at the western end of the trench, and measured >5m x >2.2m, > 0.6m in depth, and was present at 13.39m aOD. This layer comprised mid yellow brown sandy silt, with frequent rounded pebbles and occasional large rounded cobble inclusions, as well as occasional pottery, mainly of 19th-century date, hand-made iron nails, 19th-century glass, clay pipe fragments of 19th- or early 20th-century date, and fragmented faunal remains. Layer (1006) was cut by burials [1026], [1035], [1032] and [1072] as well as possible grave cut [1039], service trench [1010] and post-hole [1008] (see Phase 2). Layer (1006) also contained disarticulated human bone. During osteological assessment of the disarticulated human bone, a relatively complete 3 month old infant skeleton was found co-

mingled with the other remains. This was analysed as a discrete individual, numbered SK 1006a.

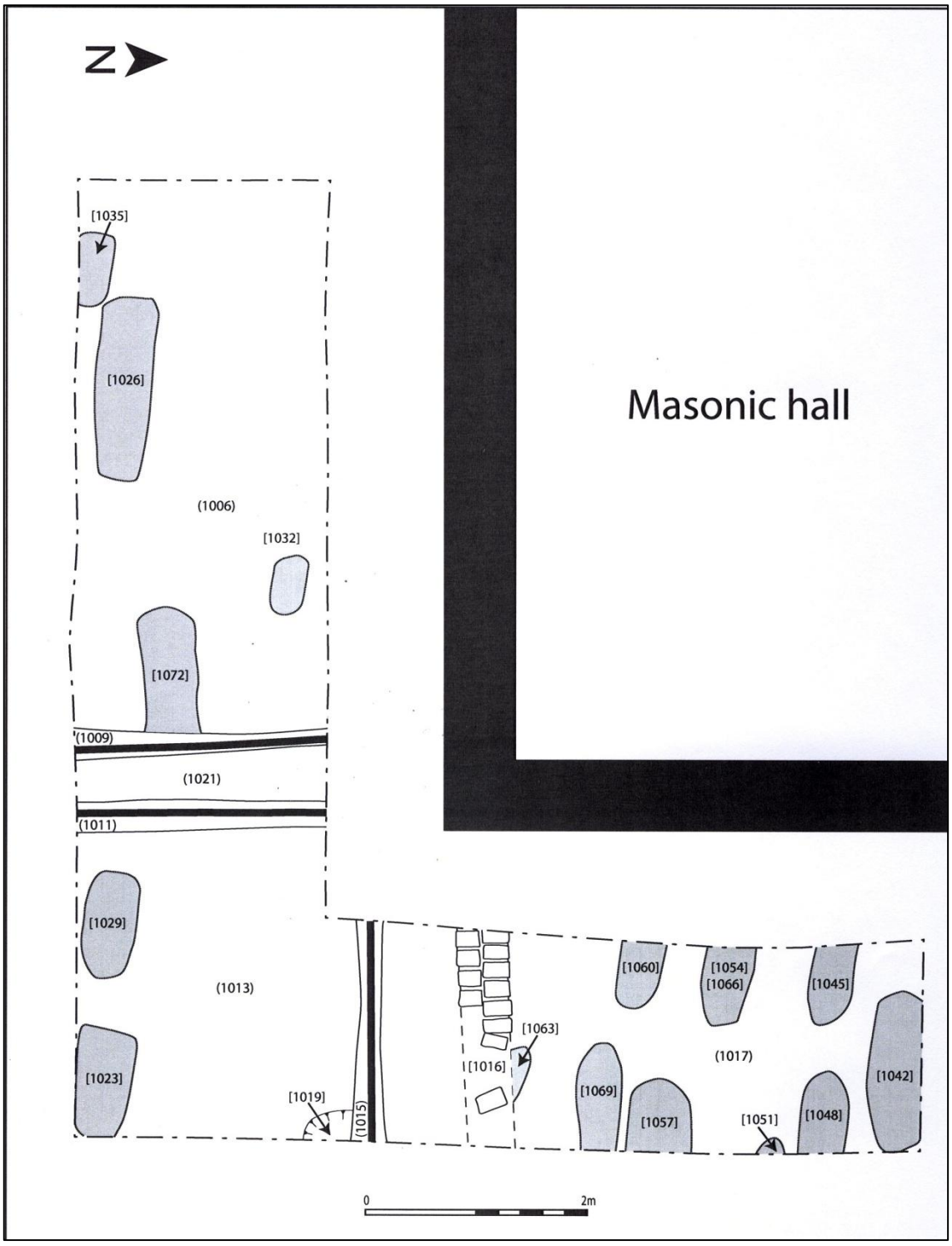

Figure 4 - Plan of excavated burials

6.1.2 Burial [1026]

Burial [1026] contained two individuals, SK 1025 and SK 1038. SK 1025 was a possible male aged 14-16 years, and SK 1038 was a 1-2 year old infant (Plate 1). Both skeletons were in a good state of preservation. Both were partially incomplete due to truncation on the left (i.e. north) side by possible grave cut [1039]. No human remains were found in direct association with cut [1039]; however the skeleton may remain *in situ* at a lower level. Both skeletons were extended, supine and oriented west to east. The burial was encountered at a depth of 13.42m aOD. The grave fill was mid-yellowish brown sandy loam (1024), which also contained frequent rounded pebbles, a single sherd of late medieval or early post-medieval pottery, and occasional disarticulated human and animal bone. SK 1025 had two congenitally fused fourth and fifth cervical vertebrae, ankylosis of one interphalangeal joint in the foot, dental calculus, enamel hypoplasia and retarded growth of three out of four of the second premolars.

Plate 1 – Burial [1026]/ SK 1025 and SK 1038 (looking south)

6.1.3 Burial [1032]

Burial [1032] contained a single articulated 4-6 month old infant, SK 1031a. However, post-excavation osteological analysis also identified the co-mingled remains of a second individual, 5-6 year old child SK 1031b. Both skeletons were very incomplete, with less than 10% of both individuals remaining. This also made the burial position difficult to ascertain, although the skull of SK 1031a was approximately supine and facing east (Plate 2). Preservation was good, although many of the bones were heavily fragmented. SK 1031a had porous lesions on the bones of the cranium and on several facial bones, which indicates an unidentified infection. The burial was at a depth of 13.40m aOD. The grave fill was mid-yellow brown sandy loam (1030), which also contained frequent rounded pebbles and occasional fragments of disarticulated human and animal bone, three sherds of post-medieval pottery, part of a possible medieval ceramic roof tile, and fragments of hand-made iron nails.

Plate 2 – Burial [1032]/ SK 1031a

6.1.4 Burial [1035]

Burial [1035] contained a single individual, 4-6 month old infant SK 1034. The skeleton was in a good state of preservation, although the bones were slightly jumbled (Plate 3). The skeleton was approximately extended, laid supine, and oriented west to east. The burial was at a depth of 13.40m aOD. The grave fill was mid-reddish brown sandy silt (1033), which contained frequent rounded pebbles.

Plate 3 – Burial [1035]/ SK 1034 (looking north)

6.1.5 Burial [1072]

Burial [1072] contained a single individual, 12-14 year old possible female SK 1071 (Plate 4). The skeleton was in a good state of preservation, if slightly fragmented. SK 1071 had slight dental calculus, and an un-erupted permanent left maxillary canine. The burial was extended, supine, and oriented west to east. Skeletal elements from the lower legs and feet

could not be recorded or lifted as they were underneath the baulk containing service trench [1010]. The burial was at a depth of 13.24m aOD. The grave fill was light orange brown silty sand (1070), which also contained frequent rounded pebbles and occasional fragments of disarticulated human bone.

Plate 4 – Burial [1072]/ SK 1071 (looking west)

6.1.6 Graveyard soil (1013)

Graveyard soil (1013) was located in the mid (south-eastern) section of the trench, and measured >1.4m x >1.3m, at a depth of 13.31m aOD. This layer comprised mid-yellow brown sandy silt, with frequent rounded pebbles and occasional large rounded cobble inclusions. Layer (1013) was cut by burials [1023] and [1029], cut feature [1019] and service trenches [1012] and [1015] (see Phase 2). Layer (1013) also contained occasional fragments of disarticulated human and animal bone, post-medieval pottery, post-medieval glass, and iron fragments.

6.1.7 Burial [1023]

Burial [1023] contained a single individual, adult possible female SK 1020. The skeleton was in a fair state of preservation, though the entire upper body had been truncated away (Plate 5). As the skeleton was located directly below brick rubble layer (1003), it is likely that the skeleton was truncated during the building of the car park at the Masonic hall. The burial was extended, supine, and oriented west to east. At its highest point (the right proximal femur), the skeleton was at a depth of 13.42m aOD. At the lowest point (the feet), the skeleton was at a depth of 13.08m aOD. The sloping of the burial in this way is unusual, and suggests that the burial may have been disturbed, though it is impossible to determine exactly when. The grave fill was mid-yellow brown sandy loam (1022), which also contained frequent rounded pebbles and occasional fragments of disarticulated human and animal bone, post-medieval pottery and glass.

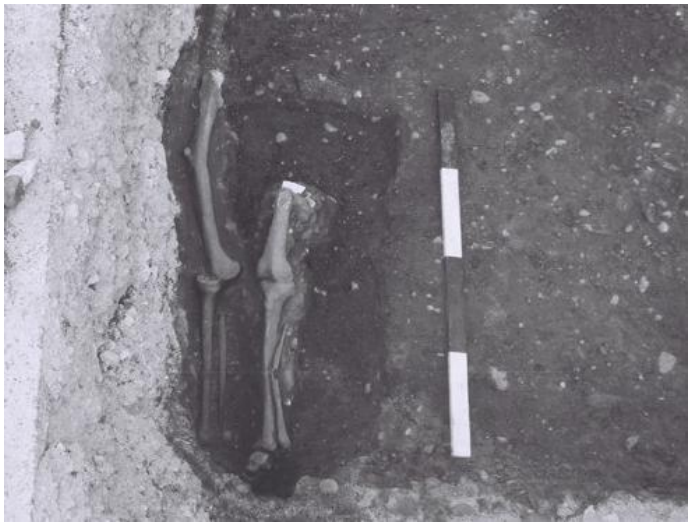

Plate 5 – Burial [1023]/ SK 1020 (looking west)

6.1.8 Burial [1029]

Burial [1029] contained a single individual, 5-6 year old child SK 1028 (Plate 6). The skeleton was in a good state of preservation, although quite fragmented. The legs of the individual were truncated and absent. Periosteal new bone formation on the inside of seven of the right ribs indicated that the individual suffered from non-specific infection of the lungs. The burial was extended, supine, and oriented west to east. The burial was at a depth of 13.28m aOD. The grave fill was orange brown sandy soil (1027), which also contained frequent rounded pebbles, disarticulated human and animal bone, and occasional fragments of iron. The skeleton was block lifted where possible due to fragmentation of the bones. Upon cleaning, several iron nails exhibiting mineralized wood remains were found within the grave fill, indicating that SK 1028 may have been buried in a coffin.

Plate 6 – Burial [1029]/ SK 1028 (looking west)

6.1.9 Cut Feature [1019]

Cut feature [1019] was cut into graveyard soil (1013), and could not be fully excavated as it ran beyond the limit of excavation to the east. The feature was sub-circular in plan (where visible), with straight sides and a flat base (Plate 7). The feature measured >0.37m x >0.19m, was 0.17m deep, and located at a depth of 13.24m aOD. It was filled with dark yellowish brown clay sand (1018), which contained occasional small, rounded pebbles and small wood fragments which disintegrated upon excavation. Several small red brick fragments were found in the upper fill, though this may be a result of later disturbance. This may represent the remains of a feature associated with a small structure related to the use of the site as a cemetery in the medieval period (e.g. a beam slot or post-hole). However, lack of dating evidence and incomplete excavation of the feature limits the reliability of this interpretation.

Plate 7 – Cut feature [1019] (looking west)

6.1.10 Graveyard soil (1017)

Graveyard soil (1017) was located in the north extent of the trench, to the east of the Masonic Hall, and measured >3.4m x >2m, at a depth of 13.37m aOD. This layer comprised mid-yellow brown sandy silt, with frequent rounded pebbles and occasional large rounded cobble inclusions, as well as occasional post-medieval pottery and glass, fragments of iron, disarticulated human and animal bone, and one silver coin (small find 1). Layer (1017) had the highest concentration of burials, and was cut by burials [1042], [1045], [1048], [1051], [1054], [1057], [1060], [1063], [1066] and [1069]. It was also cut by construction cut [1074] and service trench [1015] to the south (see Phase 2), and at the north end of the trench it was horizontally truncated by the 2007 trench cut [1005]. The large concentration of burials in this area suggests that many of them may have been intercutting; however, the homogeneity

of the graveyard soil and grave fills meant that the grave cuts themselves could not be observed, rendering the level of intercutting archaeologically invisible.

The silver coin (small find 1) recovered from graveyard soil (1017) is a so-called 'short cross' penny of the 13th century, minted during the reign of King Henry III (1216-72). The name 'HENRICUS REX' appears on the obverse of the coin surrounding the bust of the king. Short-cross coins of this type began to be minted during the reign of Henry II from 1180, and successive kings, include Richard I, John and Henry III, also minted coins of this type, retaining the 'HENRICUS REX' inscription. The coin found in graveyard soil (1017) can be identified as deriving from the reign of Henry III on the basis of the combination of the mint and moneyer named on the reverse, surrounding the cross. The coin was minted in London by the moneyer Nicole (Nicholas) (+ NICOLE ON LVN).

6.1.11 Burial [1042]

Burial [1042] contained the remains of a single individual, 12 year old possible female SK 1041 (Plates 8 and 9). The skeleton was very well preserved, with the exception of the hand bones, which were heavily eroded. The body showed evidence of cribra orbitalia and dental calculus. The burial was extended, supine, and oriented west to east. The lower legs were beyond the limit of excavation to the east, and therefore were not recorded or lifted. The burial was at a depth of 13.11m aOD. The grave fill was mid-yellow brown silty sand (1040), which also contained frequent rounded pebbles and occasional disarticulated human bone fragments.

Plate 8 – Burial [1045]/SK 1044 (top); Burial [1042]/ SK 1041 (right); Burial [1048]/ SK 1047 (bottom right); Burial [1051]/ SK 1050 (bottom left) (looking west)

6.1.12 Burial [1045]

Burial [1045] contained a single skeleton, adult possible female SK 1044 (Plate 8). Preservation was fair, and the majority of the skeleton was located beyond the edge of excavation to the west. Therefore, only the legs were recorded and lifted. The body showed evidence of slight degenerative joint disease on the medial condyle of the right tibia. The burial was extended, supine, and oriented west to east. The burial was at a depth of 13.10m aOD. The grave fill was mid-yellow brown silty sand (1043), which also contained frequent rounded pebbles and occasional fragments of disarticulated human bone.

Plate 9 – Burial [1042]/ SK 1041 (looking west)

6.1.13 Burial [1048]

Burial [1048] contained a single skeleton, 7-8 year old child SK 1047 (Plate 8). Preservation was reasonable, although the individual was quite fragmented. The legs of this individual were located beyond the limit of excavation to the east, so the majority of the pelvis and legs was not recorded or lifted. The body showed evidence of dental calculus and enamel hypoplasia, and had three dental caries. The burial was extended, supine, and oriented west to

east. The burial was at a depth of 13.12m aOD. The grave fill was mid-yellow brown silty sand (1046), which also contained frequent rounded pebbles, occasional disarticulated human bone, and one small looped piece of copper-alloy wire of possible medieval date.

6.1.14 Burial [1051]

Burial [1051] contained a single skeleton, 30-40 year old possible female SK 1050 (Plate 8). The skeleton was in a very good state of preservation, with the skull lifted intact. Only the skull of this individual was lifted, as the rest of the skeleton was located beyond the limit of excavation to the east. The skull was positioned to indicate that the burial was oriented west to east and laid supine, and it showed evidence of severe dental calculus. The burial was at a depth of 13.13m aOD. The grave fill was mid-yellow brown silty sand (1049), which also contained frequent rounded pebbles, occasional rounded cobbles, and occasional disarticulated human bone.

6.1.15 Burial [1054]

Burial [1054] contained a single adult skeleton of undetermined sex, SK 1053 (Plate 10). The skeleton was well preserved. Only the lower legs and feet of this individual were recorded and lifted, as the rest of the skeleton was located beyond the edge of excavation to the west. The skeleton appeared to be extended and supine, and oriented west to east. The burial was at a depth of 13.06m aOD. The grave fill was mid-yellow brown silty sand (1052), which also contained frequent rounded pebbles, occasional rounded cobbles, and frequent disarticulated human bone. It should also be noted that burial [1054] was located directly above burial [1066]. It is possible that burial [1054] is a later re-cut of the grave of burial [1066], but it is also possible that these two burials were interred in the same grave cut, and, thus, that skeletons SK 1053 and SK 1065 were interred sequentially within one cut. Unfortunately, the

homogenous nature of the grave fills and surrounding graveyard soil meant that a definite interpretation was not possible.

Plate 10 – Burial [1054]/ SK 1053 (above) and Burial [1066]/ SK 1065 (below) (looking west)

6.1.16 Burial [1057]

Burial [1057] contained a single skeleton, 20-30 year old male SK 1056 (Plate 11). The skeleton was in a good state of preservation. Only the upper body of the skeleton was recorded and lifted, as everything below the ribs (including the lower arms) was located beyond the limit of excavation to the east. The skeleton had kyphosis of the thoracic vertebrae and associated spinal joint disease, as well as degenerative joint disease in the right shoulder, dental calculus, enamel hypoplasia, and ante-mortem tooth loss. The skeleton appeared extended and supine, and oriented west to east. The burial was at a depth of 13.08m aOD. The grave fill was mid-yellow brown silty sand (1055), which also contained frequent rounded pebbles, occasional rounded cobbles, and occasional disarticulated human bone.

Plate 11 – Burial [1057]/ SK 1056 (looking west)

6.1.17 Burial [1060]

Burial [1060] contained a single skeleton, 30 year old female SK 1059 (Plate 12). Although the bones were well preserved, very little of the skeleton remained, possibly due to post-depositional disturbance such as insertion of later graves. This was especially true of the right side of the skeleton, though no discrete cuts were visible. The body had evidence of congenital fusion of the third and fourth thoracic vertebrae and spinal joint disease. Despite being disturbed, it was possible to see that the skeleton was extended, supine, and oriented west to east. The burial was at a depth of 13.08m aOD. The grave fill was mid-reddish brown silty sand (1058), which also contained frequent rounded pebbles and cobbles.

Plate 12 – Burial [1060]/ SK 1059 (looking west)

6.1.18 Burial [1063]

Burial [1063] was mostly located underneath the baulk containing brick structure [1016] (see section 6.1.21) to the south, and beyond the limit of excavation to the east. Only the superior portion of half a cranium was observable, and, thus, an insufficient proportion of the individual was visible for excavation or analysis. The presence and location of the cranium were recorded (and labelled as SK 1062), and this individual was left *in situ*. The burial was at a depth of 13.12m aOD, and the grave fill was mid-yellow brown sandy silt (1061).

