YORK ARCHAEOLOGICAL TRUST

SOUTH TRANSEPT LIFT SHAFT,

YORK MINSTER

EXCAVATION AND FABRIC RECORDING REPORT

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YAT York Archaeological Trust

AOD Above Ordnance Datum

BGL Below Ground Level

SUMMARY

A small excavation for a lift shaft in the South Transept of York Minster identified a sequence of activity dating from the immediate post-Roman period until the construction of the current Transept in c.1225. The main phases and points of note, from earliest to latest activity, comprise:

- *Post-Roman 'dark earth' deposits typical of York*
- *Possible post-Roman/early Anglian structural postholes in the area of the former principia*
- *A coin of Archbishop Eanbald II (c.796-830) from a secure deposit of 'dark earth'*
- *Evidence for the systematic demolition of Roman principia walls from 9th-11th centuries*
- *Possible evidence for an Anglian cemetery*
- *A late Anglo-Scandinavian cist tomb burial of mid-11th century date*
- *Construction deposits from Archbishop Thomas of Bayeux's Norman Minster of c.AD1080*
- *Construction deposits from Archbishop Walter De Grey's South Transept of AD 1225, with evidence of 13th century construction techniques and charnal disposition practises*

1. INTRODUCTION

A small excavation was undertaken in advance of the installation of a lift in the South Transept of York Minster between 5th March and 11th April 2012. Removal of partition walling exposed elevations of the transept west aisle foundations, which were also recorded. The works were required and funded by York Minster under the Heritage Lottery Fund supported York Minster Revealed project, a programme of major improvements to the visitor access and experience of the cathedral.

2. METHODOLOGY

The excavation began from the floor level at the base of the stairway that provides access to the Minster undercroft from the west aisle of the South Transept. The lower floor is at 14.36m AOD, some 2.62m below the main floor of the cathedral. The trench measured 2.7m x 2.9m and was excavated to a depth of 1.6m BGL/12.76m AOD. It was located in a previously partitioned area formerly used as a staff-room (Figure 2).

The access to the undercroft was created during the emergency engineering programme of 1967-1973 (see **4** below), and was lined with a layer of concrete up to 0.50m thick. This concrete was removed prior to the excavation by using a core-drill to break it into relatively small sections that could be lifted out. This technique produced the 'scalloped' trench edge visible in the photographs (cover plate).

Excavation was undertaken exclusively by hand under artificial lighting, using standard YAT recording and sampling procedures. In addition to standard environmental sampling, six soil micromorphology samples were taken, of which one was analysed to assess the potential of this technique to understand the deposit sequence. The artefacts, records and sample residues are currently stored at YAT under the accession code YMM/DC/2012/001, project number 5104C.

The removal of the staff-room partition walls prior to the excavation revealed extensive elevations of the South Transept west aisle foundations, not seen since the 1970s. These were recorded and are included in this report.

3. LOCATION, GEOLOGY AND TOPOGRAPHY

York Minster is located in the northern quadrant of the historic walled city (Figure 1). The geology of the area consists of drift deposits of Devensian glacial till overlying bedrock of the Sherwood Sandstone group (http://maps.bgs.ac.uk/geologyviewer/, accessed 31/07/2012). The topography of the wider area is generally flat, sloping down gradually to the River Ouse to the south and south-west, but the trench was effectively divorced from this landscape by being located inside a large building with a complex structural history that has substantially altered the topographical context. The deposits and features are therefore best understood within a re-constructed landscape derived from the extensive previous archaeological investigations at York Minster, summarised below.

4. ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

The history and archaeology of York Minster, from the documentary records of a church in c.627 to the Gothic structure completed c.1450, have been extensively published in many readily available sources and only the briefest summary is offered here.

The cathedral occupies the site of the legionary headquarters of Roman *Eboracum*, the remains of which were discovered during extensive excavations undertaken between 1967

and 1973, initially by Royal Commission archaeologists Brian Hope-Taylor and Herman Ramm, and then by Derek Phillips under the Archaeological Advisory Committee (Phillips, 1985, 28-46). These excavations created the Undercroft, and were conducted during an emergency engineering programme, necessitated by the rapid deterioration of the tower fabric due to the accelerating failure of the foundations (Phillips, 1995, 16-22). The requirements of a huge under-pinning operation required the excavation of most of the crossing and much of the eastern arm in a series of non-consecutive trenches that were, in the main, excavated rapidly by labourers under the barest of archaeological supervision (Figure 2).

Commencing with the extensive Roman structures and deposits, a long and nationally important sequence was revealed. Tantalising evidence for the immediate post-Roman fate of the *basilica* building of the *principia* was published along with the Roman phases in *Excavations at York Minster: Volume 1* (1995). Also included in this volume was an Anglo-Scandinavian cemetery that overlay the collapsed remains of the *principia* and extensive deposits of 'dark earth'. This cemetery was focussed in the area of the *basilica* and was held to be a development of an earlier, Anglian, graveyard that has huge potential significance for the early history of the Minster. Cut through this, and published in *Excavations at York Minster: Volume 2* (1985), were the foundations of the Norman cathedral of Archbishop Thomas of Bayeux of 1080. Extensively modified in the 12th century under Archbishop Roger Pont L'Evêque (Stuart Harrision, pers. comm.), this structure was then replaced in the Gothic style between c.1225 and c.1450, producing the current cathedral comprehensively analysed by Sarah Brown in *York Minster, An Architectural History c 1220-1500* (2003).

The stairway from the South Transept into the undercroft was created in 1972 following the decision to maintain an open space below the cathedral floor as a visitor attraction to display the extensive foundations revealed during the engineering operation (C Norton, pers. comm.). The north end of the South Transept west aisle had been excavated by 1969 during the main phase of the engineering programme in two trenches, labelled in the archive SC and SB, the latter of which was part of a group dug with far greater archaeological control than previously (Phillips, 1995, 21; Figure 2). The undercroft access stairwell and the lower landing were rapidly dug out to a depth of c.2.6m below the main floor as areas SE and SF, for which very few records were made. Taken together, the archaeological remains in this area spanned the front range of the *basilica* and its courtyard, which were sealed beneath the extensive rubble of the collapsed Roman buildings and then 'dark earth'. The Anglo-Scandinavian cemetery, discovered in the main part of the South Transept (area ST), was not located in the South Transept west aisle, but it is possible that the evidence for this was obliterated by the construction cuts for the Norman cathedral, and the later 13th century

foundations of the current cathedral, which respectively formed the eastern and western boundaries of areas SB, SC, and SE. The truncated construction cuts of these structures were located in the lift shaft excavation; their original extent was removed with minimal record in the 1970s when the upper 2.6m of deposits were excavated to create the sub-floor space where the 2012 excavation took place (Plate 25).

5. RESULTS

5.1 PHASE 1: LATE ROMAN/EARLY POST-ROMAN ACTIVITY

The earliest identified phase of activity represents the lowest deposits and features reached at the depth limit of the excavation and not the earliest deposits and features likely to be present in this area and now preserved *in situ* beneath the lift structure.