6.1.19 Burial [1066]

Burial [1066] contained a single skeleton, adult possible female SK 1065 (Plate 10). The skeleton was well preserved. Only the lower legs and feet of this individual were recorded and lifted, as the rest of the skeleton was located beyond the edge of excavation to the west. The body had evidence of ankylosis at one interphalangeal joint of the foot. The skeleton appeared to be extended and supine, and oriented west to east. The burial was at a depth of 13.03m aOD. The grave fill was mid-yellow brown sandy silt (1064), which contained occasional rounded pebbles. As already noted (section 6.1.14), burial [1066] was located directly below burial [1054].

6.1.20 Burial [1069]

Burial [1069] contained a single skeleton, 24-30 year old female SK 1068 (Plate 13). The skeleton was well preserved. Only the upper body of the skeleton was recorded and lifted, as everything below the ribs (including the lower arms) was located beyond the limit of excavation to the east. The body had evidence of spinal joint disease, very severe dental calculus, one carious lesion, ante-mortem tooth loss, and oral abscess. The skeleton was extended, supine, and oriented west to east. The burial was at a depth of 13.10m aOD. The grave fill was mid-yellow brown silty sand (1067), which contained frequent rounded pebbles and occasional disarticulated human and animal bone.

6.1.21 Structure [1016]

Construction cut [1074] was located in the southern area of graveyard soil (1017). This cut could not be observed in plan, but was visible in the east facing trench section. The sides of the cut were stepped with a flat base, and measured 1.1m wide and 0.19m in depth. Cut [1074] is the construction cut for brick structure [1016] (Plate 14). Cut (1074) was also filled

with dark grey brown silty sand (1073), which contained occasional small rounded pebbles and occasional small fragments of brick. This deposit was only visible in section, and appears to be the backfill of construction cut [1074].

Plate 13 – Burial [1069]/ SK 1068 (looking west)

Plate 14 – Brick structure [1016] (looking east)

Linear structure [1016] ran west to east across the north to south running part of the trench, and runs beyond the limit of excavation to the east. The structure consisted of two skins of handmade bricks, one course thick (Plate 14). These initially appeared to be bedded into graveyard soil (1017), until later examination of the section and discovery of construction cut [1074]. The structure was >1m long x 0.46m wide, and 0.06m thick, at a depth of 13.42m aOD. The bricks are approximately 0.34m long x 0.2m wide x 0.06m thick (13.39″ x 7.87″ x 2.36″). The location of the structure suggests that it would have also been exposed during the 2007 excavation, but a report on this excavation was not available at the time of writing. One brick was sampled from this structure. Detailed photographs and descriptions of the brick and structure were emailed to John Tibbles, a brick and tile specialist. Preliminary assessment has identified the brick as medieval (John Tibbles, *pers. comm.*). The size of the brick suggests that it is 14th or 15th century in date, with bricks of this size being manufactured in Hull and

Beverley from the 13th century (John Tibbles, *pers. comm.*). The size and description of the structure suggests that it may be part of a sill wall to support a sill beam; these are common in north Yorkshire from the 12th/13th centuries (John Tibbles *pers. comm.*) (but see also discussion in section 9.1 below).

Graveyard soil (1021) was located in the south of the trench, between service trenches [1010] and [1012] (see Phase 2). This layer comprised mid yellow brown sandy silt, with frequent rounded pebbles and occasional large rounded cobble inclusions. The layer was 2.2m x 0.4m, at a depth of 13.42m aOD, and was cut by [1010] to the west, and [1012] to the east. This layer was not excavated, because of its close proximity to the two service trenches.

6.2 Phase 2

A second phase of activity was represented by the cutting of three service trenches and a post-hole into earlier graveyard soils (1006), (1013), (1017) and (1021). It is likely that all four features date to the post-medieval period. All three service trenches are very similar in appearance, and it is likely that they are contemporary with each other, and are associated with the Masonic hall to the immediate north and west.

6.2.1 Cut [1008]

Cut [1008] was the cut of a square post-hole observed in the southern area of the trench, to the immediate west of service trench [1010]. Cut [1008] was made into graveyard soil (1006). The sides of the cut were sloped, with an irregular base. The post-hole measured 0.44m x 0.41m, and 0.35m deep, and was located at a depth of 13.44m aOD. Cut [1008] was filled with dark greyish brown silty loam deposit (1007), which also contained occasional small

rounded pebbles and degraded sandstone fragments, as well as occasional post-medieval pottery and glass, two iron nails, and very occasional disarticulated human bone fragments.

6.2.2 Cut [1010]

Cut [1010] was the cut of a north-south running post medieval service trench. The cut ran beyond the limit of excavation to the north and south, the observed area measuring >2m x 0.2m, at a depth of 13.44m aOD. Cut [1010] cut into graveyard soil (1006) to the west, and graveyard soil (1021) to the east. It contained a metal service pipe, and was filled with dark grey brown sandy silt (1009), which also contained occasional small fragments of red brick. This service trench was not excavated, but recorded and left *in situ*.

6.2.3 Cut [1012]

Cut [1012] was the cut of a north-south running post medieval service trench. The cut ran beyond the limit of excavation to the north and south, the observed area measuring >2m x 0.28m, at a depth of 13.42m aOD. Cut [1012] cut into graveyard soil (1021) to the west, and graveyard soil (1013) to the east. It contained a metal service pipe, and was filled with dark grey brown sandy silt (1011), which also contained occasional small rounded pebbles and occasional small fragments of red brick. This service trench was not excavated, but recorded and left *in situ*.

6.2.4 Cut [1015]

Cut [1015] was the cut of an east-west running post-medieval service trench. The cut ran beyond the limit of excavation to the west and east, the observed area measuring >2m x 0.2m, at a depth of 13.40m aOD. Cut [1012] cut into graveyard soil (1013) to the south, and graveyard soil (1017) to the north. It contained a metal service pipe, and was filled with dark

grey brown sandy silt (1014), which also contained occasional small rounded pebbles and occasional small fragments of red brick. This service trench was not excavated, but recorded and left *in situ*.

6.3 Phase 3

A final phase of activity was represented by the modern construction layers for the car park, and the 2007 excavation trench. All the contexts below were excavated by machine.

All contexts described above were sealed by layer (1003), a mid-brown orange layer comprising mixed crushed brick rubble, limestone rubble, and sand. This layer measured >7m x >7m, was 0.2m thick, and located at a depth of approximately 13.47m aOD. This layer also contained frequent red brick fragments, occasional limestone rubble, frequent angular stones and rounded pebbles, frequent fragments of disarticulated human and animal bone, and occasional fragments of post-medieval/modern pottery and glass, iron nails and wood. A few sherds of early post-medieval vessel glass were recovered (dating to the 16th or 17th century), and a single sherd of painted late medieval window glass (Hugh Willmott, *pers. comm.*.), which was presumably from one of the windows of the medieval chapel. There were also two copper-alloy artefacts recovered. One was a plate (65mm x 55mm), which had regularly placed perforations around the edge (Plate 21), and the other was a ferrule (25mm in length) that had evidently formerly been at the end of a wooden implement (see section 9.2 for further discussion) (Plate 22).

Layer (1003) was overlaid by limestone hardcore (1002), measuring >7m x >7m and 0.4m thick. Layer (1002) was directly overlaid by tarmac (1001). These are modern layers used to construct the existing car park.

Cut [1005], for the 2007 excavation, was located in the very north of the trench and was partially marked by blue tarpaulin, which had been laid at the depth at which the 2007 excavations had ceased. The cut ran beyond the edge of excavation to the north, east and west, and the observed area measured >3.5m x >2m, and up to 0.75m deep at a depth of 13.45m-13.05m aOD. The sides of the cut were straight, with an undulating base. Cut [1005] was made through tarmac (1001) (because the car park had been reinstated, all tarmac was given a single context number), limestone hardcore (1002), rubble layer (1003), construction cut [1074], associated fill (1073), and graveyard soil (1017). It was filled with backfill deposit (1004), which comprised a mixture of colours and textures; dark greyish brown silty sand, mid-reddish orange brick rubble, and crushed limestone hardcore. Fill (1004) also contained frequent rounded pebbles, occasional disarticulated human bone fragments, red brick fragments, post-medieval pottery, 19th-century clay pipe fragments, metal, glass, and one piece of shell.

7. Discussion of cemetery excavation

A total of sixteen graves were excavated by the University of Sheffield in the 2010 excavation at Bawtry's Masonic hall. Historical evidence suggests that these burials are likely to be from the cemetery associated with the medieval hospital and chapel of St Mary Magdalene (Archaeological Data Service 2004; English Heritage National Monuments Record 2007; see section 9). The chapel is thought to have occupied the site of the existing Grade II Listed Masonic hall by the 13th century (English Heritage National Monuments Record 2007; see section 9.1).

The burials were all found to be oriented west to east (with heads to the west). Burials in the southern area of the trench (to the south of the hall) were distributed significantly further apart than were burials in the northern part of the trench (to the immediate east of the hall), where burials were very closely associated and likely to be intercutting. This excavation has provided irrefutable evidence that the cemetery continued to the south of the previously known area, although the full extent of this cemetery cannot at present be determined. It is unlikely that the cemetery could have continued very much further to the north, given the proximity of the chapel to the main road, which is likely to be broadly on its medieval alignment. The burials excavated immediately to the east of the hall in 2010 and 2007 (to judge from photographic evidence from the latter excavation) were more densely positioned than were those excavated just to the east of the car park wall in 2006, and this may suggest that burial was petering out within 20 metres of the chapel.

Burials that were located physically higher in the trench were more likely to have been disturbed or damaged by modern activity. Many skeletal elements were fragmented as a result of this, as well as through general soil pressure. Despite this, and the acidic nature of many of the contexts observed, preservation of the human bone was very good.

Few finds were recovered that can certainly be said to have been of medieval date. A 13th-century coin, a copper-alloy plate and walking-stick ferrule (see section 9.2), a single fragment of painted window glass, one sherd of pottery and a piece of a roof tile are the only certain, or possible, medieval artefacts recovered during the excavation. Analysis of the animal bones by Dr Umberto Albarella identified a diverse array of bones from a variety of species, among which sheep, pig, rabbit, dog and chicken were the most frequently occurring. The remains were highly fragmented, and there is little more that could be achieved from

analysis of these remains, although it has been tentatively suggested (Albarella, *pers. comm.*.) that the remains are more likely to derive, on the whole, from medieval than post-medieval animals. Evidence of a medieval structure associated with the cemetery was observed in the form of brick structure [1016], while a possible beam slot/post-hole [1019] may also have been of medieval date. However, the limited evidence gained from these features means that little other than their presence can be ascertained at this stage (although see further discussion in section 9.1). A medieval hospital would have incorporated a range of buildings beyond the chapel, including service buildings (such as a bakehouse, brewery and granary), a hall, kitchen, dovecote and barn, although not all hospitals necessarily had all of these buildings (Rawcliffe 2007). Hospitals had varied plans (Clay 1909: 106-25), and, therefore, even the location of brick structure [1016] does not provide an indication of what type of building it may have been, if, indeed, it formed part of a building rather than a boundary wall. Brick structure [1016] seals at least one burial (Burial [1063]), and it is, thus, apparent that it did not belong to the earliest phase of the hospital.

Despite the number of burials found in the relatively small trench, natural geology was not reached during the strict time limit imposed upon the excavation. Therefore, it is highly likely that more burials are present below the level excavated, and in unexcavated areas (e.g. below the baulk containing structure [1016] where unexcavated SK 1062 was left *in situ*), as well as in previously unexcavated areas in the rest of the Masonic hall car park). The observed maximum depth of the 2007 excavation was clearly exceeded during the 2010 phase of excavation, indicating that it is highly likely that further burials are also located below the excavated depth of the remainder of the 2007 trench.

The second phase of activity on this site is likely to relate to the post-medieval/early modern period. The three service trenches closely resemble a service trench containing a lead water pipe found during the 2006 ARCUS watching brief; the latter was attributed to the refurbishment of the chapel into the current Masonic hall in the 1930's (O'Neill and Jackson 2007: 7). Some, at least, of the post-medieval finds recovered during the excavation may be associated with the two cottages built in the post-medieval period for the two poor widows housed there (see section 9.1).

The archaeology encountered during this excavation suggests that little activity took place on the site between the use of the site as a cemetery, and insertion of the three service trenches and one post-hole during the post-medieval period. However, it is unknown whether the ground level was horizontally truncated during the 1930's refurbishment of the site, or creation of the existing car park; if so, evidence of events taking place during this intervening period may have been lost. Truncation would certainly explain the significant disturbance of burials such as SK 1020. Depictions of the chapel from the 19th century suggest that the area to the immediate east of the Masonic hall was then being used as a garden, which may have been another factor in the disturbance of the burials (see section 9.1).

8. Osteological Assessment of the Human Skeletal Remains

8.1 Introduction

This report assesses the human skeletal remains recovered from the 2010 excavation. The osteological analysis of the human skeletal remains from Bawtry aimed to analyse the complete available archive of human skeletal material in order to provide preliminary reconstruction of the demography and state of health of the medieval population sample. Eighteen articulated skeletons were recorded and lifted or partially lifted from the site. These

remains, together with the remains of a minimum of eleven adults and twenty four sub-adults from the disarticulated human material were subject to an osteological assessment.

8.2 Methodology

The skeletal remains were washed over 2mm sieves in order to retain any small fragments of bone and teeth that might otherwise have been lost. Osteological recording of the skeletal remains followed the guidelines of Brickley and McKinley (2004). Dental and non-dental inventories were compiled for all individuals, with University of Sheffield skeletal inventory forms completed for each articulated individual, as well as a separate computerised database of skeletal part representation. Individual skeletons were assessed in terms of completeness, fragmentation, and levels of bone surface preservation. As there are currently no standardised guidelines to record fragmentation of bone, fragmentation was graded on a scale of 0 to 5+, with 0 representing an individual with 100% complete bones, and 5+ representing an individual where all the bones are finely crushed. This is a similar scale to the one used for recording surface preservation (Brickley and McKinley 2004).

Measurements of maximum length were taken on complete long bones using an osteometric board, in order to determine stature. Stature was estimated according to look-up tables in Trotter (1970), using maximum lengths taken from the femur. Where the femur was not available, stature was calculated using the maximum length of other long bones, in the following order of preference; tibia, fibula, humerus, ulna, radius.

Minimum number of individuals (MNI) was calculated by sorting the disarticulated material into groups of elements (e.g. femurs, ribs, lumbar vertebrae etc). Adult and sub-adult elements were separated and counted, with sub-adults being aged where possible via

comparison with sub-adult bones from the University of Sheffield Human Skeletal Reference Collection. The minimum number of adults was calculated using the single most commonly occurring skeletal element, which in this case was the mandible. The number of adult mandibles was then added to the number of articulated individuals with mandibles, in order to avoid duplication of individuals. Sub-adult elements were grouped and counted according to approximate age, with the most commonly occurring skeletal element in each age group being counted. Disarticulated sub-adult elements were then compared to sub-adult articulated elements, in order to avoid duplication of individuals. Adult pelvises were recorded in terms of sex and age where possible, and all bones recorded in terms of observed pathological lesions.

Observations of sex were made where possible, by observing sexually diagnostic traits of the pelvis and skull. Typical accuracy for sex estimation in adult skeletons from morphological traits is 90-95% when using the pelvis, and 80% when using the skull (Krogman and Işcan 1986). Higher levels of accuracy are achievable using discriminant function analysis of skeletal measurements, but this was not used here. Individuals were classified as male, possible male, intermediate, female or possible female. Juvenile skeletons were not sexed in accordance with standard practice. Adolescent skeletons were sexed utilising the same methods as the adults, but were only classified as 'possible' members of the determined sex at this age as the available methods are only of limited accuracy (Brickley 2004; Krogman 1962). Measurements of joint size were also recorded for the femoral head and femoral bicondylar width and humeral head. If no pelvis or skull fragments were available then this metrical data was used to estimate sex (Steele and Bramblet 1988; Bass 1971). If no sexually diagnostic traits or metrics were available, the individuals were sexed as 'unknown'.

Age estimations were made for adults using multiple aging techniques. Methods applied include the Lovejoy *et al*. (1985) auricular surface method (also utilising unbiased mean age estimates calculated by Gowland and Chamberlain 2005), the Suchey-Brooks (Brooks and Suchey 1990) pubic symphysis method, and also age estimation by observing dental occlusal surface wear (Miles 1963; Smith 1984). Age estimations were made for sub-adults using the Moorees *et al*. (1963) dental development method, the Maresh (1970) method of age estimation via diaphyseal length, and epiphyseal fusion times (Scheuer and Black 2000).

Once age estimations were made for each skeleton, estimates of ages were averaged and individuals were divided into age categories as follows, according to their mean age – 0-4 years, 5-9 years, 10-14 years, 15-19 years, 20-24 years, 25-34 years, 35-49 years and over 50 years – for the purpose of demographic analysis. In order to increase the sample size, aged and sexed individuals from the disarticulated assemblage were included in the demographic analysis where possible. Pathological observations were also made and interpreted in accordance with Aufderheide and Rodríquez-Martin (1998).

Where applicable, true prevalence rates (TPR) have been calculated. The following calculation was used following Roberts and Cox (2003):

$$\frac{\text{Number of elements affected}}{\text{Total number of elements observed}} \times 100\% = \text{TPR}$$

Crude prevalence rates (CPR) were calculated as follows:

$$\frac{\text{Number of individuals affected}}{\text{Total number of individuals observed}} \times 100\% = \text{CPR}$$

8.3 Minimum Number of Individuals (MNI)

A total of seventeen articulated human skeletons were excavated and recorded. One of these skeletons, SK 1062, could not be lifted, as only the superior portion of the cranial vault was observed under the baulk containing red brick structure [1016]. The location and depth of the individual, coupled with time restrictions meant that it was deemed appropriate to leave this individual *in situ*, to be fully recorded and removed in future excavations. During osteological analysis of the lifted skeletal remains, it was found that what had been labelled on site as SK 1031 contained the co-mingled remains of two individuals. These have been numbered as SK 1031a (referring to the originally excavated and recorded individual), and SK 1031b (referring to the newly discovered individual). One relatively complete infant skeleton was also found bagged separately, but with disarticulated material from graveyard soil context (1006). This individual was recorded osteologically as articulated individual SK 1006a. Therefore, the number of discrete, articulated individuals analysed for this assemblage is eighteen.

Analysis of the disarticulated assemblage indicated that a minimum number of eleven adults and twenty four sub-adults were present. When added to the articulated individuals, this gives a total MNI of fifty three individuals.

A further eight articulated individuals were apparently excavated at the site in 2007 (Christie Cox, *pers. comm.*). However, these were not available for study and therefore were not included in this analysis.

8.4 Completeness, preservation and fragmentation of the articulated remains

An estimation of percentage completeness was made for each articulated individual (Figure 5). The majority of the skeletons recovered from the site are less than 50% complete, with 44% of skeletons being less than 25% complete.