The earliest identified group of deposits, at c.12.90m AOD, consisted of extensive grey-brown clayey silts (1069, 1066) containing significant quantities of Roman CBM, limestone fragments, mortar and plaster, along with oyster shell and animal bone (Plates 1, 14 & 15; Figures 8 & 9). These deposits were interpreted as 'dark earth', a mixture of demolition material and garden soils, deriving from the probable abandonment of the *principia* as it gradually collapsed in a landscape with minimal human activity in the post-Roman period. A small amount of disarticulated human bone could suggest nearby cemeteries, or the redeposition of graveyard soils, but could also derive intrusively from the large cut features of phases 4 and 7 which contained significant quantities of human bone. The hand-collected animal bone seems to show an elevated presence of younger pig, which may reflect a similar trend noted in the 1970s excavations and interpreted by some as indicative of feasting activities in the late Roman or possibly the post-Roman *principia* (Gerrard, 2007, 306; see Appendix 9). The evidence gleaned from the processed samples, however, suggests a wider range of animal ages that are more suggestive of pig-keeping rather than consumption. This supports a model of an essentially abandoned area, with some background agricultural activity.

Deposit 1066 may have accumulated against a structure along its north-eastern edge, no further trace of which survived, but while it is possible that some intentional demolition is represented in deposits 1069/1066, it is more likely that this is demonstrated by the deposits immediately overlying them, 1065 and 1062 (Plates 2, 14 &15; Figures 8 & 9). These were far sandier and mortary in character, and contained proportionally less soil and organic material than demolition rubble, suggesting rapid deposition. Besides the considerable quantity of Roman CBM and plaster, the only Phase 1 context which contained any pottery

was 1069, amounting to 3 abraded sherds of grey-ware that could easily be residual. It is difficult, therefore, to be certain whether Phase 1 represents a late Roman re-working of the *principia* as argued by Phillips (1995, 195) or perhaps late Roman decline and then post Roman abandonment and dereliction. Given the relative inactivity suggested by the environmental sample of 1069 and the animal bone (Appendices 9 & 10), the latter seems more likely; the case for late Roman re-building in the *principia* has also been questioned by later analyses (Ottaway, 2004, 146).

The final activity of this phase is perhaps the most significant for either hypothesis. Cut into demolition deposit 1065 were two large postholes, 1060/1063 and 1061/1064 (Plates 1 & 2, Figures 3, 4 & 9). Cut 1063 was the larger of the two, measuring 0.64 x 0.52 x 0.42m deep. Cut 1064 was 0.80m to the north-east, and measured 0.52 x 0.39 x 0.38m deep. Both were steeply sloping with slightly concave bases, and although neither contained a post-pad or substantial amounts of packing material, their scale suggests they had a structural purpose. Their backfills contained snail species that favour densely vegetated areas, supporting the idea that the *principia* had become overgrown and little-used by the time the posts were lifted or rotted *in situ*. They are not necessarily contemporary, and there are too few to be confident of a meaningful alignment, but if one accepts that they were dug together and relate to each other then they lie on a line perpendicular to the nearby south-west wall of the *basilica* (Figure 4). They may relate to a late-Roman structure, possibly a scaffold to support the roof of the north-west wing, left behind to rot after abandonment in the early 5th century. Alternatively, if the underlying deposits represent post-Roman abandonment, these postholes may be the remains of an early post-Roman addition to the courtyard of the former *principia*.

5.2 PHASE 2: POSSIBLE ANGLIAN ACTIVITY

This phase consists of a single context, 1058, a layer of firm, dark brown grey, slightly clayey course sandy silt up to 0.50m thick that covered most of the trench save the upper elements of deposit 1066 at the southern end (Plates 3 & 14; Figures 8 & 9). 1058 contained appreciable quantities of abraded Roman CBM and limestone fragments along with mortar fragments and a single sherd of Roman glass. The environmental samples produced abundant evidence for plants typical of improved soils, but without the cereals associated with cultivation, along with a proportionally high quantity of snails that favour a dry, open environment. This data contributes to an interpretation of 1058 as an example of the 'dark earth' phenomenon noted in the post-Roman phases of many British urban sites (Ottaway, 2004, 146; Macphail *et al*, 2002, 350; see Appendix 10). The micromorphological analysis identified evidence for rapid deposition in the upper surface of 1058, suggesting that the process which formed it may have been on-going immediately prior to the activity in Phase 3

(Appendix 11). Deposit 1058 may therefore support the 'abandonment' or 'ruralised' interpretation of the *principia* area offered above, and as such may render the Phase 1 structural features a brief, perhaps temporary moment of activity, in an otherwise derelict landscape.

Continuity of relative inactivity is supported by the animal bone, save that the presence of pig notably declines in this phase. This may signify nothing more than the declining presence of residual Roman material over time, rather than a clear chronological break from the earlier phase. There is, however, further evidence for such a break. The samples from 1058 produced a single coin, identified as a sceatta of Archbishop Eanbald II, dating from AD796 – c.830, moneyed by Eadwine (Plates 30 & 31). Previous examples of this combination of authority and moneyer have been dismissed as 19th century forgeries (discussed in detail by the author and Dr Gareth Williams of the British Museum in Appendix 4), but analysis of the coin's metal content, together with the stratigraphic integrity of deposit 1058, demonstrates this example is genuine and, moreover, unique. This places the earliest possible deposition of the 1058 'dark earth' firmly in the mid-Anglian period, a century after the earliest recorded Anglian activity in York (Rollason, 1998, 46) and in a location where one might expect more evidence of earlier activity. A discussion of the post-Roman implications of Phases 1 and 2 appears below in **6**, but a late 8th/early 9th century date for 1058 provides a potentially significant *terminus ante quem* for the markedly increased activity of phase 3.

5.3 PHASE 3: PRE-CONQUEST DEMOLITION ACTIVITY

The next group of deposits directly overlay the 'dark earth' of 1058. While it is possible that a clearance occurred beforehand, truncating the lower material and removing any evidence for activity, this is not supported by the micromorphological analysis of the boundary between 1058 and the Phase 3 deposits. Although most of the Phase 3 molluscs and uncarbonised plant remains suggest a continuity of open grassland, it is likely that these represent disturbed residual remains, as there were also indications of deposits representing a wetter environment that may reflect imported material associated with the resumption of activity. This pattern may be reflected in the animal bone assemblage by an apparent increased presence of micro-fauna, which could be interpreted as a rise in rodents alongside a renewed human presence, although this could also reflect biases in the sampling (C Rainsford, pers com). What is most suggestive is that the earliest Phase 3 demonstrates that the walls of the *basilica* remained above ground during Phase 2 and may therefore have provided a context for any earlier activity.