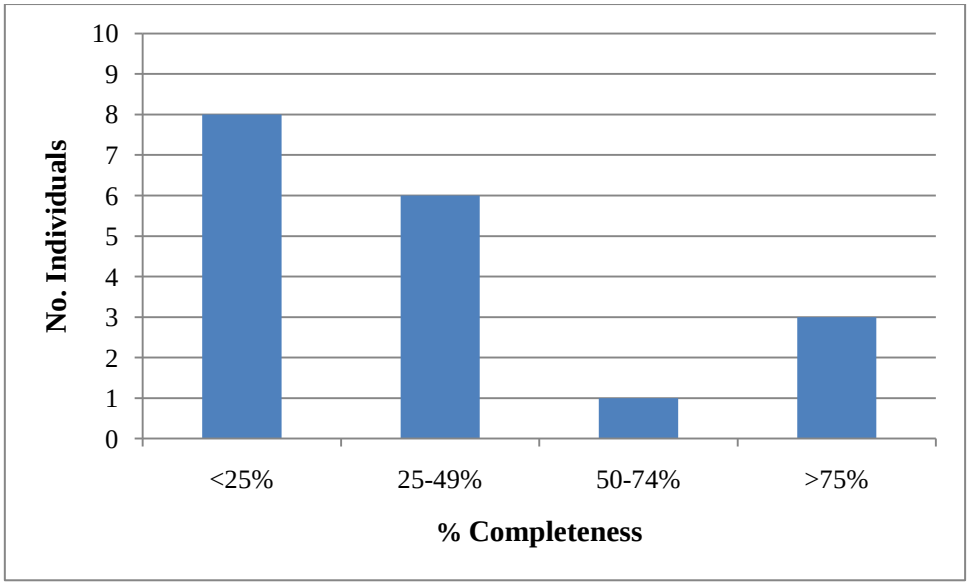

Figure 5 - Percent completeness of individuals

Completeness levels have largely been affected by the size and extent of the excavated trench. Skeletal elements that extended beyond the limit of excavation were left *in situ*, and hence could not be included in this osteological assessment. In addition, several skeletons situated at higher levels within the trench had been truncated during the laying of the car park. This is most noticeable in the case of SK 1020 (Plate 5), where the higher axial skeleton and skull had been completely truncated away. The legs of this individual were situated at a lower level within graveyard soil (1013) and have remained in decent condition.

Some of the burials had been truncated by the insertion of later inhumations, and this is especially true in the northern extent of the trench. Any body parts that were cut away, either accidentally or to purposefully make way for another inhumation, were presumably thrown back into the grave fill, to continue their existence as disarticulated or partially articulated body parts. Thus, many of the truncated remains will have been recorded as disarticulated bone within the grave fill. Re-cutting of graves within a cemetery may contribute to human bone being distributed throughout the uncut graveyard soil to some degree. Normal bioturbation and localised variation in preservation will also have played a part in reducing the completeness of the skeletons.

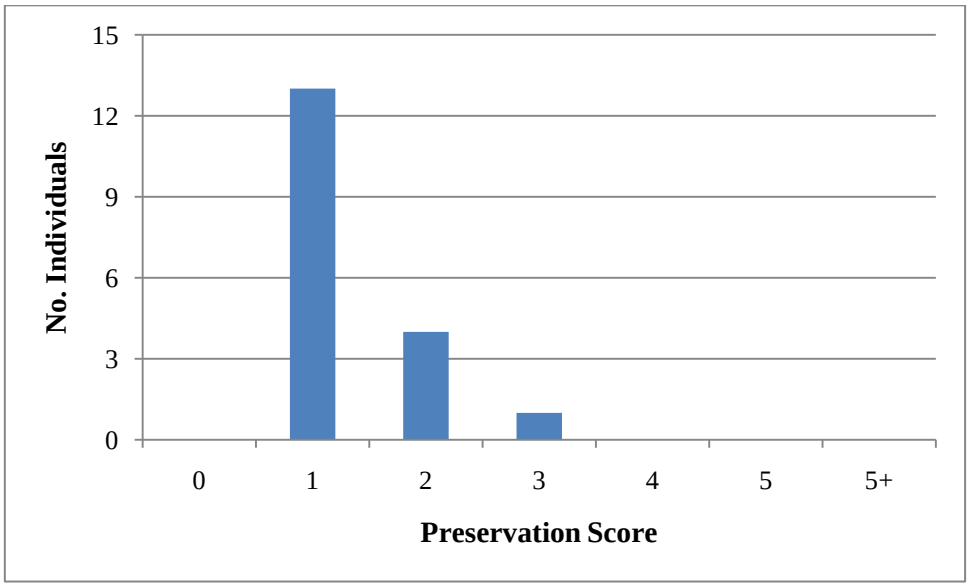

Figure 6 – Levels of preservation

Surface preservation was very good, with 94% of skeletons scoring 2 or less (Figure 6). The excavated area was situated below a tarmac surfaced car park. It is likely that the tarmac surfacing offered any underlying archaeological remains some degree of protection from damage caused by factors such as the weather. Fragmentation levels varied across the site, with the majority of remains being fragmented to some degree. Figure 7 shows the distribution of fragmentation scores.

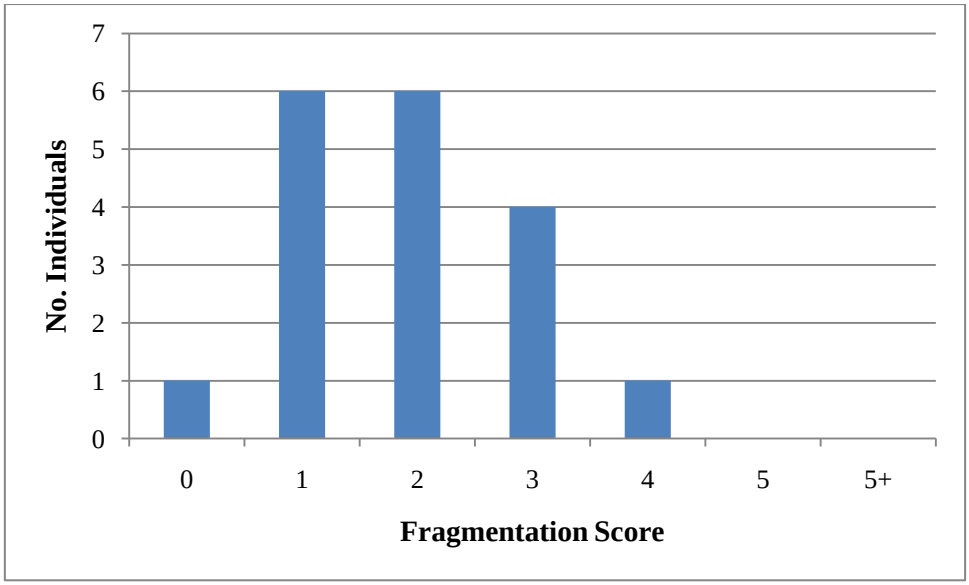

Figure 7 – Levels of fragmentation

Levels of fragmentation could depend on a number of factors, chiefly the factors already discussed in relation to completeness and preservation. Soil pressure from recent use of the site as a car park might again be responsible for slightly higher levels of fragmentation in this area, as well as post-depositional use and disturbance of the site (e.g. insertion of modern services [1010], [1012] and [1015]).

8.5 Stature

It was possible to assess stature of a selection of the adult remains, due to levels of completeness of the remains. Average stature was calculated separately for two males and seven females. Stature was calculated at 152cm and 173cm for males SK 1025 and SK 1056 respectively, giving a mean stature of 162.5cm. Average female stature was calculated at 157.5cm (with a range of 153-168cm). One unsexed adult individual, SK 1053, had mean stature of 166.5cm. Table 1 shows the average male and female stature calculated for Bawtry, as well as for other contemporary British cemetery sites.

	Date	Average Male Stature	Average Female Stature	Reference
Bawtry	14th c.	162.5cm	157.5cm	This study
All Saints, Fishergate, York	11th-16th c.	170cm	159cm	Bruce *et al*. in prep.
St. Helen-on-the-Walls, York	10th c. - 1550	169cm	157cm	Dawes and Magilton 1980
London Road, Grantham (Lincolnshire)	13th-14th c.	168.5cm	162.3cm	Craig in press
St. Peter's, Barton-upon-Humber (Lincolnshire)	950-1855	169.7cm	159.4cm	Waldron 2007
St. James and St. Mary Magdalene, Chichester (Sussex)	1118-1700	171cm	156cm	Lee and Magilton 2008
St. Mary Spital, London	1235-1528	171cm	158cm	Conheeney 1997
Late medieval Britain	1050-1550	171cm	159cm	Cox and Roberts 2003

Table 1 - Average stature in medieval Britain according to sex

Table 1 shows that average male stature at Bawtry appears much lower than at contemporary sites, and for later medieval Britain. However, it should be noted that 152cm, the stature of male skeleton SK 1025, is exceptionally small for an adult male, and it is likely that this value has lowered the average male stature at Bawtry considerably. Average male stature is usually expected to be at least 10cm larger than average female stature in any population. In contrast, the average female stature at Bawtry is only slightly below average for the rest of Britain. Despite the Bawtry female sample also being small, the good range of statures observed in this group makes it much more likely that this is a genuine reflection of female stature throughout the Bawtry population. Thus, female individuals from Bawtry seem to be of similar stature to other contemporary populations around Britain.

8.6 Sex

Biological sex could only be determined for ten articulated individuals. Of these, two were assessed as being male or possible male, and eight were assessed as female or possible female. Of the seven individuals for whom biological sex could not be allocated, one was an adult for whom the sexually dimorphic elements of the skeleton could not be observed due to skeletal incompleteness. The remaining seven individuals were sub-adults. A further four males and one possible female from the disarticulated assemblage were included in the table below. Figure 8 shows the sex distribution of the assemblage, including sexed individuals from the disarticulated assemblage, and the three sexed individuals from the 2006 watching brief (one male, one possible male, and one female; O'Neill and Jackson 2007: 4-5). As sub-adults were not sexed, they were not included. The figure below shows unequal distribution of males and females, however due to the small sample size, the sex ratio does not differ significantly from a ratio of 1: 1.

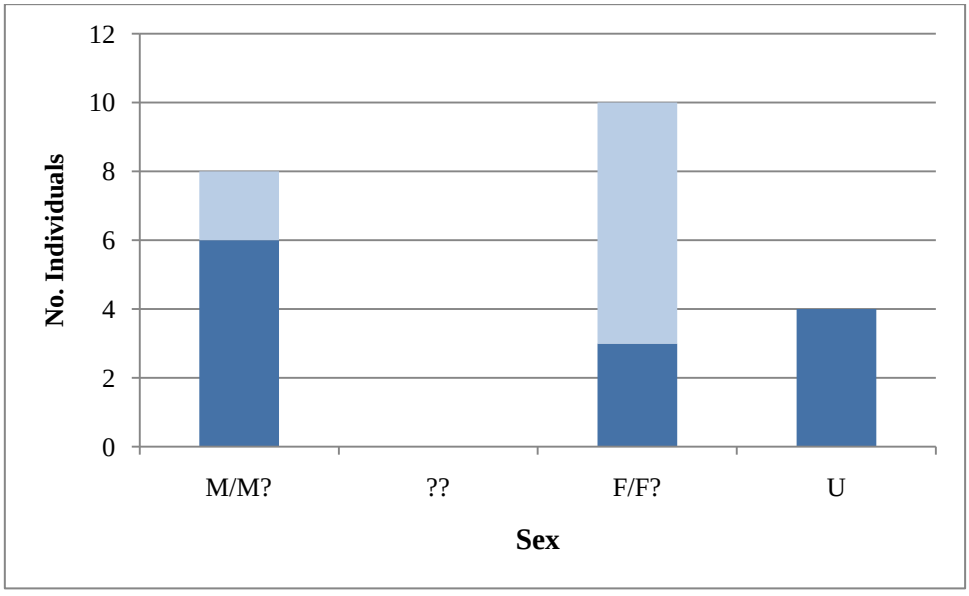

Figure 8 – Sex distribution

Sex ratios for other contemporary British cemeteries are given in Table 2. Although the Bawtry assemblage appears to be biased towards female individuals, this should not be over emphasised. The excavated sample of the population is very small, and only a portion of this

sample was able to be sexed. This fact is emphasised when observing the size of some of the population samples utilised at comparative sites in Table 2.

	Males	Females	M:F Ratio	Reference
Bawtry	8	10	0.8: 1	This study
All Saints, Fishergate, York (parish churchyard)	172	162	1.06:1	Bruce *et al*. in prep.
St. Helen-on-the-Walls, York (parish churchyard)	338	394	0.86:1	Dawes and Magilton 1980
London Road, Grantham (probably leper hospital cemetery)	14	10	1.4: 1	Craig in press

Table 2 – Calculated sex ratios for late medieval Britain

Modern human populations have a sex ratio at birth that usually averages at 1.05:1, though the operational sex ratio for adults is usually closer to 1:1 due to greater mortality of males during the developmental period (Schmitt 2005). Slight differences in ratios between Bawtry and the other cemeteries may have arisen because of genuine sex ratio differences, but is more likely to be a product of the smaller sample size. It is likely that the Bawtry assemblage represents a slightly biased sample of normal, attritional deaths from a civilian population, indicating that in terms of sex, it is unlikely to be completely representative sample of the whole population from which it derives.

8.7 Age

A total of thirty six individuals were assigned an age at death. Of these, fourteen were articulated individuals. A further four articulated individuals could only be aged as ‘adult’, due to skeletal incompleteness. The remaining twenty two aged individuals were from the disarticulated assemblage, and a further two aged individuals were from the 2006 watching brief (O’Neill and Jackson 2007: 4-5). The age at death distribution for the Bawtry

assemblage can be seen below in Figure 9. The age categories reflect the precision with which age at death can be estimated from the skeleton, with five year age categories being employed to 24 years, and three broader age categories for adults aged 25 years and over.

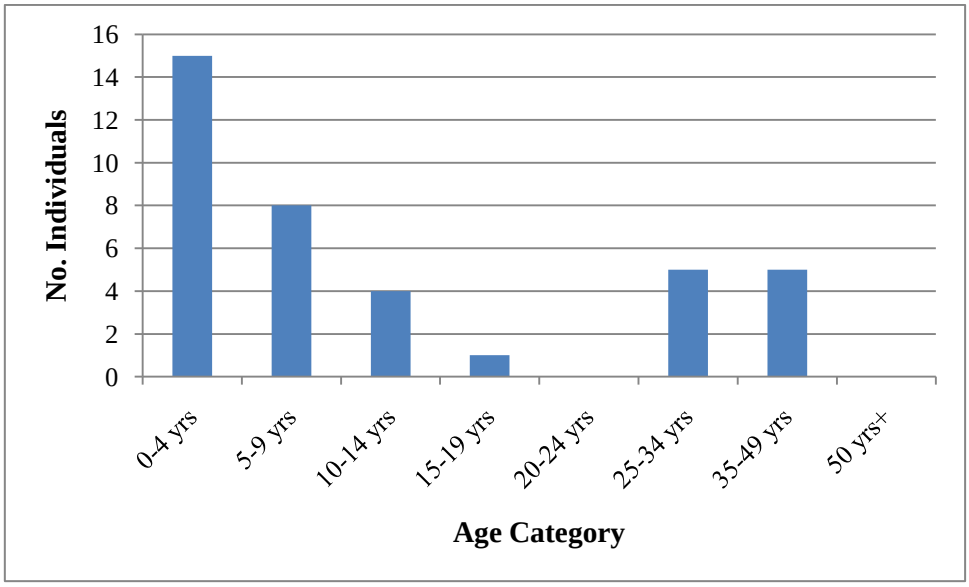

Figure 9 – Age at death distribution

Figure 9 shows that the Bawtry assemblage approximates an attritional age at death profile. The distribution is bimodal, with larger numbers of deaths occurring in infants and middle adults. However, one anomalous departure from the expected attritional mortality profile occurs within the 25-34 year age category. The Bawtry assemblage has an excess in the number of deaths in this age category. Attritional age at death profiles typically show a peak in the number of deaths in older middle adults (35-49 years), with numbers falling slightly in the older adult category (>50 years). In the Bawtry sample, this peak in deaths appears in the slightly earlier, young middle adult, age category.

Could a slight excess in the number of 25-34 year olds occur because of preservation bias? Taphonomic processes are known to contribute to under-representation of infants and young children (Chamberlain 2000: 105), but it is much less likely that burial environment has favoured the preservation of young middle adult individuals. Observer error in terms of age

estimation in just this age category is unlikely, as the same methods of age estimation were utilised as for all other adult age categories. However, adult age estimation methods rely on degenerative changes that do not always correlate well with specific periods of elapsed time. This can lead to systematic under-aging of older adults, a pattern which is often observed in assessment of other assemblages (Chamberlain 2006: 90). This may account for the slight excess in the number of individuals in the 25-34 year age category at Bawtry. Conversely, it may be a product of random chance within the population sample.

The Bawtry age at death distribution was compared with those from other medieval cemeteries in Britain, as well as model age at death distributions. These are shown in Figure 10. Model distributions are given for male populations with an average age at death of 20 (e0=20) and 30 (e0=30) years (Coale and Demeny 1983). Data from St Helen-on-the-Walls (Dawes and Magilton 1980: 84-109) and Grantham (Craig in press) were adjusted proportionally to fit the age categories selected for the Bawtry assemblage. This adjustment was made by assuming individuals were evenly distributed within each designated age category.

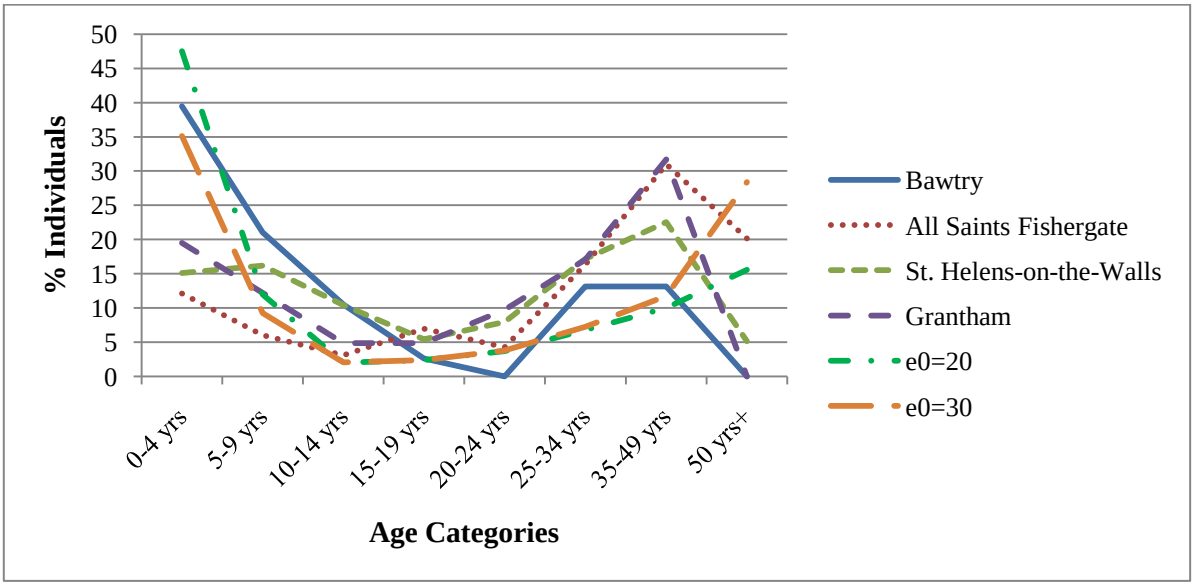

Figure 10 - Comparison of model and late medieval age at death distributions

Figure 10 shows that when compared to the model curves, the Bawtry assemblage most closely resembles the model curve e0=20. Unusually, infants are well represented in this assemblage. Infants are commonly under-represented in archaeological assemblages for several reasons, including preservation bias, bioturbation, and excavator's error, as well as the failure to analyse disarticulated material, which is where infant and child remains may be better represented. Indeed, nineteen of the twenty eight individuals aged 14 years or less were found within the disarticulated assemblage at Bawtry. This highlights the importance of including demographic data from disarticulated assemblages within demographic analysis where appropriate; without this data, sub-adults would have been largely under-represented within this population sample.