A series of steeply angled sandy silts, contexts 1053-1055, and 1070-1073, were identified in the north-eastern corner of the trench (Plates 4 & 14, Figures 8 & 9). Although they were

truncated to the east by the construction cut of the 13th century arcade wall foundation (1019), they retained a distinct pattern of deposition, radiating away from the north-east corner for approximately a metre and forming a pitched bank of laminated deposits up to 0.45m thick that gave the impression of having developed in relation to a feature beyond the north east corner of the trench. All the deposits sloped downwards from north-east to south-west and contained significant quantities of Roman CBM, limestone fragments, mortar, plaster and charcoal. A degree of trampling was suggested in the banding of rubble-rich layers and thinner, more silty deposits with refuse remains. Taken together, this suggested the successive deposition of material in the process of demolishing a nearby structure. The micromorphological analysis of the lower four contexts in this group suggested alternating periods of rapid deposition, sealing earlier layers before soil development could begin, with 'quieter' periods of at least several months when some plant growth had begun to re-establish. These periods were not prolonged, however, as further deposition occurred before the full development of soils could occur (Appendix 11). The large quantities of mortar and limestone are thought to derive from the *in situ* cleaning and preparation of stonework for re-use, with the CBM and the charcoal, which was mainly oak, representing other structural elements. The remains of the *basilica* are suggested as the most likely source, as its front (south-west) wall lies within 3 metres of the trench on a north-west – south east axis that accords well with the profile of these Phase 3 deposits. Taken with the evidence for the rapid deposition punctuated by relatively brief pauses in activity, and the possible re-dressing of building materials, this strongly suggests an organised process of demolishing the *principia* structures rather than a gradual process of decay. This interpretation is partly founded on a series of very similar deposits described in the published Minster sequence, and is discussed in section **6**.

The banked demolition material was overlain by two levelling dumps of very similar material, 1057 and 1059, before resuming with a further sequence of banked demolition deposits, 1049-1052 (Plate 14, Figures 8 & 9). This second sequence of banked material was slightly sandier than the lower one, but contained similar quantities of demolition rubble and residual Roman pottery albeit with greater quantities of probable domestic refuse in the form of animal bone and oyster shell. This sequence followed the earlier profile, overlying the earlier bank and extending it by up to 1m to the south, and the plant and invertebrate remains confirmed the continuity of trampled demolition spreads in a waste ground environment from the earlier group. The final layer in this sequence, 1049, appeared more heavily trampled, suggesting it was the final element of this activity and represented a possible working surface at around 13.30-13.60m AOD as it levelled off to the south to a greater extent that those beneath it. The two sequences of banked material, separated by dumping, are thought to be closely related in origin and time, following the pattern observed micromorphologically

at the base of the first sequence. The second sequence did not extend the height of the banked material above 13.60m AOD but rather seemed to spread out to the west and south, suggesting either the managed deposition of waste material at the time of deposition, or possibly that the deposits have weathered and slumped away from the line of the *basilica* wall.

Along with the Roman building rubble recovered from this group were five pot sherds, four of which were certainly Roman and the fifth may be 10th century but is so abraded that a Roman date is possible (Appendix 2). However, the late 8th/early 9th century coin from the underlying Phase 2 'dark earth', together with the abraded pottery, demands a post-Roman date for this demolition activity, which was sealed beneath the deposits of Phase 4 that were in turn cut by a pre-conquest burial in Phase 5. Therefore, despite the lack of direct dating evidence to corroborate the date of the coin's deposition, it is reasonable to place Phase 3 in the Anglian or Anglo-Scandinavian periods. The implications, both of there being standing Roman structures into the 7th century, and major construction activities taking place from that date, are of national significance and are discussed below in section **6**.

Cut into the demolition sequence in the southern part of the trench was a large refuse pit, cut 1048 / fills 1049, 1045 and 1046 (Figure 9), which contained much shell along with disturbed demolition rubble and small quantities of residual Roman pottery. This pit extended across the width of the trench and beyond the southern limit of excavation, and was therefore probably more than 2m across. At only 0.28m deep with a flat base, however, it was clearly heavily truncated. It may be that a clearance took place, associated with the final deposits of Phase 3, 1035, 1044 and 1045, which were a series of firm, slightly clayey, silty sands, containing charcoal and building rubble (Figure 9). These are interpreted as a deliberate levelling of the area south-west of the now demolished *principia* to around 13.60 – 13.65m AOD, and formed a clear stratigraphic break between the demolition activity of Phase 3 and the deposits and features of Phase 4.

5.4 PHASE 4: POSSIBLE DISTURBANCE OF AN ANGLIAN CEMETERY

The Phase 4 activity commences with two large cut features, initially interpreted as pits (Figure 9). The earliest, 1044/1042, was at least 2.2m long and 1m wide, and up to 0.75m deep, aligned north-west – south east. It was completely truncated to the west by the 13th century transept foundation cut 1011, but probably extended beyond this point; it is possible that this feature was linear in plan as there was a suggestion of a parallel return slope from the south east. However, this was difficult to define because the feature had also been very heavily truncated by a second pit, cut 1040, described below. The fill of 1042, 1039, was a very mixed plastic sandy clay with limestone fragments from re-deposited demolition waste,

and also contained domestic midden and plant remains typical of open, disused ground, giving the impression of an in-fill of waste material rather than a use-deposit. This could easily represent a refuse pit, but if a linear shape in plan were accepted, it could suggest that 1042 represents a boundary feature that was intentionally back-filled. If so, it could relate to the Anglo-Scandinavian cemetery found previously beneath the Minster, whose alignment 1042 appears to respect. The Anglo-Scandinavian cemetery is interpreted as a continuation of an earlier, Anglian burial ground on this alignment (Norton, 1999, 4), and it is therefore possible that cut 1042 may represent evidence for this. The degree of truncation makes this difficult to substantiate, but not impossible.

Further evidence to support the Anglian interpretation may provided by the other Phase 4 features and deposits. As referred to above, a large sub-rectangular pit, cut 1040, measuring at least 1.7m x 1.3m by 0.33m deep, had severely truncated the possible linear feature. Pit 1040 had two fills, the lowest of which, 1037, consisted mainly of re-deposited human bone, and the other, 1036, a firm brown-grey course sand with significant amounts of human bone and a single sherd of residual Roman pottery, along with two fragments of whale bone that may indicate some disturbed craft-working waste (Appendix 9). Interpreted as a charnel pit, cut 1040 could relate to the disturbance of an early graveyard, as burials were removed following the infilling of the possible boundary ditch or pit 1042 described above. The assemblage of human bone from 1037 exhibited a good level of preservation and suggested a minimum of nine individuals (Appendix 7), although the feature extended beyond the limits of excavation so this figure is not definitive. The environmental evidence from 1037 showed proportionally high quantities of charcoal, possibly deriving from burnt grave markers and coffins, but more likely to be from charcoal-lined burials, several later examples of which were identified in the Anglo-Scandinavian graveyard excavated in the 1960s (Philips, 1995, 87). These are well known from later Anglo-Saxon burial and may have origins in earlier Anglian practice (Taylor, 2001, 178). In both 1037 and 1036, there was a lack of carbonised seeds, but an abundance of ‘weeds’ typical of the enriched soils associated with cemeteries. Throughout the Phase 4 deposits, there was a marked fall in the presence of micro-fauna, suggestive of a significant change of land-use in contrast with that of Phase 3 that may reflect the change from a demolition site to a ‘quieter’ cemetery. A shallow grave-shaped feature (1032/1033) on the Anglo-Scandinavian alignment just 0.35m north-east of the charnel pit may be an emptied burial, which could suggest a disturbed graveyard. To the south-east, a 0.50m wide, 0.17m deep sub-square cut feature may represent a robbed footing, but it was heavily truncated by the C13th foundations and cannot be interpreted further.

A clear hiatus in activity may be represented by the final deposits in Phase 4, a 0.20m thick levelling sequence of mid grey-brown silty sands (1030, 1031, 1034) that raised the ground level to around 13.75m AOD with material rich in building debris, sealing the earlier pits. This material was cut by a confirmed late Anglo-Scandinavian burial in Phase 5 (see below), suggesting that Phase 4 represents a period of re-organisation after the clearance of an early cemetery. However, an alternative interpretation of the cut features and the levelling material is that they represent the disturbance typical of the long-term use of a single graveyard rather than the destruction of one and the re-establishment of burials in the area at a later date. A single sherd of 10th century York ware from the charnel deposit 1037 may offer an early Anglo-Scandiavian date for the disturbance of an earlier cemetery, or may simply be a residual sherd in a deposit of 11th century date, created during the use of the known cemetery published by Phillips.

5.5 PHASE 5 ANGLO-SCANDINAVIAN BURIAL

This phase is represented by a single stone-lined cist burial, comprised of contexts 1021-1027 (Plates 6-10, Figures 5, 6 & 9). Only the extreme north-east end of the burial had survived, consisting of a lining of five limestone blocks (1025) and a single limestone cap (1022) surrounding a pair of *in situ* feet (1024), truncated above the metatarsals. The bones were fully formed, representing an adult of unknown sex, with a minor variation in the formation of the bone surface (see Appendix 7). A sample was sent for Accelerated Mass Spectrometry (AMS) radiometric dating at the Scottish Universities Environmental Research Centre (SUERC) (see Appendix 8). This provided a radiocarbon age BP of 929 ± 19, with a calibrated date of 1036-1158 at 95.4% probability.

The foundation cut of the C13th South Transept west wall had completely removed the rest of the tomb, which would have projected to the south-west (Figure 5); fortunately, enough had survived to be confident of its interpretation. Stylistically, the burial reflected the later Anglo-Scandinavian graves identified in the 1960s ten metres to the north east of the lift shaft trench (Philips, 1995, 85; Figures 2 and 6), as the stone lining contained similarly re-used moulded fragments, and the south-west – north-east alignment is correct. Stratigraphically, the grave was cut from c.13.75m AOD, which accords with those already known from the 11th century cemetery, and was sealed by Phase 6 deposits considered to derive from late 11th century activity. Together with this data, the earlier sector of the radiocarbon date range supports the interpretation that 1024 is therefore a burial of c.1036-1080, representing the final phase of the Anglo-Scandinavian cemetery. This is significant for two reasons. Firstly, as referred to above, it places the Phase 3 demolition deposits firmly in the pre-conquest period, and secondly, it may confirm the pattern seen in the Anglo-Scandinavian cemetery for only the last phase of burials in the mid 11th century to occur

outside the confines of the former *basilica* (Philips, 1995, 80; Figure 6). This pattern may in turn provide the context for the Phase 3 robbing of the Roman building as this presumably decrepit structure was cleared in advance of a cemetery, possibly from as early as c. AD 800 but certainly before c. AD 1000.

5.6 PHASE 6: CONSTRUCTION OF THE 11TH CENTURY CATHEDRAL

As noted above, the 1970s removal of 2.6m of deposits below the transept floor to create the undercroft entrance severely truncated the sequence exposed during this excavation. The latest Phase 6 deposits represent, at 13.82m AOD, the highest surviving archaeological deposits in this area, but must be understood to be a fraction of those that were present prior to 1972.

Sealing the Phase 5 cist burial were two dump deposits of dark brown-grey clayey sand, 1028, and soft brown sandy silt, 1020, both containing some limestone and domestic waste. These were overlain by 1013 and 1012, two spreads of yellow-brown and brown-white coarse sandy mortar, interpreted as a construction deposit relating to the building of the cathedral of AD 1080, at c.13.83m AOD. This interpretation is founded on the level of similar deposits recorded immediately to the north in area SB, which were observed to occur beneath extensive ground make-up deposits that were banked up against the face of the new Norman foundations, bringing the late 11th/early 12th century ground level up to c.15m AOD (Phillips excavation archive). The equivalent of these deposits in the lift shaft area were those removed in the 1970s and visible in the photographs (Plate 25).

5.7 PHASE 7: CONSTRUCTION OF THE 13TH CENTURY CATHEDRAL

The 1970s truncation removed a significant amount of 13th century deposits, but due to the presence of the standing fabric, substantial evidence survived to demonstrate the process of building the South Transept from c. AD 1225. The lift shaft trench was demarcated on the west by the foundations of the west wall of the west aisle, and on the east by the massive sleeper wall foundation of the arcade, which truncated the entire stratigraphic sequence in the trench (Plates 13-19, Figures 7-11).

The west aisle wall construction cut, 1011, was observed from c. 13.85m AOD as a 0.60m wide trench with near vertical sides until the break of slope at c. 13.35m AOD created a concave base, the lowest visible element of which was at c.13.00m AOD, although it is very likely that the profile continued downwards beyond the western limit of excavation. The true cut point of this foundation, however, was recorded in the 1960s at c.15m AOD. Foundation cut 1011 contained 1043, a four coursed wall of limestone blocks up to 0.40 x 0.20 x 0.20m, some of which were purpose-cut and others were re-used moulded elements of the earlier

11th and 12th century phases of the cathedral. The lowest two courses of this foundation projected into the trench by up to 0.40m and were bedded in a deposit of soft, grey lime mortar and limestone fragments. These courses were later removed; the stones are described by Stuart Harrison, York Minster Cathedral Archaeologist, in Appendix 6. The elevations of the walls visible above the top of the trench in the Undercroft stairwell were recorded by Mark Johnson and contained a significant quantity of re-used 12th century stone (Figures 15-17; Plates 26-29). The sequence of the walls above the trench is discussed further below in section 6 but it is important to state that these too are foundations. In total, therefore, the foundation of the west aisle wall is at least 3.7m deep, consisting mainly of a limestone wall approximately 2m wide on the western side and perhaps 4m wide in total.

Construction cut 1011 was packed with 1041, a loose light grey-brown sand containing large amounts of medieval construction debris and a copper alloy belt buckle (sf6, Appendix 3). This deposit was sealed beneath 1010, a compact construction backfill of limestone rubble in a coarse sandy mortar, which in turn was below 1007, a friable grey-brown coarse sand that was truncated by the 1970s limit of excavation. It is likely that, given the banded nature of the medieval construction backfills observed during the 1960s and 70s (Phillips excavation archive, Plate 25), this pattern would have continued to the original cut point some 1.15m higher up.

The western arcade of the South Transept was shown to sit upon even more substantial foundations than those seen below the aisle wall. Furthermore, it was evident that the foundations had been built in two phases, with a hiatus between them that almost certainly represents different seasons of the original building campaign.