The current English Heritage guidelines for reporting on human bone from archaeological sites state that disarticulated human skeletal material is only 'of limited scientific value' and 'not usually considered worthy of study at the analysis phase'. In nearly all cases, disarticulated material is discarded without study, yet the results of analysing disarticulated remains can transform our understanding of the demographic profile of a cemetery. For example, one of the few medieval cemeteries where disarticulated material was included in the demographic analysis is that at Black Gate, Newcastle-upon-Tyne (dating to c.800-1100), where it was found that 35% of the disarticulated individuals were sub-adults, compared to 24% of the articulated skeletons; this cemetery has, notably, been assessed as part of a doctoral thesis and not a developer-funded project (Mahoney-Swales in progress).

There are also several differences between the age at death distribution for Bawtry and the model curves. First, there is an unusually high proportion of children in the 5-9 and 10-14 year age categories. One reason for this may lie in the location of the trench in close

proximity to the church; there is some evidence that during the medieval period, infants and children were preferentially buried in close proximity to church buildings. This has been noted among medieval burials at Kellington (Yorkshire), and there is further evidence for zoning of infants in the same manner at Bolsover (Derbyshire) (Hadley 2001: 48), although the date of the burials is uncertain. Excavation of the lay cemetery to the south-west of the church at the Augustinian Priory of SS Peter and Paul at Taunton (Somerset) revealed a group of 20 infants (Gilchrist and Sloane 2005: 67). Nonetheless, although zoning of sub-adults in this manner did occur during the medieval period it was seemingly more common in the later Anglo-Saxon period, especially in the immediate vicinity of the walls of a church, and has been identified at, for example, Raunds (Northamptonshire) (Boddington 1996: 54-5), Tanners Row, Pontefract (Yorkshire) (Lee n.d.) and Cherry Hinton (Cambridgeshire) (Ferrante di Ruffano and Waldron n.d.: 15). One explanation for this practice may be the belief that water running off the church roof was holy, therefore blessing any burials into which it came in contact (Boddington 1996: 69; Hadley 2010: 107). However, it is unknown how widespread this belief was during the medieval period and there may be other reasons why infants may be preferentially buried in the area close to the church. Nonetheless, the fact that there is a comparatively high proportion of infants and children in the vicinity of the Masonic Hall, which is believed to be the chapel of St Mary Magdalene, may be attributable to the preferential zoning of infants and children around the church.

Second, the Bawtry assemblage has fewer young adults (20-24 years) than expected. Certainly, proportions of young adults within age at death distributions are often low; at this age individuals have survived the susceptibility to disease and other life threatening factors that can accompany childhood, but are yet to be vulnerable to the degenerative features of old age that can have a bearing on life span. Young adults commonly represent the ‘prime’

members of the population, at the lowest risk of fatality. This is emphasised by the fact that even large assemblages only contain small numbers of young adults: for example, only 23 out of 545 individuals at All Saints Fishergate (4.25%) were young adults. Thus, the absence of young adults among the Bawtry assemblage can partly be explained by the expectation that there would be expected to have been low numbers anyway, compounded by the small size of the assemblage.

Like the model curves, the number of adult individuals increases with age, but the numbers peak in the age category 25-34 and 35-49 years rather than in one of the older, 35-49 or 50+, categories. This pattern is often demonstrated in archaeological samples, and can also be seen clearly in the distributions shown for the other assemblages in Figure 10. As discussed above, it is attributable to the systematic under-estimation of the ages of older adults (Chamberlain 2006: 90).

8.8 Non-Dental pathology among the articulated remains

Several instances of non-dental pathology were observed in a total of nine articulated individuals. These are discussed below.

8.8.1 Ankylosis

Ankylosis of a joint may occur for a variety of reasons, including trauma, infection, degenerative joint disease and developmental abnormalities. Two individuals (SK 1025 and SK 1065) each had ankylosis at one joint. In both cases this was the interphalangeal joint of the foot, between one intermediate and one distal phalange. Due to loss of other phalangeal bones, it was not possible to deduce which digit of the foot was affected. However, the fifth

digit may be more vulnerable, as it is located in a more exposed position on the lateral aspect of the foot.

As none of the affected individuals had pathological markers related to infectious disease, it can be assumed that this was not a causative factor of ankylosis in the Bawtry sample. Furthermore, neither individual has symptoms of degenerative joint disease. Therefore, it is most likely that for these individuals, the ankylosis had a traumatic origin. As the ankyloses occur in the distal part of the toes, it is likely that they were caused by accidents such as trips and falls, 'stubbing' the toe on an obstruction, kicking (perhaps during interpersonal violence), or dropping a heavy object on the foot.

8.8.2 Congenital fusion of the vertebrae

Congenital vertebral fusion was found in two individuals (SK 1025 and SK 1059). It was observed that SK 1025 had fusion of the fourth and fifth cervical vertebrae, but only at the right neural arch, from the right articular surfaces to the spinous process. The body of C4 was slightly compressed on the right side, but there is no evidence of infection, degeneration or bone remodelling. This indicates that the vertebral fusion is congenital, rather than a result of infection or trauma. In modern populations, approximately seven in every 1000 individuals have congenital fusion of two or more vertebrae (Anderson and Brockmeyer 2008: 426). These usually develop as a result of abnormal growth of the foetus during pregnancy, although this can be caused by a number of factors, including genetic predisposition (Anderson and Brockmeyer 2008: 431). Cervical bony fusion is also commonly found in foetal alcohol syndrome, suggesting that maternal alcoholism is another possible environmental influence on abnormal development of these vertebrae (Anderson and Brockmeyer 2008: 431).

SK 1059 had fusion of the third and fourth thoracic vertebrae, both on the right side of the vertebral bodies and the right neural arch. T3 appears collapsed on the right side and the right neural arch appears slipped. As with SK 1025, there is no evidence of infection or trauma. It is most likely that the right neural arch of T3 has fused incorrectly to T4 during development, giving this slipped appearance. It was also observed that SK 1059 has lipping, pitting and a small area of eburnation present on the right inferior articular facet of T4 and corresponding superior articular facet of T5, as well as Schmorl's nodes on T5-6 and T8-9. While there is not enough evidence to confirm that these degenerative changes are directly associated with the fusion on T3 and T4, the localised nature of the pathological lesions suggests that they may be linked. The fusion of T3 and T4 may inadvertently cause disproportionate stresses in this region, causing localised rapid degeneration. This will be discussed further below, in relation to degenerative joint disease.

8.8.3 Congenital kyphosis of the vertebrae

Kyphosis is an angular deformity of the spine, with curvature usually in excess of 40° (Aufderheide and Rodríguez-Martin 1998: 68). It most commonly involves the thoracic spine, and can occur in relation to ossification disorders such as achondroplasia, or localised spine malformation (Aufderheide and Rodríguez-Martin 1998: 68). The exact aetiology of congenital kyphosis is unknown, but it likely that hereditary factors are involved (Aufderheide and Rodríguez-Martin 1998: 68).

The thoracic vertebrae (T1-6 and T8-12) of SK 1056 were observed curving anteriorly, with the same vertebral bodies being slightly wedge shaped, though not excessively. The spinal column does not twist in the characteristic way commonly observed in scoliosis; therefore it was determined that the individual had congenital kyphosis of the spine. No evidence of

other, underlying conditions that can be associated with kyphosis, such as rickets, was found. Acute osteophytosis of T5-6 was also observed, and to a lesser degree in T8-12. Seven associated ribs were also afflicted. This was diagnosed as degenerative joint disease (see below). However, SK 1056 is only a young adult, and degeneration of this magnitude would be more commonly found in older individuals. It is therefore suggested that in this case, degeneration of these areas was caused by increased stress being placed on specific thoracic vertebrae, as a result of kyphosis.

8.8.4 Degenerative joint disease (DJD)

Degenerative joint disease (DJD) is a chronic, noninflammatory, progressive condition where loss of cartilage produces lesions, eventually causing direct interosseous contact inside diarthrodial joints (Aufderheide and Rodríguez-Martin 1998: 93). The condition usually occurs after 40 years of age (Aufderheide and Rodríguez-Martin 1998: 93), but is not exclusive to this age range. Previous research has suggested that DJD is an age-related condition (Rogers *et al*. 1987), though it is also affected by weight, sex, ancestry and movement (Waldron 1994; Knüsel *et al*. 1997: 481). The spine, knees and hips are all commonly affected, although any joint is potentially at risk (Aufderheide and Rodríguez-Martin 1998: 94-5). It may also occur where the joint has been altered (e.g. by disease, trauma, or congenital defect), and it has also been linked to factors such as occupational stress and obesity (Aufderheide and Rodríguez-Martin 1998: 93).

A total of four individuals were observed having pathological markers on joint surfaces associated with spinal and/or extra-spinal degenerative joint disease. These markers include osteophytes (‘lipping’), Schmorl’s nodes, erosive lesions, pitting and eburnation (Aufderheide and Rodríguez-Martin 1998: 93-7). As no individuals were found with specific

arthritic conditions (e.g. rheumatoid arthritis), all individuals with possibly arthritic pathologies were included under DJD. In each case, the presence, location and type of pathological marker were recorded, and can be seen below in Table 3.

Skeleton Number	Sex	Age	Description of Observed Lesions
SK 1044	F?	Adult	Pitting and slight osteophytic growth on the medial condyle of the right tibia.
SK 1056	M	20-30 yrs	Severe osteophytic growth on the right sides of T5-6 and the right sides of T8-12.T11 is the most severely affected. T9-10 also have significant osteophytic development around the articular facets for the corresponding right ribs. Seven ribs also have excessive osteophytic growth lateral to the neck and around the tubercle. Two of these ribs also have pitting of the tubercle. The right humeral head and corresponding anterior glenoid also have slight osteophytic growth.
SK 1059	F	30 yrs	Osteophytic growth and pitting on the right inferior articular facet of T4 and the superior articular facet of T5. T5 also has a small area of eburnation on the same articular facet. Schmorl's nodes are present on the inferior side of thoracic vertebrae T5-6 and T8-9, and the superior side of T6.
SK 1068	F	24-30 yrs	Osteophytic growth and pitting on the bodies of C3-4. Pitting on C5, and slight osteophytic growth on T1-2. Schmorl's nodes are present on T2-7 and T9-11.

Table 3 - Summary of DJD

True prevalence rate (TPR) of extra-spinal degenerative joint disease was calculated at 14.3% for the right tibia, 11.1% for the right humerus, and 9.5% for the right scapula. Table 4 shows TPR of spinal joint disease for each vertebra. Crude prevalence rate (CPR) of spinal joint disease was calculated at 16.6% (3/18), and extra spinal joint disease at 11.1% (2/18). CPR of spinal joint disease in late medieval Britain was calculated at 20.9%, and extra-spinal joint disease at 13.57% (Cox and Roberts 2003: 281). Three vertebrae, plus two metatarsals exhibiting evidence of DJD were also found within the disarticulated material. These were not included in the TPR calculations because of time restraints, but are discussed separately in the section of this report that discusses the disarticulated remains (section 8.11.4).

Spinal joint disease is clearly more common in the Bawtry assemblage than extra-spinal joint disease. The thoracic vertebrae are most commonly affected, though low sample numbers make it difficult to determine whether observed frequencies are due to chance or to elevated levels of activity that exacerbate stresses in particular regions of the spine. The presence of DJD in the right shoulder, thoracic vertebrae, and several associated ribs may be associated with the congenital kyphosis of the vertebrae observed (see above).

As stated above, only a small percentage of individuals suffered from DJD; this may be a product of the relatively young age at death profile observed. DJD is age progressive, and the Bawtry sample includes a large proportion of sub-adults and prime age adults. It is possible that individuals in the sample had died before the pathological lesions associated with DJD had had time to develop. Crude prevalence of both spinal and extra-spinal joint disease appears lower than average for late medieval Britain. However, the prevalence of both forms of DJD is highly variable, and this difference is unlikely to be significant.

Recording standards and techniques used to record DJD at other sites vary greatly, and it is unknown whether sites with higher prevalences of the condition had excluded sub-adults from their calculations. This is clearly an issue that needs to be addressed in the future.

8.8.5 Schmorl's nodes

As discussed above, Schmorl's nodes are a pathological marker frequently associated with DJD of the spine. They are visible as indentations on the superior or inferior surfaces of vertebral bodies. Schmorl's nodes represent sites of herniation in the intervertebral disc material through the vertebral body end plates (Rogers 2000: 169-70). They are usually most common in lower thoracic and lumbar vertebrae (Rogers 2000: 170).

Vertebrae	Total	Cases	TPR
C2	8	0	0%
C3	10	1	9.5%
C4	7	1	13.3%
C5	8	1	11.8%
C6	9	0	0%
C7	7	0	0%
T1	5.5	1	16.7%
T2	5.5	1	16.7%
T3	6.5	0	0%
T4	8	1	11.8%
T5	8	2	23.5%
T6	8	1	11.8%
T7	6	0	0%
T8	6.5	1	14.3%
T9	6.5	1	14.3%
T10	5.5	1	16.7%
T11	6	1	15.4%
T12	6	1	15.4%
L1	4	0	0%
L2	4	0	0%
L3	4	0	0%
L4	4	0	0%
L5	6	0	0%

Table 4 - TPR of spinal joint disease according to vertebrae

Schmorl's nodes were found in two individuals from Bawtry. SK 1059 had Schmorl's nodes present on the fifth, sixth, eighth and ninth thoracic vertebrae. SK 1068 had Schmorl's nodes present on the second to seventh, and ninth to eleventh thoracic vertebrae. Table 5 shows the true prevalence rate (TPR) of Schmorl's nodes for each vertebra.

While Table 5 shows the frequency of Schmorl's nodes for each vertebra, it also takes into account whether certain vertebrae have better rates of preservation. Middle and thoracic vertebrae are often affected by Schmorl's nodes, as observed in the above individuals. Both affected individuals are relatively young; less than 30 years of age. This would suggest that rather than being age related, the presence of Schmorl's nodes are possibly a product of elevated levels of physical activity. Physically demanding tasks put stress on the mid thoracic to mid lumbar vertebrae, most commonly on T8-11. Pfirrmann and Resnick (2001: 373) attribute Schmorl's nodes in this region to acute or chronic micro-trauma due to excessive loading of the axial skeleton (e.g. heavy lifting). Biochemical factors may also affect an individual's susceptibility, as can genetic predisposition (Modic and Ross 2007: 44). The lower thoracic area (T8-10) is also subject to increased stress because of the natural curvature of the spine (Phillips and Heywood 1995: 569). However, as discussed above in relation to spinal joint disease, low sample numbers make it difficult to determine whether observed frequencies of Schmorl's nodes are due to elevated levels of activity that exacerbate stresses in particular regions of the spine, or whether they are due to random chance.

Vertebrae	Total	Cases	TPR
C2	8	0	0%
C3	10	0	0%
C4	7	0	0%
C5	8	0	0%
C6	9	0	0%
C7	7	0	0%
T1	5.5	0	0%
T2	5.5	1	16.7%
T3	6.5	1	14.3%
T4	8	1	11.8%
T5	8	2	23.5%
T6	8	2	23.5%
T7	6	1	15.4%
T8	6.5	1	14.3%
T9	6.5	2	28.6%
T10	5.5	1	16.7%
T11	6	1	15.4%
T12	6	0	0%
L1	4	0	0%
L2	4	0	0%
L3	4	0	0%
L4	4	0	0%
L5	6	0	0%

Table 5 - TPR of Schmorl's nodes according to vertebrae

8.8.6 Infectious disease

Two examples of non specific infection were observed. These are described and discussed separately below.

SK 1028 (a 5-6 year old child) had slight periosteal new bone formation on the medial shaft of seven right ribs, anterior to the rib neck. New bone formation was only slight, and notably absent on the left ribs. Periostitis on the ribs is frequently associated with tuberculosis. Tuberculosis is a chronic or acute infection of the soft and skeletal tissue (Aufderheide and Rodríguez-Martin 1998: 118). It is usually a biphasic disease, manifesting initially in the lungs after the bacterium is inhaled, healing, then potentially reinfecting and spreading to structures bordering the lungs and eventually other areas of the body including the skeleton (Aufderheide and Rodríguez-Martin 1998: 119-21). Tuberculosis can also be contracted directly through consumption of infected meat. Skeletal manifestations of tuberculosis therefore usually represent individuals with the secondary stage of the disease. More than 40% of cases of skeletal tuberculosis involve the spine, though other commonly affected areas include the joints, metaphyses and ribs (Aufderheide and Rodríguez-Martin 1998: 134). The most commonly affected ribs are ribs four to eight, and periostitis is most often observed on the internal side of the rib, and commonly involves several adjacent ribs (Kelley and Micozzi 1984). However, rib periostitis alone is only considered to be indirect evidence of tuberculosis (Cox and Roberts 2003: 232), and no other evidence of tuberculosis (or pathological lesions of any sort) was found in this individual. It is possible that the rib lesions observed in SK 1028 are indicative of tuberculosis, however lack of further evidence means that this diagnosis cannot be confirmed. It is also possible that the rib periostitis is suggestive of non-specific infection of the lungs or another respiratory disease. Full diagnosis is not yet possible, based on the limited macroscopic evidence.

SK 1031a (a 4-6 month old infant) had a number of porous lesions concentrated on (but not limited to) the outer table of the skull. These lesions were observed on the left and right parietals (Plate 15), the frontal (including in the upper orbits), both temporals, both the

anterior and posterior aspects of the right zygomatic, the sphenoid (including the pars basilaris, lesser wings and hypophyseal fossa), the occipital (including the pars latralis) and the outer right mandible.