The main construction cut, 1019, was slightly irregular, projecting 1.2m into the trench at the northern end and 0.90 at the southern. The cut point was observed at 13.80m AOD, but once again was certainly truncated in the 1970s along with the backfills and probably originated from c. 15m AOD. The base extended beyond the excavation depth limit of 12.76m AOD, demonstrating that the original foundation trench was very substantial. It may also have been open for some time as several of the deposits within it probably derived from slumping, which in turn may account for the irregular shape in plan.

The earliest observed element of the foundation was 1068, a deposit of packed irregular limestone blocks and fragments up to 0.30m across in a matrix of soft, light grey-brown sandy mortar, of which only the uppermost course was observed. The irregular and slightly crude nature of 1068 suggested that it may be the lowest element, but this could not be proven; it may, however, have been built segmentally as there appeared to be a break

approximately half-way along its length. This could also be interpreted as an attempt to in-fill a 'soft-spot' in the base of the foundation trench, possibly caused by the robbing of a post-Roman structure during the wall construction. This phenomenon has been demonstrated very clearly elsewhere in the Minster sequence but cannot be taken any further here.

Build over this deposit was 1067, a four-coursed wall of large, rough-shaped limestone blocks up to 0.80 x 0.40 x 0.20m, smaller squared blocks up to 0.20m x 0.20m x 0.20m and re-used moulded stonework of probable 12th century date, including two chamfered plinths (Stuart Harrison, pers com). The projecting elements of 1067 were removed and their stones are described in Appendix 6. Wall 1067 stood 0.60m high and projected 0.50m into the trench. Banked against its face were two deposits of yellow-brown silty sand, 1056, and mid grey-brown silty sand, 1018, both of which contained fragments of limestone and pebbles, and both of which may have derived from slumping of the construction cut, although the upper deposit 1018 contained mortar flecks that could derive from the building of 1067.

Sealing these backfills was 1016, a remarkable deposit of disarticulated human bone 0.15m deep and filling the entire length of cut 1019, extending beyond both the northern and southern limits of excavation. 1016 was so extensive that it was initially interpreted as an earlier charnel pit, cut into by the 13th century foundation trench, but during excavation it became clear that 1019 was in fact the primary construction cut, particularly as fill 1056 contained medieval CBM and fill 1018 produced 12th century masonry fragments (Appendix 5). 1016 was therefore interpreted as deriving from both the 12th century and pre-conquest cemeteries known from this area, which were disturbed by the enormous 13th century foundations. A full catalogue of the human bone was compiled by Anwen Caffell and Malin Holst of York Osteoarchaeology Ltd, and forms Appendix 7 of this report. Given the likely mixed origins of deposit 1016, it is of limited interpretative value for this excavation, save as evidence for the behaviour of the 13th century cathedral builders.

The disturbed human bone was almost certainly stock-piled before being re-interred within the foundation cut following the construction of wall 1067, the trench therefore serving a secondary purpose as a *de facto* charnel pit. It is argued that this occurred at the end of a construction season, in the autumn, as a significant quantity of frog bones were recovered from the skulls (Appendix 9). It is possible that the frogs had found in the stock-piled skulls a dark, damp place to hibernate, and had subsequently been buried alive when the charnel was packed into the foundation trench. 1016 was sealed beneath 1015, a construction backfill of friable mid grey-brown coarse sand that almost certainly represents the end of one year's building, sealing the stonework in preparation for the winter.

Deposit 1015 was cut by 1014, a north-south aligned linear trench projecting 0.40m into the trench. This trench was 0.35m deep and cut vertically down onto the lower projecting stone work of wall 1067. Set within it, and directly on top of wall 1067, was wall 1017. This was a two-coursed wall of limestone blocks up to 0.60m x 0.40m x 0.40m, which included re-used elements of the 11th century cathedral. One of these re-used blocks exhibited the red-inscribed plaster work typical of the exterior of the Norman church of AD 1080 (Stuart Harrison, pers com). Wall 1017 represents the higher element of the arcade foundation identified within the trench; as before, the exposed stonework above the trench is also a foundation.

Cut 1014 is therefore interpreted as an effective re-cut of 1019, dug in the following building season to re-expose enough of the lower stonework to site the upper element of the foundations, but not intended to fully expose 1067 as this was not necessary to construct the rest of the footing. 1014 had a subtly different alignment to 1019, suggesting a refinement of the wall-lines that is supported by the exposed walls discussed in section **6** (Figure 7). Crucially, the earliest construction backfill deposit in 1014, 1009, consisted once again purely of disarticulated human bone, obviously disturbed from deposit 1016 during the cutting of 1014. 'Construction-charnel' deposits 1009 and 1016 were very distinct. 1009 exhibited a far greater degree of sorting than 1016, with far fewer small bones surviving than in the earlier deposit, consistent with a model of repeated disturbance (see Appendix 7). Additionally, the long bones and pelvises were positioned along the line of wall 1017, in marked distinction to 1016, where the bone was randomly jumbled into the cut (Plates 11 & 12). This distinction defined secondary cut 1014, and also the intentional use of the foundation trenches as charnel pits by the 13th century cathedral builders, showing a degree of both respect and opportunistic ingenuity that has survived into modern practice.

The final construction backfill, 1008, was a loose grey-brown silty sand that was sealed beneath 1005, one of three patches of friable, dark brown-grey clayey silt (including 1004 and 1006), initially interpreted as the possible remnants of a 13th century construction spread but consequently seen as re-deposited debris during the 1970s excavation, as the true cut-point of the foundations was some 0.6m above the starting point of the lift shaft trench.

5.8 PHASE 8: MODERN ACTIVITY

The upper 0.66m of the deposits represent the creation of the undercroft entrance, and consisted of 1003, a 0.18m thick make-up deposit of compacted grey sandy silt that was overlain by a thin layer of pale grey silty clay, 1002. This in turn lay below 1001, the 0.48m thick concrete of the undercroft entrance floor, the surface of which was at 14.36m AOD.

6. DISCUSSION

A discussion of the deposits excavated in the lift shaft excavation must take place in the context of the sequence recorded in 1967-1972, supported by its stratigraphic archive. This archive includes sections recorded in area SB, some 7.3m north of the lift shaft, which provide the nearest comparable sequence (Figure 2).

The early Phase 1 deposits of dark earth and demolition rubble, identified at c.12.90m AOD, bear some similarity to the sequence of 'mud silts' and 'buff layers' found at a similar depth in the 1960s and interpreted by Phillips as evidence for robbed floors in the *basilica* that continued in active use long after the end of the Roman period, before the roof finally collapsed as late as the 9th century (Phillips, 1995, 33-74, 195). Carver, summarising the objections and alternatives to Phillips' interpretation in the same publication, has demonstrated that the mud silts can be viewed mainly as a product of gradual late 4th and early 5th century decline. The collapse of the *principia* structures occurs by the 8th century in a largely 'abandoned' landscape characterised by sporadic agricultural and industrial activity, and concerted activity is not again evident until the 9th century. (Phillips, 1995, 194-195). The complex arguments and subtly varying interpretations are too lengthy to unpack in this report, but the interpretation of the lift shaft sequence follows other analyses in tending to support Carver's model rather than Phillips' (see Tweddle, 1999, and to a lesser extent Ottaway, 2004, 149).

The term 'dark earth' is a descriptive one which is often applied loosely to a range of similar materials deposited both gradually and fairly rapidly; the common thread in Britain and across Northern Europe is a clear association with decaying Roman buildings (Macphail *et al*, 2002, 349-350). The 'dark earth' of the Phase 1 sequence does not suggest Phillips' sub-floor layers, although this may reflect the fact that this area is in the Roman courtyard rather than any of the buildings. It does however suggest at least partial abandonment and degrading of the Roman buildings, probably in the post-Roman period. The absence of firm dating evidence limits further interpretation, save that the post holes clearly represent structural activity of some sort. It is not possible to associate them with any suspected early Anglian structure such as the putative Royal enclosure or even the Minster of c. AD 627 (Tweddle, 1999, 190; Norton, 1999, 4), but they may represent modifications to the *principia* in the form of buildings within the former courtyard associated with the 'ruralised' landscape of the post 5th century suggested by Carver.

Evidence for the 5th – 8th centuries in York is notoriously scarce (Ottaway, 2004, 149), and the Phase 2 deposit 1058 contributes little further specific detail. The clean stratigraphic

break between Phase 2 and the Phase 1 postholes and rubble may suggest that a clearance took place, truncating the earlier material, prior to the deposition of deposit 1058. This may be the process that removed the posts in the phase 1 post-holes, but if correct, this event remains undated beyond it being prior to the late 8th century.

The dark earth of Phase 2 is chiefly distinguished from Phase 1 by the coin of c.796-830. As discussed in Appendix 4, previous examples of Archbishop Eanbald and the moneyer Eadwine have been proven to be 19th century fakes, but this example is almost certainly genuine. As the Phase 3 activity is interpreted as the demolition of the *principia*, it is reasonable to relate Phase 2 to the decline of this building. The Phase 3 material was banked and successively deposited in relatively thin layers, suggesting demolition, whilst 1058 was homogenous and level, right down to the microscopic layering of its constituent elements (Appendix 11), perhaps indicating a more gradual process of 'natural' dilapidation, as is argued for Phase 1. The micromorphological analysis of the upper surface of 1058 suggested rapid deposition, but as the sample only encountered the upper surface, this interpretation may not apply to the entire deposit. It is however, possible to suggest that the deposition of 1058 was an on-going process when the Phase 3 demolition started, sealing the surface of 1058 beneath the banked material before it could develop into a mature soil.

If 1058 represents an accumulative process that took many years to develop, the coin may suggest many centuries of relative inactivity following the end of the Roman occupation in the early 5th century at least into the early 9th century. The coin could also have been deposited many years after it was minted, making 1058 even later; similarly, 1058 may be re-deposited, perhaps explaining the micromorphological evidence. It is also possible that the coin is intrusively present via a cut feature from a later phase, although if this were the case the presence of a different fill type from the mortar-rich deposits above would have been obvious, and as the entire lift shaft sequence was hand excavated it is not likely that such a feature was missed. However, despite all these possible scenarios, without further analysis of the soil samples it not possible to take any one of them any further. It is reasonable to suggest a late 8th/early 9th century date is the earliest possible point at which the Phase 3 demolition could have commenced.

Derek Phillips' sequence may help to confirm the 8th/9th century date for phase 2, thereby providing a useable *terminus ante quem* for the subsequent phases, as very similar material of this date was interpreted as part of the Anglo-Scandinavian graveyard soil overlying the collapsed *principia* debris (Phillips, 1995, 80). The lift shaft sequence suggests that a significant phase of demolition and possible burial activity took place before any clearly Anglo-Scandinavian burials, but these two sequences are not irreconcilable.

The main Minster sequence seemed to show very clearly that the Anglo-Scandinavian burials remained within the area of the *basilica* until the mid 11th century (Phillips, 1995, 80); the earliest date of AD 1038 obtained for the lift shaft burial, located outside the *basilica*, seems to neatly support this suggestion, but it may be that the later burials have obscured the real picture. The Phase 3 evidence for the demolition of the *basilica* from the early 9th century sits uncomfortably with Carver's suggestion that the stub walls of the Roman structures were used as the limits of the 11th century cemetery (Phillips, 1995, 192), but could support the idea of an earlier cemetery in this area, with the Roman walls cleared to make way for the burials hinted at by the Phase 4 sequence, which could be Anglian if not early Anglo Scandinavian. The lift shaft Phase 3 sequence is therefore critical to the understanding of the pre-conquest landscape of this part of York.

The Phase 3 demolition deposits closely resemble a similar sequence of "finely banded mineral silts" identified in the 1960s and nick-named the 'Ashy Bands'. These were interpreted by Phillips as representing the final clearance of the *basilica* during the construction of the Norman cathedral after 1080 (Phillips, 69; 194). Whilst the two sequences could represent entirely separate phases of demolition, work undertaken by the author with Dr Mark Whyman on the Phillips archive has shown that while the robbing of the Roman foundations can be associated clearly with Thomas' cathedral, the demolition of the above ground walls represented by the 'ashy bands' can be viewed as a distinct and earlier phenomenon, even though no evidence has yet emerged to definitively separate them. The dating of the lift shaft Phase 5 burial could provide that evidence, although in proving that Phase 3 is pre-conquest, it doesn't determine if it is Anglian or Anglo-Scandinavian.

At the very least, the Phase 3 demolition deposits and later phases suggest that part of the *basilica* was cleared before c.AD 1000, and if one accepts that this clearance occurred from the early-mid 9th century, then the putative Anglian cemetery suggested by Phase 4 could provide the context for this activity. This may be reinforced by the micromorphological evidence for the demolition being a relatively rapid process, which could be interpreted as an implication that there was a specific purpose to the clearance beyond simply retrieving building materials. The confinement to the *basilica* footprint of most of the Anglo-Scandinavian burials does not preclude the possibility that the Anglian cemetery long argued to pre-date it (Norton, 1999, 4) could have been located further to the south-west. Indeed, it would seem natural that the mainly 10th century burials should lie elsewhere from those of barely 50 years earlier. The last phase of the known Anglo Scandinavian cemetery is usually interpreted as truncating earlier activity (Phillips, 1995, 80); the mid 11th century date for the 'spilling out' of burials into the wider area, seemingly reinforced by the Phase 5 burial, may provide the context for the Phase 4 activity, as burials that were then 200 years old were

cleared for new ones, in-filling the putative boundary 'ditch' and creating the charnel pit. In this context, the difficulty of interpreting Phase 4 as a break between one cemetery and a later one, or merely the continual use of a wider area as a cemetery, becomes one of interpreting the functional distinction between the Anglian and Anglo-Scandiavian landscapes of York. This is beyond the scope of this report. It seems clear, however, that at the very least the lift shaft sequence has refined the data for the development of the post-Roman landscape later occupied by the Minster, even if it hasn't entirely resolved it.