Plate 15 – Porous lesions on parietal of SK 1031a

Macroscopically, these porous lesions resemble the subperiosteal haemorrhage lesions commonly associated with scurvy; however, other observations made are inconsistent with scurvy as a diagnosis, or do not provide positive evidence of scurvy. For example, there is no evidence of accompanying periostitis or hypertrophic bone formation, and many of the bones that are characteristically affected by scurvy, such as the maxilla, are absent or incomplete. Furthermore while the affected bones have a porous appearance, many of the pores are more than 1mm in diameter; porous lesions associated with scurvy are typically less than 1mm (Mahoney-Swales and Nystrom 2009). The porous lesions also appear to penetrate the bone

obliquely, whereas the lesions associated with scurvy tend to penetrate vertically (Mays 2007). Thus, there is insufficient evidence to suggest a diagnosis of scurvy in this individual.

That the observed lesions, alternatively, represent porotic hyperostosis is unlikely, as this condition is characterised by porous lesions that are limited to the frontal, parietals and occipital bones. The orbital lesions may be indicative of cribra orbitalia, but the combination of these lesions and lesions present elsewhere imply that another pathological condition is also present. While the observed lesions provide insufficient evidence of a specific pathological condition, they do indicate that SK 1031a was suffering from some form of inflammatory condition. However, it can only be classified as a case of non-specific infection.

8.8.7 Cribra orbitalia

One individual (SK 1041, a 12 year old possible female; Plates 8 and 9) had orbital lesions consistent with diagnosis of cribra orbitalia (Plate 16). Lesions were bilateral, and located in the anterior portion of the orbits. Cribra orbitalia is associated with iron deficiency anaemia (Lewis 2000: 45). Cribra orbitalia manifests as small lesions in the orbital roof, with 90% of cases being bilateral (Aufderheide and Rodríguez-Martin 1998: 349). The condition predominantly occurs in infants and young children but is also visible as inactive or ‘healed’ (i.e. remodelled) lesions in adults (Aufderheide and Rodríguez-Martin 1998: 349-50).

Plate 16 - Cribra orbitalia, right orbit of SK 1041

A second skeleton, SK 1031a (Plate 2), had lesions that may be a result of cribra orbitalia. However, for reasons discussed above (section 8.8.6), it has not been included in the Bawtry prevalence calculation. A further two possible cases of cribra orbitalia were observed in the disarticulated material. These were not included in the TPR calculations due to time restraints, but are discussed separately in the section of this report that records disarticulated bone (section 8.11.6).

TPR of cribra orbitalia at Bawtry was calculated at 9.09%. TPR has not been calculated for late medieval Britain, although CPR has been calculated at 10.8%, with a range of 1-51.4% (Cox and Roberts 2003: 234). However, CPR is of limited accuracy, as it does not take into account the presence of articulated individuals with missing skulls. It can be deduced that prevalence of cribra orbitalia was highly variable in the late medieval period; thus, prevalence within the Bawtry sample falls within this broad range.

8.9 Dental Pathology among the articulated and disarticulated remains

Of the eighteen articulated individuals, twelve had recordable dentitions providing a total of 247 teeth. A total of 86 teeth were found from the disarticulated assemblage. In order to calculate TPR, teeth from both articulated and disarticulated assemblages were used in calculations. Therefore, the combined assemblages yielded a grand total of 333 teeth. Dental calculus was the most common dental condition observed in this population. Enamel hypoplasia was observed as being the next most common. Unless stated otherwise, TPR was calculated by dividing the number of affected teeth by the total number of teeth.

8.9.1 Dental calculus

Dental calculus is mineralised plaque situated on the surface of the teeth. It may occur on any aspect of a tooth, including exposed roots (Freeth 2000: 227). Of the twelve articulated individuals with teeth, seven had dental calculus, with ninety six teeth affected. A further twenty teeth from the disarticulated assemblage had dental calculus. Thus, a total of 116/333 teeth had dental calculus. Dental calculus was not scored for severity, but presence was recorded for each tooth. The form of calculus (i.e. supragingival or subgingival) was not recorded.

Calculus formation has a complex aetiology, in which high protein diets, levels of calcium and phosphate in the blood, fluid consumption, oral micro-organisms, and possibly by intake of fats and carbohydrates all can play a role (Lieverse 1999: 224-5). Non-dietary factors affecting presence of calculus include non-dietary chewing, using teeth as tools, and oral hygiene practices (Lieverse 1999: 229-30).

TPR of dental calculus at Bawtry was 34.8%. TPR of dental calculus in late medieval Britain has been calculated at 54%, with a range of 38-71.2% (Cox and Roberts 2003: 262). Therefore, dental calculus within the Bawtry sample is slightly below what might be expected for the period. Dental hygiene was not widely practised during the late medieval period, with the exception of the use of toothpicks (Cox and Roberts 2003: 256). Therefore, it is debateable whether this slightly lower prevalence of dental calculus represents elevated levels of dental hygiene in this population. Instead, lower prevalence is likely to be a product of the young age at death profile, as dental calculus is accumulative.

8.9.2 Dental caries

Dental caries is a disease caused by bacterial decay and consequent destruction of the enamel and dentine of the teeth (Aufderheide and Rodríguez-Martin 1998: 402; Liebe-Harkort *et al*. 2009). Bacteria in dental plaque produce acid in response to carbohydrates such as sugar and starch (Freeth 2000: 229; Liebe-Harkort *et al*. 2009). Therefore, wherever plaque accumulates on the teeth, caries may form (Freeth 2000: 229). However, other factors affecting the prevalence of dental caries can include enamel composition and structure, tooth morphology and position, presence and amount of saliva, composition of the diet, and presence of naturally occurring fluorine in drinking water (Soames and Southam 1985: 19).

Of the twelve articulated individuals with teeth, three individuals had a total of five dental caries, an average of 1.7 caries per carious individual. Both SK 1050 and SK 1068 had one carious lesion; SK 1047 had three. A further three teeth from the disarticulated assemblage had carious lesions. Thus, a total of 8/333 teeth had dental caries.

TPR of dental caries was calculated at 2.4%. TPR for late medieval Britain has been calculated at 5.5%, with a range of 1-40.7% (Cox and Roberts 2003: 259). Although the Bawtry sample falls at the lower end of the range, it is not significantly different than is expected for the period.

8.9.3 Abscess

Dental abscesses (also known as 'periapical abscesses' or 'periapical inflammations') develop when bacteria enter the root cavity or when the tooth pulp is exposed to bacteria as a result of trauma, heavy occlusal wear or caries (Hillson 1996: 285; Holst 2005).

Three abscesses were observed in one articulated individual (SK 1068). Of these, two were maxillary, and one was mandibular. A total of five teeth were affected, and all of these were molars. No abscesses were observed in the disarticulated material.

TPR of dental abscesses was calculated at 1.5%. TPR of dental abscesses for late medieval Britain was 3.11%, with a range of 1-9.6% (Cox and Roberts 2003: 260). Again, prevalence of dental abscesses is slightly lower than average for the period, but does not differ significantly.

8.9.4 Enamel hypoplasia

Enamel hypoplasia is a defect in the depth of tooth enamel formation resulting from growth disturbance severe enough to disrupt tooth development (Aufderheide and Rodríguez-Martin 1998: 405). These non-fatal incidents can represent a variety of causes, but has to be sufficient for the body to divert energy from non-vital processes to those necessary for survival (Aufderheide and Rodríguez-Martin 1998: 405). Episodes of malnutrition and acute

disease are two such stressors that may cause enamel hypoplasia (Aufderheide and Rodríguez-Martin 1998: 405). The hypoplastic lesions can take several forms, ranging from the classic furrow-type defects (linear enamel hypoplasia) to pit-type defects of various sizes, as well as plane-type defects (Hillson 1996: 166-7).

Four articulated individuals had enamel hypoplasia, with twenty five teeth being affected. A further eight teeth from the disarticulated assemblage had hypoplastic lesions. Thus, a total of 33/333 teeth had enamel hypoplasia.

TPR of enamel hypoplasia at Bawtry was 9.9%. TPR of enamel hypoplasia in late medieval Britain has not been calculated.

8.9.5 Ante-mortem tooth loss

Three articulated individuals had ante-mortem tooth loss, with twenty one teeth being lost ante-mortem. A further eleven teeth were lost ante-mortem from the disarticulated assemblage, giving a total of thirty two lost teeth. TPR was calculated by dividing the number of affected teeth (n=32) by the total number of teeth (n=333) plus the total number of empty affected (n=32) and empty unaffected tooth sockets (n=62), and multiplying by 100.

TPR of ante-mortem tooth loss at Bawtry was calculated at 7.5%. TPR of ante-mortem tooth loss in late medieval Britain has been calculated at 19.44%, with a range of 4.5-30.3% (Cox and Roberts 2003: 263). As with observed incidence of other dental pathologies, prevalence of ante-mortem tooth loss at Bawtry is low, but within the expected range for the period. This could again be a product of the young age at death profile of the assemblage. No evidence for

tooth extraction was observed at Bawtry, so it is likely that all tooth loss was due to infective disease or dental trauma.

8.9.6 Developmental anomalies

Two articulated individuals were found to have developmental anomalies. No examples of dental anomalies were found in the disarticulated material.

SK 1025 (a 14-16 year old possible male) (Plate 1) has retarded growth of the permanent second premolars in the left maxilla and both sides of the mandible (Plate 22). This has resulted in the individual retaining the deciduous second molars in the corresponding areas of the jaws. These deciduous molars are heavily worn, and as the enamel of the deciduous teeth is much thinner than that of the permanent teeth, would have been likely to wear down to the root over a short period of time had this individual lived for a longer period. The permanent premolars would have been likely to never erupt. In the right maxilla, the second premolar has erupted and the deciduous second molar been shed. This has been observed as occurring occasionally in both archaeological and modern individuals (Hillson 1996: 114).

SK 1071 (a 12-14 year old possible female) (Plate 4) has an unerupted permanent left maxillary canine (Plate 18). None of the deciduous teeth have been retained, though it was observed that the third molar was present in the left maxilla, but where the canine had erupted in the left mandible the third molar was absent.

Plate 17 – SK 1025, retained left maxillary dM1

Plate 18 – SK 1071, unerupted permanent left maxillary canine

8.10 Non-dental elements among the disarticulated remains

The disarticulated bones from Bawtry were well preserved, although many were extremely fragmented and/or incomplete. A total (minimum number) of 758 disarticulated bones were recovered from the excavated area. A further 0.66kg of crushed, unidentified disarticulated

bone was recovered, but not analysed. Table 6 provides a summary of the observed disarticulated bone elements, among which cranial fragments, ribs and vertebrae were the most commonly found elements.

	Total No.	**Left**	**Right**	**%**
Cranium	104	-	-	13.7
Clavicle	11	5	6	1.5
Scapula	19	11	8	2.5
Humerus	20	10	10	2.6
Ulna	17	8	9	2.2
Radius	26	10	16	3.4
Carpal	13	5	8	1.7
Metacarpal	48	-	-	6.3
Hand Phalanx	52	-	-	6.9
Manubrium	2	-	-	0.3
Sternum	4	-	-	0.5
Ribs	89	46	43	11.7
Vertebrae	87	-	-	11.5
Pelvis	13	-	-	1.7
Femur	23	10	13	3.0
Patella	10	4	6	1.3
Tibia	26	13	13	3.4
Fibula	16	6	10	2.1
Tarsal	57	26	31	7.5
Metatarsal	72	34	38	9.5
Foot Phalanx	49	-	-	6.5
Total	758	188	211	100

Table 6 – Summary of disarticulated bone elements

Of the 758 disarticulated bones recovered, 620 (81.8%) were located within graveyard soils, 62 bones (8.2%) were recovered from grave fills associated with discrete inhumations, and 52

(6.9%) bones were found within rubble layer (1003), which lay directly below the limestone hardcore of the car park, and sealed the majority of the trench. The remaining 24 (3.2%) bones were found within 2007 trench backfill (1004).

The disarticulated assemblage yielded a minimum of eleven adults and twenty four sub-adults. Of the sub-adults, nineteen were assigned approximate ages. Five could not be aged, as bone elements were not sufficiently complete. The nineteen aged sub-adults were subsequently included in the demographic profile of the cemetery assemblage (section 8.7).

Of the thirteen pelvises recovered, eight were adult and five were juvenile. The age and sex estimations possible for five of these eight adult pelvises are summarised in Table 7. These individuals were subsequently included in the demographic profile of the cemetery assemblage (section 8.6 and 8.7).

Context	Sex	Age
1006	M	20-30 years
1017	M	30-34 years
1017	M	35-44 years
1017	Unknown	30-39 years
1055	F?	Unknown

Table 7 – Demographic summary of disarticulated adult pelvises

8.11 Non-dental pathology among the disarticulated remains

Several examples of pathological lesions were also found amongst the disarticulated material. These are summarised below.

8.11.1 Post-cranial fracture

One right adult tibia from graveyard soil (1006) had a very well healed fracture of the proximal tibial shaft. A significant quantity of well remodelled periosteal new bone was present on the medial aspect of the proximal shaft, indicating the approximate location of the fracture. However, the fracture itself was so well healed that the fracture type could not be determined. This tibia is the only example of a post-cranial fracture found during this phase of excavation of the site.

8.11.2 Ankylosis

One example of ankylosis of a joint was found within graveyard soil (1017). The intermediate and distal phalanges from one adult toe were fused at the interphalangeal joint. No evidence of infection or degenerative joint disease was observed in either phalangeal bone. Therefore, as with the two examples observed within the articulated assemblage (section 8.8.1), it is most likely that this case of ankylosis was a result of low grade trauma.

8.11.3 Fusion

Two cases of congenital fusion were observed. Firstly, one case of fusion of the second and third cervical vertebrae was found within 2007 trench backfill (1004). The vertebrae were fused at the left articular process. Although there appeared to be a substantial amount of new bone formation, the fused area also appeared to be well remodelled. Macroscopically, it is not possible to deduce why fusion has occurred (e.g. as a result of trauma, infection, etc.) and there is insufficient evidence that this represents a case of Klippel-Feil syndrome. Radiography may be able to confirm the causal factor.

Secondly, one sacrum was found fused to the pelvis at the right auricular surface in graveyard soil (1006). The auricular was well remodelled, though the sacrum and a small part of the right ilium were broken off the main body of the right pelvis post deposition (Plate 19). The left side of the pelvis was present, and appeared normal. It is likely that this sacral fusion is congenital.

Plate 19 – Fused sacrum and pelvis from graveyard soil

8.11.4 Degenerative joint disease (DJD) and Schmorl's nodes

One left first and one second metatarsal were found exhibiting DJD within graveyard soil context (1006). Osteophytes and slight microporosity was present on and around the corresponding articular facets between the two metatarsals, though no evidence of degenerative changes was observed on the articular facet for MT3. The heads of both

metatarsals were slightly lipped, this being more pronounced on the first metatarsal. No other obviously matching foot bones were found within the disarticulated material, and the two bones in question could not be married up to an articulated individual. There is no evidence to suggest that this case of extra-spinal DJD is anything other than age related, localised degeneration.

A further three vertebrae were found exhibiting evidence of spinal joint disease within graveyard soil (1013). Osteophytes were present on C6 and L5, and a Schmorl's node was also present on L5. One example of T12 had eburnation on the inferior side. It is unknown whether these vertebrae belonged to the same individual.

8.11.5 Non-specific infection

Three cases of non-specific infection were found within the disarticulated material. First, one adult right tibia was observed with periostitis on the medial midshaft. Second, one juvenile distal ulna fragment was observed with severe periostitis on the medial midshaft. Both bone fragments were found within graveyard soil (1006). Periosteal new bone can form as a result of inflammation of the periosteum following infection or trauma (White 2000: 392). As well as non-specific infection, trauma, aseptic haemorrhage and ulceration, periostitis may be a symptom of other infective conditions such as syphilis, leprosy or tuberculosis (Aufderheide and Rodríguez-Martin 1998: 179; Cox and Roberts 2003: 235). The anterior tibia is particularly prone to the formation of periostitis, as there is little soft tissue between the bone and surface of the skin, leaving it more susceptible to repetitive micro-trauma (Manchester 1983).

Third, three fragments of infant occipital bone were found with endocranial periosteal new bone formation, and both macro and microporosity, within graveyard soil (1017). As the occipital was fragmented and incomplete, a more precise age estimate could not be given. No other matching bones could be married up to this individual. Endocranial periosteal new bone forms as a result of inflammation or haemorrhage of the meninges (Lewis 2004: 93). Observation of such new bone formation in the occipital, and indeed the frontal and parietals, can be indicative of a number of pathological conditions including meningitis, tuberculosis, congenital syphilis, bone tumour, subdural haematoma, vitamin deficiency (vitamins A, C and D), and head trauma (Lewis 2004). However, as no other skeletal elements were present, no other evidence for any of these pathological conditions could be observed.

8.11.6 Cribra orbitalia

Two possible cases of cribra orbitalia were observed within graveyard soil (1006). One frontal bone, belonging to a child of approximately 8-9 years, was found with bilateral orbital lesions. One fragment of frontal bone, belonging to an infant of approximately 12-18 months, was found with lesions in the left orbit.

8.12 Conclusion

Human skeletal remains from Bawtry were mostly well preserved, with varying degrees of fragmentation but low levels of completeness in many cases. Stature was approximately average for the period for females, as was the calculated sex ratio for the population. Male stature was below average for the period, but this may be attributable to low numbers of male individuals, and the fact that one of the males (SK 1025) had a particularly short stature (152cm). The age at death profile was that of a normal attritional cemetery, with the exception of slight over-representation of individuals in the 25-34 years age category.

Unusually, infants and children were well represented due to the inclusion of demographic data ascertained from the disarticulated assemblage. Any slight discrepancies from model demographic profiles may be attributable to the small sample size.

In term of non-dental pathology, cases of ankylosis, congenital vertebral fusion, degenerative joint disease, Schmorl's nodes, non-specific infectious disease, and cribra orbitalia were observed within the articulated assemblage. Examples of post-cranial fracture, ankylosis, congenital/non-congenital fusion of skeletal elements, degenerative joint disease and Schmorl's nodes, non-specific infectious disease, and cribra orbitalia were found within the disarticulated assemblage. Prevalence of all non-dental pathologies was approximately average for the period.

In terms of dental pathology, slightly lower than average prevalence of dental calculus, dental caries, abscess, enamel hypoplasia, and ante-mortem tooth loss were found, as well as two developmental anomalies. Although all dental pathology prevalence rates fell within the expected ranges for the period, all were consistently at the lower end of their prevalence ranges. This could reflect good oral hygiene amongst the population, or could be a product of the young age at death profile for the assemblage. Many dental pathological conditions (e.g. dental calculus) are accumulative and, hence, are exacerbated with age.

9. Bawtry in context

The excavations undertaken in 2010 in the car park of the Masonic hall at Bawtry uncovered part of what is believed to have been the cemetery of the medieval hospital of St Mary Magdalene. A discussion follows of the evidence for the presence of a hospital in Bawtry, and then the excavation is set in the context of other hospital cemetery excavations.

9.1 The Masonic hall at Bawtry: the presumed site of the medieval hospital chapel of St Mary Magdalene

Written sources reveal that there was a hospital in Bawtry in the Middle Ages from at least the 13th century; it was certainly in existence by 1280 when the hospital of Bawtry is specifically mentioned in the Episcopal registers of the Archbishops of York (Page 1910: 162), but it is unclear at what point the hospital acquired burial rights. There is an account from 1635 written by John Slacke, who was then master of the hospital, of the state of the hospital and chapel, in which among his benefactors is listed 'Anthony Morton, Esq., who was buried in the Chappell' (Page 1910:164). This comment reveals that the hospital was, then, certainly used as a place of burial in the early post-medieval period. Whether the chapel was ever used as the burial place for the wider community is debatable from the written record, both in the medieval and the post-medieval period. From at least the late 14th century the chapel served as a chantry, that is to say it had a specific role in providing prayers for the soul of a donor (Hadley 2001: 80-1). The donor in question was Robert Morton, escheator of the county of Nottingham and knight of the shire from 1361-1393, who made a substantial donation to the priory of Nostell (Yorkshire) in 1390 on the stipulation, *inter alia*, that 8 marks a year were paid in perpetuity to the chaplain of St Mary Magdalene in Bawtry so that prayers may be said for the soul of Robert and his wife, Joan, and also for their family and ancestors. Robert's will, written at Bawtry in 1396, made handsome provision for the chapel: he left 40 shillings to the chapel and cattle and corn to the value of £10 to the master, William Myrfyne. However, it is unclear where Robert and his wife were to be buried (Page 1910: 162-3).

Plate 20 - The Masonic hall, Bawtry (formerly the chapel of St Mary Magdalene) (from the south east)

The fate of the chapel after the death of Robert Morton is uncertain. Robert, the son of Robert Morton, was involved in the Percy revolt against Henry IV, and lost his lands to the crown, including the chapel and chantry of St Mary Magdalene (Page 1910: 163). The chapel was, nonetheless, still serving as a chantry in the early 15th century, as can be seen from a donation made in 1403 by John Scot, knight, in order that prayers were said for his soul and the souls of his family (Page 1910: 163). The hospital was still in existence at the time of the Reformation, and when it was visited in 1545 as part of the Dissolution process, it was recorded that the hospital had been founded for the poor (Page 1910: 163). The hospital was unusual in surviving the Reformation, when many hospitals – as monastic institutions – were

dissolved. However, its fortunes were mixed. By the 1580s the master, James Brewster, was accused of subverting the hospital and its funds for his own purposes, for allowing fixtures and fittings to be taken away, and for permitting cattle to be housed in the chapel (Page 1910: 163). The chapel was repaired by the aforementioned John Slacke in the early 17th century. Little is known of the fate of the hospital over the next 200 years; by the 1830s it was being used as a carpenter's shop, but it was restored in 1839 (Page 1910: 164), and in 1910 the income to the hospital foundation continued to house two poor widows (Page 1910: 164). In the early 20th century, however, the chapel was transformed into a Masonic hall, a function which it still serves.

The architecture of the Masonic hall provides few clues about the origins of the hospital of St Mary Magdalene. The building that is now the Masonic hall was rebuilt in 1839 thanks to the patronage of Edward Harwood Greaves, and is now rendered with cement (English Heritage National Monuments Record 2007; Jefferson 2002: 13). The windows have been replaced, and the only surviving external feature of medieval date is the 15th-century image niche in the east wall, with moulded sill, quadrant moulded jambs and crocketed and castellated canopy (English Heritage Listed Buildings record). The Masonic hall is a single cell, with four bays, but given the external rendering it is not certain that this represents the medieval form of the hospital. However, engravings of the chapel from the early 19th century suggest that this was, indeed, the original form of the hospital, although it is also apparent that there was previously a door at the west end of the south wall (where there is now a window), and that there had also previously been a door further east in the south wall, although this had been blocked up by the early 19th century, and its position between the windows suggests that it was not part of the original layout of the chapel (Figure 11). Medieval hospitals had three main forms: 1) linear, in which the infirmary hall and chapel were adjacent and reflected the structure of a

parish church with nave and chancel; 2) 'L'-shaped, in which the hall was aligned north-south and the adjoining chapel was east-west; and 3) 'T'-shaped, in which the chapel abutted the eastern side of a longer north-south hall (Gilchrist and Sloane 2005: 33). Although the 19th-century images do not show the west wall very clearly, it seems likely that the hospital at Bawtry was of linear form.

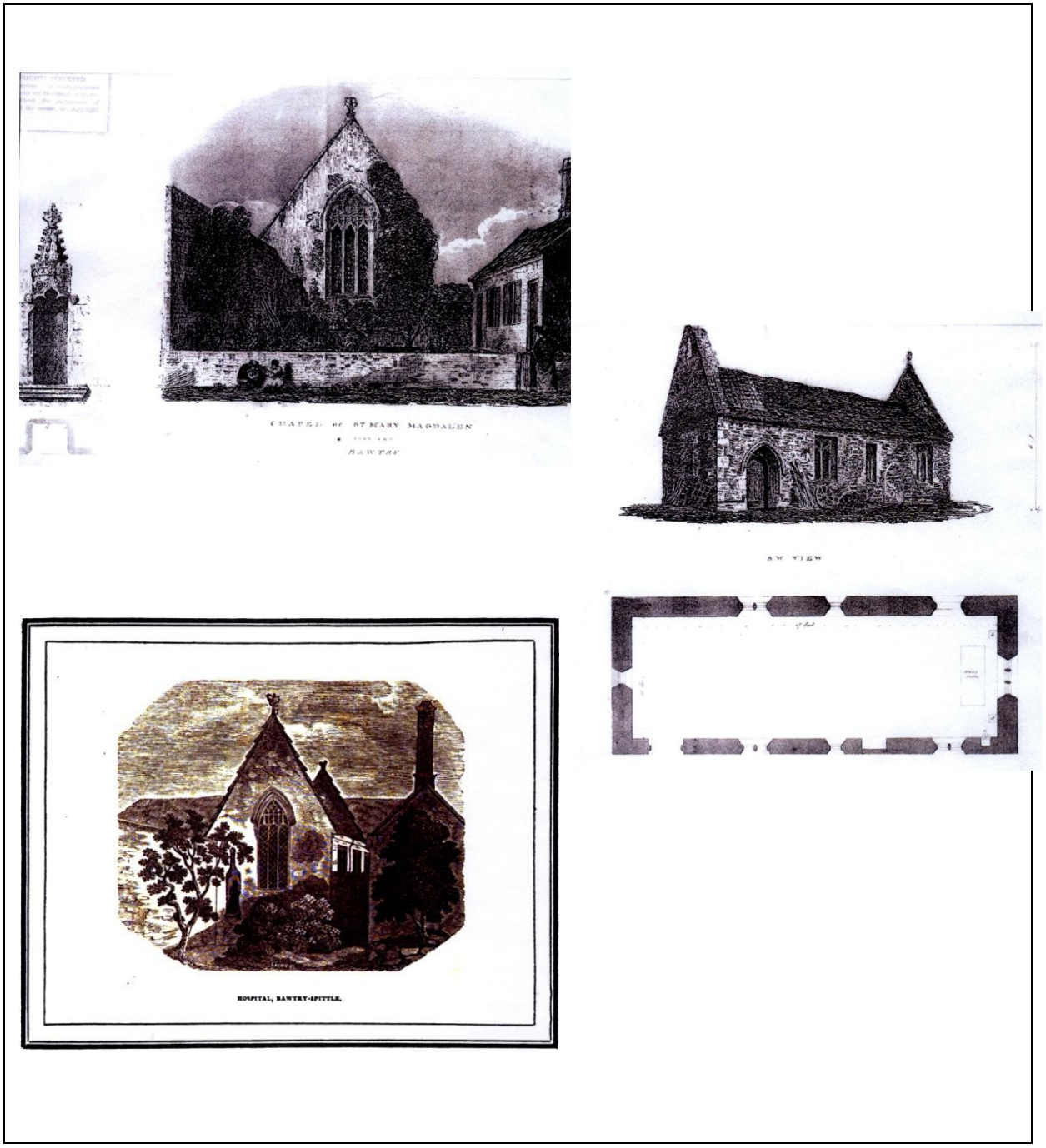

Figure 11 - The chapel of St Mary Magdalene in the 19th century (woodcuts from Peck 1813)

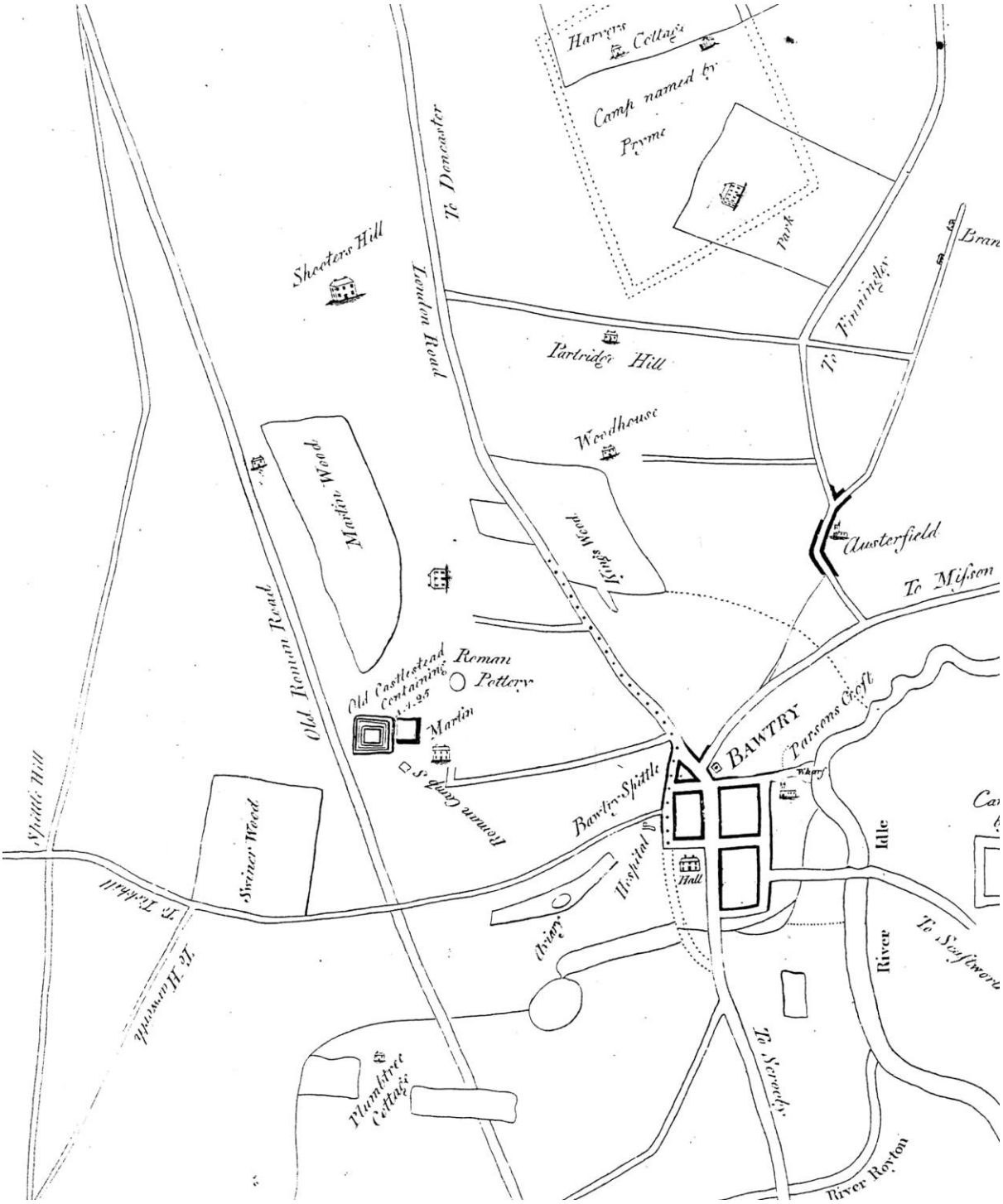

Figure 12 - Plan of Bawtry in the early 19th century (from Peck 1813)

From the written account it is not apparent when the hospital began to provide burial, let alone for whom. There is no certainty that a medieval hospital would have a cemetery (see section 9.2), and the same is true of a chantry chapel (although many of these were established in other religious institutions, typically parish churches, which themselves had cemeteries) (Hadley 2001: 80-1). The township of Bawtry was an outlying part of the large medieval parish of Blyth (Nottinghamshire), and the church of St Nicholas in Bawtry was until the 19th century a chapel of the parish church of Blyth. Accordingly, the chapel of St Nicholas was not initially permitted to perform burial rites – which is often the case for medieval chapels of major parish churches – and it was only in 1344 that a licence was granted to permit the parishioners of Bawtry to be buried in a cemetery adjacent to the chapel of St Nicholas (Hunter 1828: 73; Cumberpatch and Dunkley 1996: 184). From this evidence it might, thus, be deduced that it is unlikely that the chapel of St Mary Magdalene possessed burial rights before the mid-14th century either. Nonetheless, the possibility that the hospital may not have buried the dead before the mid-14th century is one that needed to be tested archaeologically rather than merely assumed.

Several pieces of evidence suggest that the burials excavated at Bawtry in 2006, 2007 and 2010 date to the medieval period. First, the general paucity of coffin furniture is in keeping with a cemetery of medieval date. This is in contrast to cemeteries of early post-medieval date where we might expect to find more metal coffin fittings (e.g. compare the medieval and early post-medieval phases at Barton-upon-Humber, Lincolnshire; Waldron 2007). It is also worth noting that the burials excavated at Bawtry have little in common with burials of earlier centuries excavated elsewhere in northern England (e.g. of the period c.700-1100), which are likely to include some evidence for, in particular, stone linings or charcoal (Hadley 2001: 97-106). Second, the burials excavated in 2006 were disturbed by two later animal

burials (O'Neill and Jackson 2007: 5), one of which produced two sherds of pottery of medieval date (broadly datable to between the 9th and 15th centuries), which it was assumed had been disturbed from the fill of Grave 3 (O'Neill and Jackson 2007: 7, 17). This suggested that the graves were of broadly medieval date. Third, Burial [1063]/SK 1062 was sealed by brick structure [1016], which seems likely to date to the 14th or 15th century (see section 6.1.21). Fourth, a coin recovered during the 2010 excavations in graveyard soil (1017) dates to the 13th century. It is unfortunate that this was not found in close association with a given burial, although given the absence of clear grave cuts it should be noted that even the presence of artefacts in close association with a particular skeleton cannot be taken as reliable dating evidence from the grave fill, a matter compounded by the levels of intercutting of burials.

In order to illuminate further the date of burials at the site, and courtesy of an anonymous donation, a radiocarbon date was acquired by the Department of Archaeology, University of Sheffield to identify the period of use of the cemetery. This was undertaken as part of the process of preparing for the 2010 field school, and a sample of bone from skeleton 5 (site code SMM07 (SK005)) excavated in 2007 was submitted for radiocarbon dating to the University of Waikato Radiocarbon Dating Laboratory (submission code SMM07/005; laboratory code Wk-25972). The results confirm that this burial is of later medieval date, although it is not entirely clear from the calibration curve whether the burial dates to the second half of the 14th century — after the parishioners of Bawtry had apparently first acquired burial rights, albeit at the chapel of St Nicholas — or whether the burial dates to the late 13th to early 14th century, which would suggest that the hospital was providing a place of burial earlier than was the chapel of St Nicholas (Appendix C). The mother church of Bawtry was at Blyth, which was held by a Benedictine priory founded there in 1088 by Roger de

Builli (Page 1910: 83). The Benedictine order had a particular interest in hospital foundations, and is known to have founded some particularly early examples in the region, such as Partney (Lincolnshire), which appears to have been founded by c.1115 and to have provided burial from an equally early date (Atkins and Popescu 2010: 251-2). A sample of human bone from the 2010 excavations has been submitted for radiocarbon dating and the results of this analysis will be discussed in a separate report and in the planned publication (McIntyre and Hadley forthcoming).

The precise date for the origins of burial at Bawtry remains unknown, but it is apparent from the radiocarbon date that burials were taking place by at least the 14th century in the cemetery adjacent to the current Masonic hall, which was the location of the chapel of St Mary Magdalene. The latest possible date of the burials excavated is uncertain, although there is little to suggest on the basis of the excavated evidence that any were of post-medieval date. As has been noted, the written record reveals that burial continued into the post-medieval period at the chapel, but the high-status burial of Sir Anthony Morton is recorded as having taken within the chapel rather than the surrounding cemetery.

The excavations in 2010 suggested that burial to the east of the hospital chapel was more extensive and denser than burial to the south of the chapel. Given the limited scale of the excavations this can only be a tentative deduction, but there is further evidence to suggest that there may have been distinct zones of burial around the hospital chapel. Brick structure [1016] was of later medieval date (see section 6.1.21), and it ran eastwards from the south-east corner of the hall. It is possible that this wall was part of a building, although it may also have been a boundary wall of some sort; walls are certainly known to have demarcated areas of burial in the cemeteries of monasteries in the later medieval period (Gilchrist and Sloane

2005: 35-6). The 19th-century engravings of the chapel depict what appears to be a tall brick wall in roughly the same location and alignment as brick feature [1016] (Figure 11). In the 19th century, this wall formed the boundary of a garden, associated with the cottages in which two poor widows were housed. Although the wall appears to be rather tall for a mere boundary wall, there is no specific evidence visible in the 19th-century engravings to suggest that the wall had ever been part of a building, and no traces of doors or windows can be seen. In sum, it cannot be demonstrated conclusively that the wall in the 19th-century engravings and brick structure [1016] are the same feature, but at the very least the line of a wall present in the late medieval period appears to be perpetuated in the 19th century by a tall brick wall that delimited the garden of the cottages of the poor widows.

9.2. Bawtry in the context of medieval hospital excavations

The 2010 excavations offered an opportunity to throw important new light on a category of burial ground that is poorly understood, especially in the north midlands and north of England. In a recent review of the cemeteries of hospitals, it was reported that only around 30 have been partially or entirely excavated. Of these, some have had extensive excavations and the cemeteries were very large (e.g. St Mary Spital, London where 10, 500 burials have been excavated), but others were rather smaller (e.g. recent excavations at the rural hospital of Partney have revealed 43 burials, and this is thought likely to be the entirety of the cemetery) (Atkins and Popescu 2010: 254). In the recent detailed survey of medieval monastic cemeteries by Roberta Gilchrist and Barney Sloane (2005), the limited range of excavated and published hospital cemeteries was notable, and in this context the excavations at Bawtry take on particular importance.