In the post-conquest part of the lift shaft sequence, the direct evidence for the construction of the Norman cathedral was largely obliterated by the rapid excavation of the 1970s. However, the truncated foundations of the 13th century South Transept contained significant evidence for the nature of the cathedral's reconstruction after c.1225 beyond demonstrating the seasonality and the consideration taken for the human remains described above. The elevations revealed behind the stud-walling of the former staff room at the base of the stairwell (Plates 24-29, Figures 15-17) contained sufficient amounts of 12th century masonry for the Cathedral Archaeologist Stuart Harrison to identify significant elements of the alterations made to the Norman South Transept chapels by Archbishop Roger Pont L'Evêque after 1154 (pers. comm.; Plates 16-23, Figures 10-14 and Appendix 6), which were demolished during Archbishop Walter De Grey's rebuilding after 1225 (Brown, 2003, 13). In the arcade foundation, the mis-alignment of wall 1017 over the lower wall 1067 was associated with an error in the laying out of the 13th century works identified by Dr Christopher Norton. This is evidenced by the poorly aligned join between the 13th arcade sleeper wall footing and the south-west corner of the Norman church, which the later structure was effectively extending southwards as an extension of the foundation for the 13th century arcade (C Norton pers. comm.). The alignment of wall 1017 can be seen as an attempt to correct this, along with the seemingly intentional progressive stepping back of the upper footing, as seen in the north facing elevation (Figure 16).

Finally, the extensive depth of concrete bears witness to the extent and quality of the engineering programme enacted in 1966 under the then Surveyor of Fabric Bernard Fielden. It is also the opinion of the author that the level of analysis possible on the sequence from such a small excavation also bears testament to the remarkable achievement of Derek Phillips' archaeological team in producing such an extensive and comprehensible sequence in extremely difficult circumstances. It is an honour to contribute in a small way to their continuing legacy of research and service.

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Illustrations	I.D. Milsted, L. Collett
Editor	M.R. Stockwell

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APPENDIX 1: FIGURES AND PLATES