9.2.1 Excavation of hospital cemeteries in the region of Bawtry

There is no available research agenda for South Yorkshire as part of the English Heritage Regional Research Frameworks, however those available for adjacent regions provide useful context for understanding the importance of analysis of the cemetery at Bawtry (Barrett 2000; Everson 2000). In Lincolnshire, for example, the Regional Framework notes how poorly understood are the variety of ecclesiastical institutions in that region, including hospitals, and also draws attention to the paucity of excavation of medieval cemeteries of any great size, with the main exceptions being those at St Peter's, Barton-upon-Humber, St Paul-in-the-Bail in Lincoln, and St Mark's in Lincoln, all of which were – at the time that the framework was written – unpublished (although St Peter's has since been partially published: Waldron 2007). Nonetheless, it is acknowledged that even more limited insights from small-scale excavations (such as those conducted at Holton-le-Clay, Healing, Keelby and Stow) are still important to our understanding of burial practices in the period c.900-1500.

Since the Regional Framework for Lincolnshire was produced, a medieval hospital cemetery has been excavated and published at Partney (Atkins and Popescu 2010), and another, excavated nearly 20 years ago at Grantham, is to be published shortly (Craig in press). The hospital at Partney is believed to have been founded under the patronage of Bardney Abbey in the early 12th century, and dedicated to St Mary Magdalen. The associated cemetery is thought to have gone out of use in the early 14th century after the hospital was converted to a cell of Bardney (Atkins and Popescu 2010: 212). Following analysis of the human remains, it was concluded that the hospital probably catered for poor travellers, rather than the elderly or lepers (Atkins and Popescu 2010: 250). The location of the hospital near to both the road leading towards Louth and the routeway between Lincoln and Skegness may also be relevant to understanding the role that it served. The 43 skeletons excavated were in two principal

zones, each with distinctive characteristics, and most of the adult burials were males (Atkins and Popescu 2010: 217). To the south of what appears to have been the pathway through the cemetery, were 26 graves in four north-south rows, and all were young or mature adults. All but one individual that could be assigned a sex was male; the single exception was a possible female, which survived in poor condition (Atkins and Popescu 2010: 218). At least nine of the burials were in anthropomorphic grave cuts, of which one was lined with stone, and at least twenty of the graves included ledges, which may have been intended to support wooden grave covers. One individual had been interred within a hinged and padlocked chest or coffin (Atkins and Popescu 2010: 219). Four of these burials contained the remains of a pewter chalice, which is typically a symbol of a priest's burial (Atkins and Popescu 2010: 220). In contrast, the area of burial to the north of the pathway included five sub-adult burials. There was no evidence for coffins, or for anthropomorphic grave cuts, and the burials were notably shallower than those in the southern cemetery (Atkins and Popescu 2010: 222). There was also a single male burial excavated within the chapel, which is thought to have been a patron (Atkins and Popescu 2010: 255)

A forthcoming volume on the history of Grantham includes a chapter on the excavations conducted almost 20 years ago at the presumed site of the medieval hospital of St Leonard. This chapter (by Glyn Coppack) incorporates a skeletal analysis conducted by Lizzy Craig (formerly of the Department of Archaeology, University of Sheffield, now at the University of Bournemouth) (Craig in press). Skeletal analysis has proved crucial to identification of the nature of this cemetery, as the examples of leprosy strongly suggest that the cemetery is to be associated with the lost hospital of St Leonard. Leprosy is a comparatively rare condition among the cemetery populations of parish churchyards and monastic cemeteries, and tends to be restricted in the later medieval period to hospitals specifically devoted to the care of lepers

(Gilchrist and Sloane 2005: 206-07). The publication of the results of this cemetery excavation will be a major contribution to the understanding of later medieval funerary practices in the region.

In Derbyshire, several medieval hospitals are documented, but there has been little excavation of these. Documented examples include those at Barlborough, Bolsover, Staveley, Chesterfield and Castleton, but only the latter two have undergone archaeological excavation. In Chesterfield, ARCUS excavated the burial of a priest, evidenced by chalice and paten (Hadley 2001: 113-14), and the hospital at Castleton is the subject of an on-going project led by Colin Merrony of the Department of Archaeology, University of Sheffield. In Nottinghamshire, parts of the cemetery of a hospital at Newark, dedicated to St Leonard, have been excavated. Excavations undertaken in 1927 identified around 90 skeletons, including the stone-lined burial of a priest including a chalice and paten. More recent excavations identified a minimum of 87 individuals. There is a complete absence of sub-adults among the remains excavated (Bishop 1983).

8.2.2 Medieval hospitals and the roles they served

It is important to set the excavations of what appears to have been a hospital cemetery at Bawtry in its regional and national context (e.g. Bishop 1983; Cardwell 1995; Carlin 1989; Craig in press; Farley and Manchester 1989; Gilchrist and Sloane 2005; Harrison 1969; Lee and Magilton 1989; Leech and McWhirr 1982; Parsons 1968; Price 1998; Sloane and Malcolm 2004; Smith 1979; Thomas *et al*. 1997). Medieval hospitals fulfilled a variety of roles (Clay 1909). In essence, they were monastic communities, staffed by those who had taken religious vows, but the majority of their occupants – unlike other monasteries – were members of the laity. Hospitals certainly sometimes provided medical care, but this was not

their principal role. Rather, the monastic staff dedicated their time to providing prayer for the sick. Indeed, a number of studies have argued that the bays in which beds were positioned in hospitals were deliberately located so as to afford a view of the high altar during the Mass, which was imbued with curative properties in the medieval mindset (Gilchrist 1992). There were a variety of types of hospital, providing for differing groups within society, such as lepers, the poor, the elderly, pilgrims and wayfarers and the general sick (Gilchrist 1992; Gilchrist and Sloane 2005: 205-06).

Hospitals were also sometimes places of burial, both for the people they cared for, and the religious communities who ran them. Burials including a chalice and/or paten, which are indications of priestly burial, have been found at the hospitals of St Giles, Brompton Bridge, Brough (Yorkshire) (Cardwell 1995), St Mary Magdalen, Partney (Atkins and Popescu 2010: 220) and St Leonard, Chesterfield (Hadley 2001: 113-14). Yet, some hospitals did not have the right to bury the dead, or only acquired it later. For example, the hospital of St John in Exeter (Devon) was founded in 1185 but did not acquire permission to bury the dead until 1351 (Gilchrist and Sloane 2005: 63); although it is not explicitly stated, the date is suspiciously close to the outbreak of plague in 1348 and it can be surmised that it was a response to the unprecedented demand for burial in the years that followed.

Medieval hospitals sometimes also took on the role of burying ostracized groups, such as felons, excommunicates and those who had been executed. This is a role that had been served in the later Anglo-Saxon period by separate cemeteries, which can be identified by evidence of decapitation, bound limbs, prone burial, multiple graves and apparently careless arrangements of the body within the grave. They were typically in locations remote from settlements, and provided burial for those who had been judicially executed, or otherwise

excluded from burial in consecrated ground (e.g. excommunicates, the unbaptized, felons, etc.) (Reynolds 2009). After the Norman Conquest, however, these cemeteries appear to have quickly gone out of use, and the Normans and their successors both executed felons close to or within settlement sites and also buried their bodies within consecrated ground (Daniell 2002). Sometimes this was evidently at a hospital. For example, the body of a woman hanged at Lincoln in 1284 was taken to the leper hospital for burial (Hadley 2001: 51). Sometimes, however, felons were buried in a parish churchyard, particularly those in poorer parts of towns. The recently published report on the cemetery of St Margaret in Combusto in Norwich details a number of unusual burial types, including prone burial, burial on unusual alignments, multiple graves and evidence for bound limbs (Stirland 2009). It is believed that this churchyard provided burial for felons; in the later Middle Ages the churchyard of St Margaret was given the suffix '*ubi sepeliuntur suspensi*' ('where those who were hanged are buried') (Stirland 2009: 36). The high levels of pathology and some evidence for leprosy suggest that it may also have been providing burial for a neighbouring hospital that did not have the right to bury the dead (Stirland 2009: 34-7).

Mass burial pits have been identified at the hospital of St Mary Spital in London and St Margaret in Huntingdon, and although both sites are yet to be fully published these burial deposits raise important questions about the individuals who may have been buried in these cemeteries; that these are the burials of felons or were emergency provision in the wake of the Black Death (as is known to have occurred in the cathedral cemetery in Hereford) are both possibilities (Gilchrist and Sloane 2005: 74-7).

Given the range of individuals potentially buried in a hospital cemetery, it is not surprising to find that they have very varied demographic and palaeopathological profiles. The cemeteries

of known leper hospitals typically produce evidence of leprosy, although it must be noted that since leprosy can take many years to manifest itself on the skeleton not all individuals showing external physical symptoms of leprosy will produce bony changes that will be apparent during an osteological examination (Cox and Roberts 2003: 267-72). Moreover, since leper hospitals are known to have taken in the relatives of those with leprosy (especially children) it is not surprising that leprosy rates rarely exceed 20% of the skeletal population of a leper hospital cemetery, and in most cases the prevalence is considerably lower (Cox and Roberts 2003: 270-1). Not all individuals in hospital cemeteries display skeletal evidence indicative of any other form of illness, either, which, again, is not surprising given the range of individuals that may be buried there and the fact that many diseases common in the medieval period (e.g. plague) do not manifest themselves on the skeleton (Farley and Manchester 1989; Cox and Roberts 2003: 266-7).

Nonetheless, despite these challenges, osteological analysis can be crucial in identifying whether a hospital cemetery has been encountered. For example, as already noted, evidence for leprosy among some of those individuals buried in the Spittelgate district of Grantham identified this as the cemetery of the hospital of St Leonard, which is documented in Grantham from the 13th century, but which had not previously been located. Although there is no documentary evidence that this hospital housed lepers the recent osteological analysis conducted by Lizzy Craig (in press) appears to confirm that it did. The dedication to St Leonard is another hint as this is the second most common dedication for leper hospitals in later medieval England, and, as with other later medieval hospitals, it is situated outside the main urban area of Grantham (Gilchrist 1992).

In a recent review of the skeletal populations of a selection of medieval hospitals, it was suggested that particular types of hospital have distinctive demographic profiles in their cemeteries. For example, aside from yielding evidence of leprosy, leper hospitals are also typified by higher numbers of females, infants and children. There is no reason to suppose that females were more susceptible to leprosy than males, and their greater numbers among the populations of hospital cemeteries may be a result of cultural perceptions of female propensity towards sexual sin, with which leprosy was widely associated (Gilchrist and Sloane 2005: 205-06). Infirmaries cared for the poor and the sick, and their cemeteries are dominated by the burials of males, with few or no infants and children (Gilchrist and Sloane 2005: 204). It is worth noting, however, that the functions of some hospitals changed over time, leading to transformations in the groups cared for and ultimately buried in their cemeteries (Gilchrist and Sloane 2005: 204-05). Therefore, it is far from straightforward to draw on the demographic profile of the cemetery of a hospital to identify the nature of a particular hospital, and this is especially true if only part of a cemetery has been excavated, as this may reflect the profile of only one group within society that were buried there.

The osteological analysis of the Bawtry cemetery population excavated in 2010 provides few indications of what sort of role the hospital of St Mary Magdalene may have performed in the later Middle Ages. The stature, sex ratio, health profile and pathologies from the skeletal population vary little from those of contemporary parish churchyards (see section 8). Little, if any, significance can be attached to the slight prevalence of females among the adult population, given the relatively small number of burials excavated. The population at Bawtry is not particularly stressed, and the low levels of dental pathologies are notable (although possibly to be assigned to the relatively young age of the skeletal sample analysed). There is no evidence for any individual suffering from leprosy. The written record suggests that the

hospital was founded for the poor (section 9.1) and the demographic profile suggests that a cross-section of the community was buried in the cemetery of the hospital.

One artefact recovered during the excavation is of particular interest in illuminating the hospital of St Mary Magdalene. The perforated copper-alloy plate recovered from the rubble layer (1003) is of a type found in the cemeteries of a number of medieval hospitals and monasteries, which was used to assist in the healing of limbs (Plate 21). Although the example from Bawtry was found in the rubble layer above the burials, elsewhere such artefacts have been found in graves. In the cemetery of the Gilbertine Priory of St Andrew in York, for example, two copper-alloy plates were found *in situ* around the right knee of an adult male who had experienced a major fracture of this joint (Knüsel *et al*. 1995: 381). Two copper-alloy plates were found in association with the humerus of an adult female buried in the cemetery of the leper hospital of St Mary Magdalene in Reading (Berkshire). This female was suffering from osteomyelitis (an infection of the bone). Analysis of the inside of the copper-alloy plates suggests that they were lined with dock leaves, which it is assumed were used for their recognised curative properties (Gilchrist and Sloane 1995: 103). Copper-alloy plates have also been found in graves at the Cistercian abbey of St Mary at Stratford Longthorne (Essex), the hospital of St Mary Spital in London, and the Cluniac priory at Pontefract (Yorkshire), each with impressions of either fabric or vegetative material (Gilchrist and Sloane 1995: 104). It is unclear why such these plates were left in the grave; they may have been left on the body inadvertently, or, alternatively, have been buried with the deceased because it was believed that they would continue to assist in the healing process in the afterlife (Gilchrist and Sloane 2005: 104).

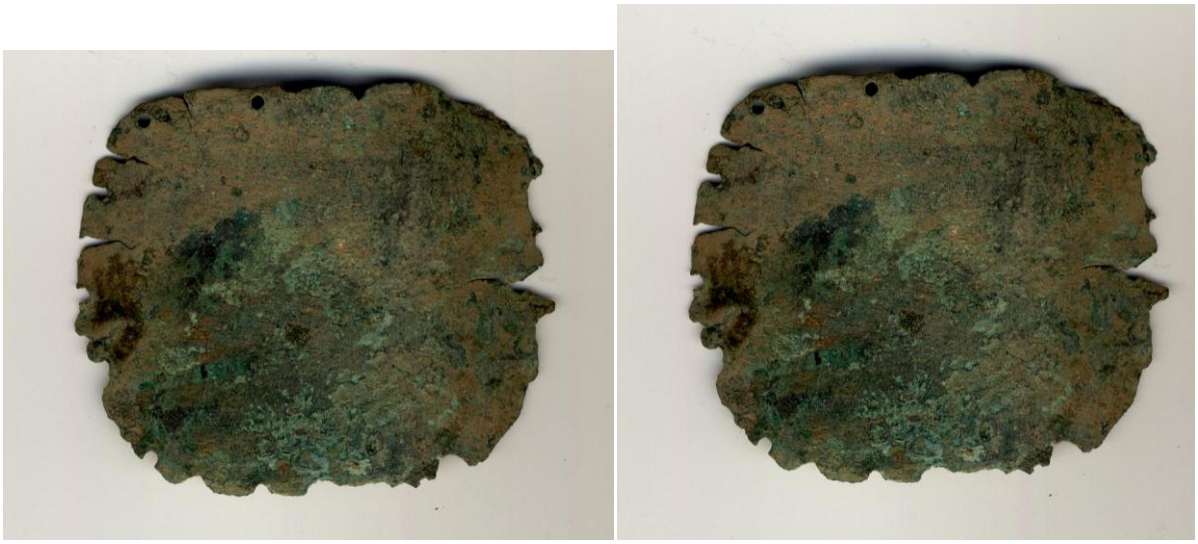

Plate 21 – Copper-alloy plate

Plate 22 – Copper-alloy ferrule (wood preserved on the inside on the left)

These copper-alloy plates all seem to date to between the 12th and 14th centuries. Since the copper-alloy plate from Bawtry was not found in direct association with a skeleton, it is impossible to know whether it had been buried with one of the individuals interred in the cemetery, but it is certainly possible by comparison with these other examples from medieval graves. The copper-alloy plate is the only artefact recovered during the 2010 excavation that can be interpreted as having served a curative function. However, the copper-alloy ferrule that was also recovered from rubble layer (1003) was probably from the end of a walking

stick of late medieval or early post-medieval date, and may also have aided someone who was sick or injured (Plate 22). The ferrule was slightly flattened at the end, indicating that it had borne weight, and fragments of wood survived within the ferrule. Again, it is impossible to know whether it had been deposited in a grave, although the presence of wood within the ferrule reveals that it had not merely dropped off the end of a walking stick. Its recovery from the area of a cemetery of a hospital is, at the very least, intriguing and may indicate that it was another medical aid for those who received care at the hospital.

10. Conclusion

The excavations undertaken in the car park of the Masonic hall in Bawtry in July 2010 were on a small scale but they have, nonetheless, thrown important new light on medieval Bawtry. Although only a single radiocarbon date has been acquired (from the 2007 excavations) it seems highly likely that the burials encountered in 210, as well as those previously excavated in 2006 and 2007, all date to the medieval period. Eighteen burials were excavated, but analysis of the disarticulated human skeletal material revealed the remains of a minimum of fifty three individuals. This skeletal population was not particularly stressed, and in this respect offers little illumination of the medieval hospital, but the recovery of a copper-alloy plate, which was probably used in the healing process of a diseased or injured limb, and the ferrule of a walking stick provide some insight into the sort of care that that a later medieval hospital may have offered. The discovery of part of a late medieval wall in the cemetery may have been part of a building, or have served to demarcate parts of the cemetery. If the latter, it is noticeable that the eastern and southern parts of the cemetery did not have distinctive demographic profiles, although the burials in the eastern area were considerably more densely arranged and there was more evidence of intercutting of burials.

Bibliography

Anderson, R. C. E. and Brockmeyer, D. L. 2008. Congenital Vertebral Anomalies. In A. L. Albright, P. D. Adelson and I F. Pollack (eds), *Principles and Practice of Paediatric Neurosurgery*, pp. 425-43. New York: Thieme Medical Publishers Inc.

Archaeological Data Service 2004. *Hospital of St. Mary Magdalene*. Available at: http://ads.ahds.ac.uk/catalogue/search/fr.cfm?rcn=NMR_NATINV-320871

Atkins, R. and Popescu, E. 2010. Excavations at the hospital of St Mary Magdalen, Partney, Lincolnshire, 2003. *Medieval Archaeology* 54: 204-70

Aufderheide, A. and Rodríquez-Martin, C. 1998. *The Cambridge Encyclopaedia of Human Palaeopathology*. Cambridge: Cambridge University Press

BABAO *Code of Ethics* 2008. Available at: http://www.babao.org.uk/index/ethics-and-standards

Bass, W. M. 1971. *Human Osteology: a laboratory and field manual of the human skeleton*. Colombia: Missouri Archaeological Society

Bishop, M. W. 1983. Burials from the cemetery of the hospital of St Leonard, Newark. *Transactions of the Thoroton Society* 87: 23-35

Boddington, A. 1996. *Raunds Furnells: the Anglo Saxon church and churchyard*. London: English Heritage

Brickley, M. 2004. Determination of sex from archaeological skeletal material and assessment of parturition. In M. Brickley and J.I. McKinley (eds), *Guidelines to the standards for recording human remains*, pp. 23-5. IFA paper no. 7. Southampton and Reading: BABAO and the IFA

Brickley, M. and McKinley, J. I. 2004. *Guidelines to the Standards for Recording Human Remains*. Available at: http://www.babao.org.uk

Brooks, S. and Suchey, J. M. 1990. Skeletal age determination based on the os pubis: a comparison of the Acsádi-Nemeskéri and Suchey-Brooks methods. *Human Evolution* 5: 227-38

Bruce, G., McIntyre, L. and Chamberlain, A. T. in prep.. *Excavation of the Medieval Church and Cemetery of All Saints, Fishergate*

Cardwell, P. 1995. The hospital of St Giles by Brompton Bridge, North Yorkshire. *Archaeological Journal* 152: 109-245

Carlin, M. 1989. Medieval English hospitals. In L. Granshaw and R. Porter (eds), *The Hospital in History*, pp. 21-39. The Wellcome Institute Series in the History of Medicine. Wellcome Institute: London

Chamberlain, A. T. 2000. Problems and prospects in palaeodemography. In M. Cox and S. Mays (eds), *Human Osteology in Archaeology and Forensic Science*, pp. 101-15. London: Greenwich Medical Media

Chamberlain, A. T. 2006. *Demography in Archaeology*. Cambridge: Cambridge University Press

Chan, B. 2006. *Archaeological Mitigation of land surrounding Bawtry Hall, Bawtry, South Yorkshire*. Unpublished ARCUS report 944.2: University of Sheffield

Church of England/ English Heritage 2005. *Guidance for Best practice for treatment of Human Remains Excavated from Christian Burial Grounds in England*. London: English Heritage/ Church of England

Clay, R. 1909. *The Medieval Hospitals of England*. London: Eyre

Coale, A. J. and Demeny, P. 1983. *Regional Model Life Tables and Stable Populations*. London: Academic Press

Conheeney, J. 1997. The human bone. In C. Thomas, B. Sloane and C. Phillpotts (eds), *Excavations at the Priory and Hospital of St Mary Spital, London*, pp. 218-31. London: Museum of London Archaeology Service

Cox, M. and Roberts, C. 2003. *Health and Disease in Britain, from Prehistory to Present Day*. Stroud: Sutton Publishing Ltd

Craig, E. in press. The medieval hospital at Grantham. In D. Start and D. Stocker (eds), *The Making of Grantham: the medieval town*. Lincoln: Heritage Trust of Lincolnshire

Cumberpatch, C. and Dunkley, A. 1996. *Excavations at 16-20 Church Street, Bawtry, South Yorkshire*. British Archaeological Research Report 248. Oxford: Tempus Reparatum

Dawes, J. D. and Magilton, J. R. 1980. *The Cemetery of St Helen-on-the-Walls, Aldwark*. The Archaeology of York: The Medieval Cemeteries 12/1. London: Council for British Archaeology

English Heritage 1991. *Management of Archaeological Projects*. Available at: http://www.eng-h.gov.uk/guidance/map2/

English Heritage National Monuments Record 2007. *Hospital of St. Mary Magdalene*. Available at: http://pastscape.english-heritage.org.uk/hob.aspx?hob_id=320871

Farley, M. and Manchester, K. 1989. The cemetery of the leper hospital of St Margaret, High Wycombe, Buckinghamshire. *Medieval Archaeology* 32: 82-9

Freeth, C. 2000. Dental health in British Antiquity. In M. Cox and S. Mays (eds), *Human Osteology in Archaeology and Forensic Science*, pp. 227-37. London: Greenwich Medical Media

Gilchrist, R. 1992. Christian bodies and souls: the archaeology of life and death in later medieval hospitals. In S. Bassett (ed.), *Death in Towns: urban responses to the dying and the dead, 100-1600*, pp. 101-18. Leicester: Leicester University Press

Gilchrist, R. and Sloane, B. 2005. *Requiem: The Medieval Monastic Cemetery in Britain*. London: Museum of London Archaeology Service

Gowland, R. L. and Chamberlain, A. T. 2005. Detecting plague: palaeodemographic characterisation of a catastrophic death assemblage. *Antiquity* 79: 146-57

Hadley, D. M. 2001. *Death in Medieval England*. Stroud: Tempus Publishing Ltd

Hadley, D. M. 2010. Burying the socially and physically distinctive in later Anglo-Saxon England. In J. Buckberry and A. Cherryson (eds), *Burial in Later Anglo-Saxon England, c.650-1100*, pp. 101-13. Oxford: Oxbow

Harrison, A. C. 1969. Excavations on the site of St. Mary's hospital, Stroud. *Archaeology Canterbury* 84: 139-60

Hillson, S. 1996. *Dental Anthropology*. Cambridge: Cambridge University Press

Holst, M. 2005. Artefacts and environmental evidence: the human bone. In C. A. Spall and N. J. Toop, *Blue Bridge Lane and Fishergate House, York. Report on Excavations: July 2000-July 2002*. Archaeological Planning and Consultancy, available at: http://www.archaeologicalplanningconsultancy.co.uk/mono/001/rep_bone_hum1a.html

Hunter, J. 1828. *South Yorkshire*. London: J.B. Nichols

Institute of Field Archaeologists 2008. *Standard and Guidance for Archaeological Excavation*. Available at: http://www.archaeologists.net/modules/icontent/inPages/docs/codes/exc2.pdf

Jefferson, P. 2002. *Archaeological Desk-Based Assessment of land near Bawtry Hall, Bawtry, South Yorkshire*. Unpublished ARCUS Report: University of Sheffield

Kelley, M. A. and Micozzi, M. S. 1984. Rib lesions in chronic pulmonary tuberculosis. *American Journal of Physical Anthropology* 65 (4): 381-86

Knüsel, C. J., Göggel, S. and Lucy, D. 1997. Comparative degenerative joint disease of the vertebral column in the medieval monastic cemetery of the Gilbertine Priory of St Andrew, Fishergate, York, England. *American Journal of Physical Anthropology* 103: 481-495

Krogman WM. 1962. *The Human Skeleton in Forensic Medicine*. Springfield, Illinois: Charles C. Thomas

Krogman, W. M., and Işcan, M. Y. 1986. *Human Skeleton in Forensic Medicine*. Springfield, IL: Charles C. Thomas

Lee, F. and Magilton, J. 1989. The cemetery of the hospital of St. James and St. Mary Magdalene, Chichester – a case study. *World Archaeology* 21 (2): 273-282

Lee, F., and Magilton, J. 2008. Physical anthropology. In J. Magilton, F. Lee and A. Boyleston (eds), *Lepers Outside the Gate: excavations at the cemetery of the hospital of St James and St Mary Magdalene, Chichester, 1986-7 and 1993*, pp. 150-6. CBA Research Report 158. York: Council for British Archaeology

Leech, R. H. and McWhirr, A. D. 1982. Excavations at St. John's hospital, Cirencester. *Transactions of the Bristol and Gloucester Archaeological Society* 100: 191-209

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

Lewis, M. E. 2004. Endocranial lesions in non-adult skeletons; understanding their aetiology. *International Journal of Osteoarchaeology* 14: 82-97

Liebe-Harkort, C., Ástavaildsdóttir, Á. and Tranæus, S. 2009. Quantification of dental caries by osteologists and odontologists – a validity and reliability study. *International Journal of Osteoarchaeology* 20 (5): 525-39

Lieverse, A. R. 1999. Diet and the aetiology of dental calculus. *International Journal of Osteoarchaeology* 9: 219-232

Lovejoy, C. O., Meindl, R. S., Pryzbeck, T. R. and Mensforth, R. P. 1985. Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of adult skeletal age at death. *American Journal of Physical Anthropology* 68: 15-28

McIntyre, L. and Hadley, D. M. forthcoming. *Excavations at the Medieval Hospital of St Mary Magdalene, Bawtry, South Yorkshire*

Mahoney-Swales, D. in progress. *Bridging Biological Anthropology and Social Archaeology to Explore the Differing Social Conditions Encountered in Urban and Rural Contexts in later Anglo-Saxon England*. University of Sheffield PhD thesis

Mahoney-Swales, D., and Nystrom, P. 2009. Skeletal manifestation of non-adult scurvy from early medieval Northumbria: The Black Gate Cemetery, Newcastle-upon Tyne. In M. E. Lewis and M. Clegg (eds), *Proceedings of the Ninth Annual Conference of the British Association for Biological Anthropology and Osteoarchaeology*, pp. 31-41. BAR International Series 1918. Oxford: Archaeopress

Manchester, K. 1983. *The Archaeology of Disease*. Bradford: University of Bradford

Maresh, M. M. 1970. Measurements from roentgenograms. In R. W. McCammon (ed.), *Human Growth and Development*, pp. 157-200. Springfield, IL: Charles C. Thomas

Mays, S. 2007. A likely case of scurvy from early Bronze Age Britain. *International Journal of Osteoarchaeology* 18 (2): 178-87

Miles, A. E. W. 1963. Dentition in the estimation of age. *Journal of Dental Research* 42: 255-63

Modic, M. T., and Ross, J. S. 2007. Lumbar degenerative disk disease. *Radiology* 245: 43-61

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

O'Neill, R. and Jackson, R. 2007. *Archaeological Watching Brief at Bawtry Hall, Doncaster, South Yorkshire*. Unpublished ARCUS Report no. 944c.1: University of Sheffield

Ordnance Survey. 2006. *Doncaster, Conisborough, Maltby and Thorne*. Sheet 279, 1: 25,000

Page, W. 1906. *A History of the County of Nottingham, Vol. 1*. London: Victoria County History

Page, W. 1910. *A History of the County of Nottingham, Vol. 2*. London: Victoria County History

Parsons, J. E. 1968. Archaeological observations at Kepier hospital, 1961. *Transactions from the Durham and Northumberland Antiquities and Archaeological Society*, new series 1: 59-71

Peck, W. 1813. *A Topographical History and Description of Bawtry and Thorne, with the villages adjacent*. Doncaster: Thomas and Hunsley

Pfirrmann, C. W. A., and Resnick, D. 2001. Schmorl's nodes of the thoracic and lumbar spine: radiographic-pathologic study of prevalence, characterisation, and correlation with degenerative changes of 1,650 Spinal Levels in 100 cadavers. *Radiology* 219: 368-74

Phillips, D. and Heywood, B. 1995. *Excavations at York Minster Volume 1 – From Roman Fortress to Norman Cathedral*. London: HMSO

Pre-Construct Archaeology 2003. *Land Adjacent to Bawtry Hall, Tickhill Road, Bawtry, South Yorkshire: an archaeological field evaluation and buildings appraisal*. Unpublished PCA Report

Price, R. 1998. *St. Bartholomew's Hospital, Bristol: the excavation of a medieval hospital, 1976-8*. York: CBA

Rawcliffe, C. 2007. The earthly and spiritual topography of urban hospitals. In K. Giles and C. Dyer (eds), *Town and Country in the Middle Ages: contrasts, contacts and interconnections, 1100-1500*, pp. 251-74. Society for Medieval Archaeology Monograph 22. Leeds: Maney

Reynolds, A. 2009. *Anglo-Saxon Deviant Burial Customs*. Oxford: Oxford University Press

Rogers, J., Waldron, T., Dieppe., P. and Watt, I. 1987. Arthropathies in palaeopathology: The basis of classification according to most probable cause. *Journal of Archaeological Science* 14: 179-93

Rogers, J. 2000. The palaeopathology of joint disease. In M. Cox and S. Mays (eds), *Human Osteology in Archaeology and Forensic Science*pp, pp. 163-82. London: Greenwich Medical Media

Scheuer, L. and Black, S. 2000. *Developmental Juvenile Osteology*. London: Academic Press

Schmitt, D. P. 2005. Fundamentals of human mating strategies. In D. M. Buss (ed.), *The Handbook of Evolutionary Psychology*, pp. 258-91. London: John Wiley and Sons

Sloane, B. and Malcolm, G. 2004. *Excavations at the Priory of the Order of the Hospital of St. John of Jerusalem, Clerkenwell*. London: Museum of London Archaeology Service

Smith, G. H. 1979. The excavation of the hospital of St. Mary, Ospringe, commonly called the Maison Dieu. *Archaeology Canterbury* 95: 81-184

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

Soames, J. V., and Southam, J. C. 1985. *Oral Pathology*. Oxford: Oxford University Press

Steele, D. G. and Bramblet, C. A. 1988. *The Anatomy and Biology of the Human Skeleton*. College Station, Texas: Texas A&M University Press

Stirland, A. 2009. *Criminals and Paupers: the graveyard of St Margaret Fyebriggate in Combusto, Norwich*. Gressenhall: East Anglian Archaeology

Thomas, C., Sloane, B. and Phillpotts, C. 1997. *Excavations at the Priory and Hospital of St. Mary Spital, London*. MoLAS monograph 1. London: Museum of London Archaeology Service

Trotter, M. 1970. Estimation of stature from intact long bones. In T. D. Stewart (ed.), *Personal Identification in Mass Disasters*, pp. 71-83. Washington D. C.: Smithsonian Institution Press

Waldron, T. 1994. *Counting the Dead: The Epidemiology of Skeletal Populations*. Chichester: Wiley and Son

Waldron T. 2007. *St Peter's, Barton-upon-Humber, Lincolnshire: a parish church and its community. Volume 2. The human remains*. Oxford: Oxbow

Walker, K. 1990. *Guidelines for the Preparation of Excavation Archives for Long Term Storage*. London: UKIC Archaeology Section

White, T. D. 2000. *Human Osteology*. London, Academic Press

Appendix A: Burial Licence

LICENCE FOR THE REMOVAL OF HUMAN REMAINS

The Secretary of State, in exercise of the power vested in him by section 25 of the Burial Act 1857 (20 & 21 Vic., cap.81), grants a licence for the removal of the remains of **persons unknown** from the place in which they are now interred at **Bawtry Lodge Hall, Tickhill Road, Bawtry, Doncaster, South Yorkshire**

2. It is a condition of this licence that the following precautions shall be observed:

   (a) The removal shall be effected with due care and attention to decency;

   (b) The ground in which the remains are interred shall be screened from the public gaze while the work of removal is in progress;

   (c) The removal shall be to the satisfaction of the environmental health officer for the district in which the remains are at present interred and in accordance with any additional conditions they may impose;

   (d) The remains shall be reinterred, as soon as practicable, and in any event no later than within two years of the date of disinterment, in a burial ground in which interments may legally take place. In any intervening period they shall be kept safely, privately and decently.

3. This licence merely exempts those from the penalties, which would be incurred if the removal took place without a licence. It does not in any way alter civil rights. It does not confer the right to bury the remains in any place where such right does not already exist.

4. This licence expires on **22 June 2011.**

Paul Ansell

Paul Ansell
on behalf of the Secretary of State for Justice

Ministry of Justice

Licence Number: **10-0098**
File Number: **OPR/072/61**
Date: **23 June 2010**

Appendix B: Context List

*It should be noted that grave cuts were not visible during excavation, and therefore the grave cuts listed in the context list were the cuts made during excavation to facilitate removal of skeletal remains.

Context	Type	Description
1001	Deposit	Tarmac
1002	Deposit	Limestone hardcore
1003	Deposit	Brick rubble layer below (1002)
1004	Fill	Fill of [1005]
1005	Cut	Cut of 2007 trench
1006	Deposit	Mid-yellow brown sandy silt graveyard soil
1007	Fill	Fill of [1008]
1008	Cut	Cut of square post-hole into (1006)
1009	Fill	Fill of [1010]
1010	Cut	Cut of N-S pipe trench through (1006) and (1021)
1011	Fill	Fill of [1012]
1012	Cut	Cut of N-S pipe trench through (1013) and (1021)
1013	Deposit	Mid-yellow brown sandy silt graveyard soil
1014	Fill	Fill of [1015]
1015	Cut	Cut of E-W pipe trench through (1013) and (1017)
1016	Structure	E-W brick structure in construction cut [1074]
1017	Deposit	Mid-yellow brown sandy silt graveyard soil
1018	Fill	Fill of [1019]
1019	Cut	Cut of shallow feature in (1013)

SK 1020	Skeleton	Inhumation in grave cut [1023]
1021	Deposit	Mid-yellow brown sandy silt graveyard soil
1022	Fill	Fill of grave [1023]
1023	Cut	Grave cut for SK 1020, in (1013)
1024	Fill	Fill of grave [1026]
SK 1025	Skeleton	Inhumation in grave cut [1026]
1026	Cut	Grave cut for SK 1025 and SK 1038, in (1006)
1027	Fill	Fill of grave [1029]
SK 1028	Skeleton	Inhumation in grave cut [1029]
1029	Cut	Grave cut for SK 1028, in (1013)
1030	Fill	Fill of grave cut [1032]
SK 1031a	Skeleton	Inhumation in grave cut [1032]
1032	Cut	Grave cut for SK 1031a, in (1006)
1033	Fill	Fill of grave cut [1035]
SK 1034	Skeleton	Inhumation in grave cut [1035]
1035	Cut	Grave cut for SK 1034, in (1006)
1036	Void	Voided context
1037	Void	Voided context
SK 1038	Skeleton	Inhumation in grave cut [1026]
1039	Cut	Cut truncating SK 1025 and SK 1038
1040	Fill	Fill of grave cut [1042]
SK 1041	Skeleton	Inhumation in grave cut [1042]
1042	Cut	Grave cut for SK 1041, in (1017)
1043	Fill	Fill of grave cut [1045]

SK 1044	Skeleton	Inhumation in grave cut [1045]
1045	Cut	Grave cut for SK 1044, in (1017)
1046	Fill	Fill of grave cut [1048]
SK 1047	Skeleton	Inhumation in grave cut [1048]
1048	Cut	Grave cut for SK 1047, in (1017)
1049	Fill	Fill of grave cut [1051]
SK 1050	Skeleton	Inhumation in grave cut [1051]
1051	Cut	Grave cut for SK 1050, in (1017)
1052	Fill	Fill of grave cut [1054]
SK 1053	Skeleton	Inhumation in grave cut [1054]
1054	Cut	Grave cut for SK 1053, in (1017)
1055	Fill	Fill of grave cut [1057]
SK 1056	Skeleton	Inhumation in grave cut [1057]
1057	Cut	Grave cut for SK 1056, in (1017)
1058	Fill	Fill of grave cut [1060]
SK 1059	Skeleton	Inhumation in grave cut [1060]
1060	Cut	Grave cut for SK 1059, in (1017)
1061	Fill	Fill of grave cut [1063]
SK 1062	Skeleton	Inhumation in grave cut [1063]
1063	Cut	Grave cut for SK 1062, in (1017)
1064	Fill	Fill of grave cut [1066]
SK 1065	Skeleton	Inhumation in grave cut [1066]
1066	Cut	Grave cut for SK 1065, in (1017)
1067	Fill	Fill of grave cut [1069]

SK 1068	Skeleton	Inhumation in grave cut [1069]
1069	Cut	Grave cut for SK 1068, in (1017)
1070	Fill	Fill of grave cut [1072]
SK 1071	Skeleton	Inhumation in grave cut [1072]
1072	Cut	Grave cut for SK 1071, in (1017)
1073	Fill	Fill of construction cut [1074]
1074	Cut	Construction cut for structure [1016], in (1017)

Appendix C: Results of radiocarbon dating of skeletal material from 2007 excavations