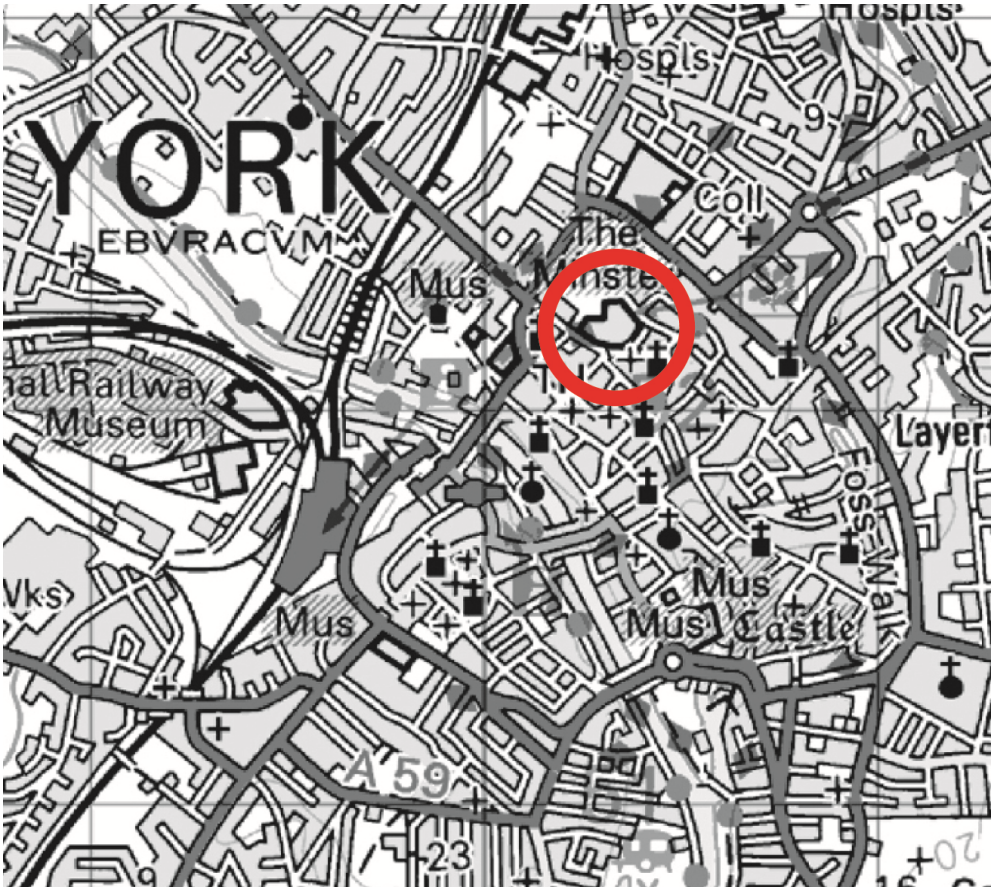

Figure 1 Site location

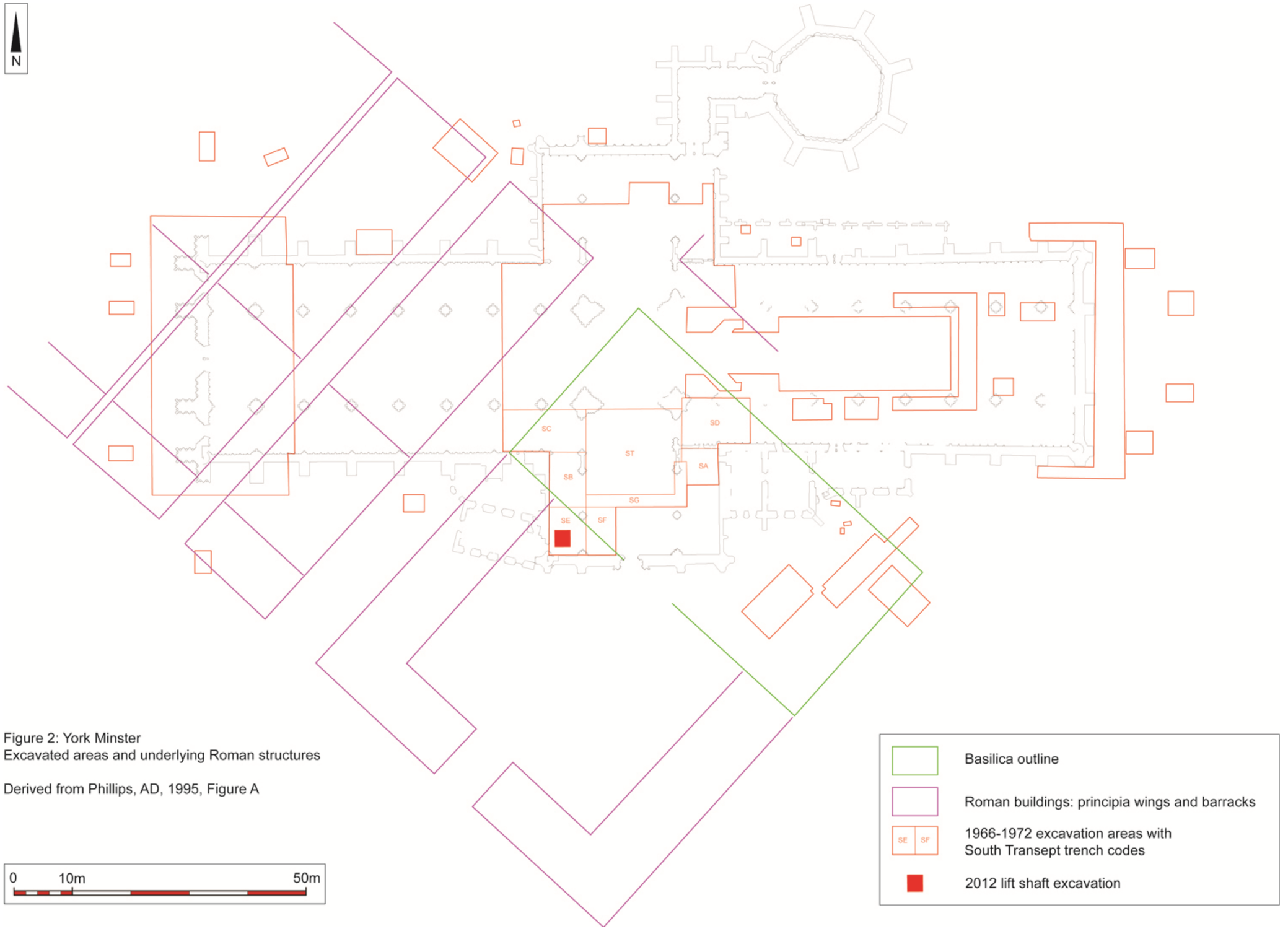

Figure 2: York Minster
Excavated areas and underlying Roman structures

Derived from Phillips, AD, 1995, Figure A

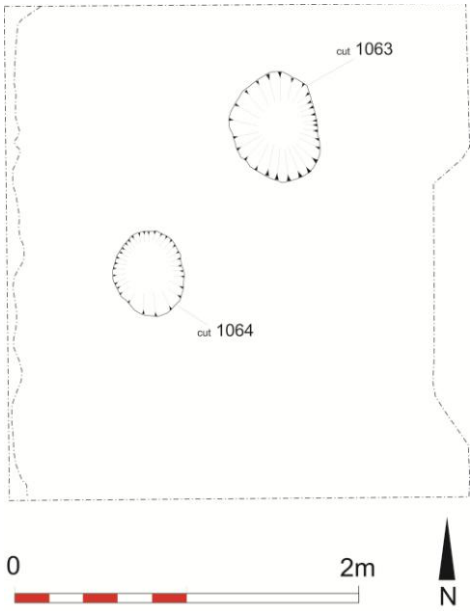

Figure 3 Phase 1 post holes

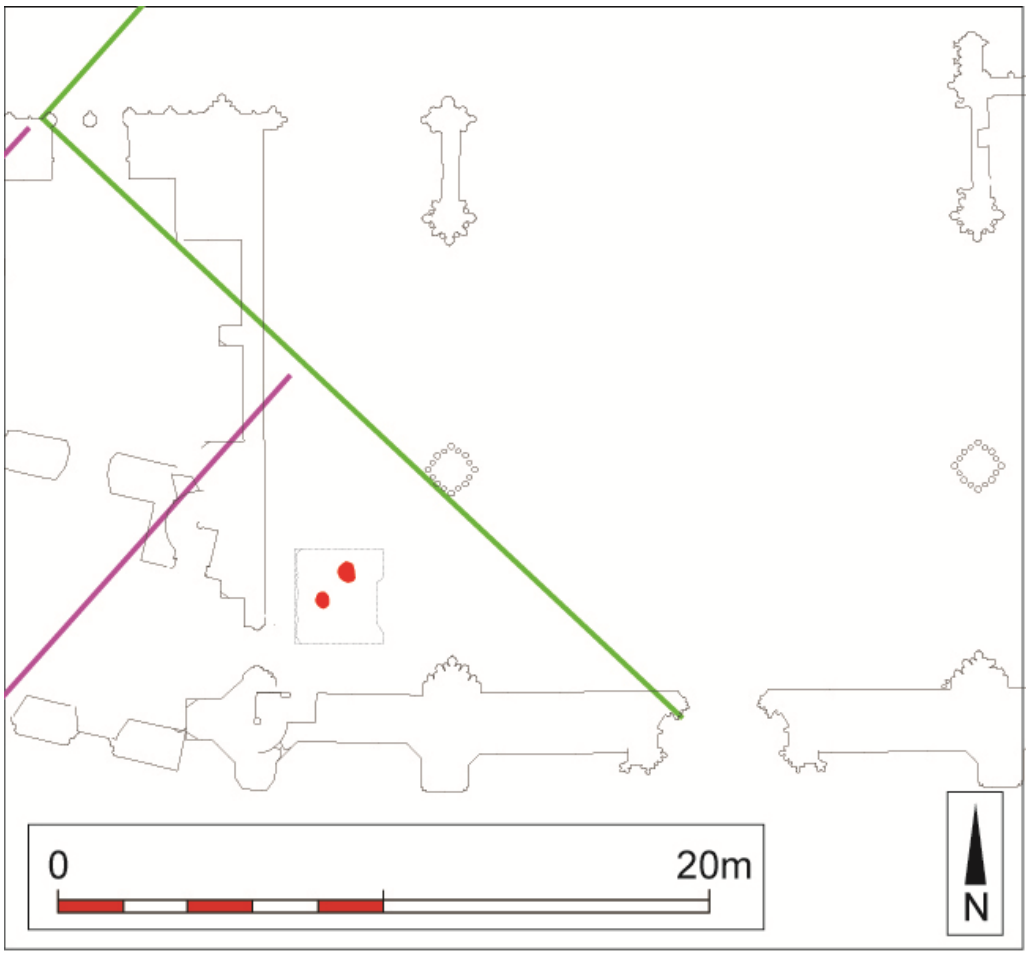

Figure 4 Location of postholes in Principia courtyard

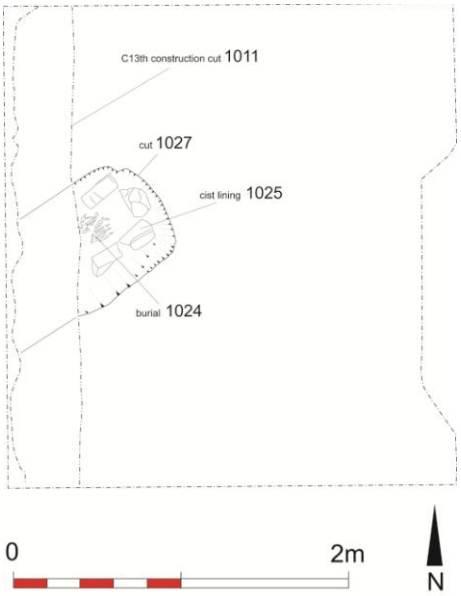

Figure 5 Phase 5 11th century cist burial

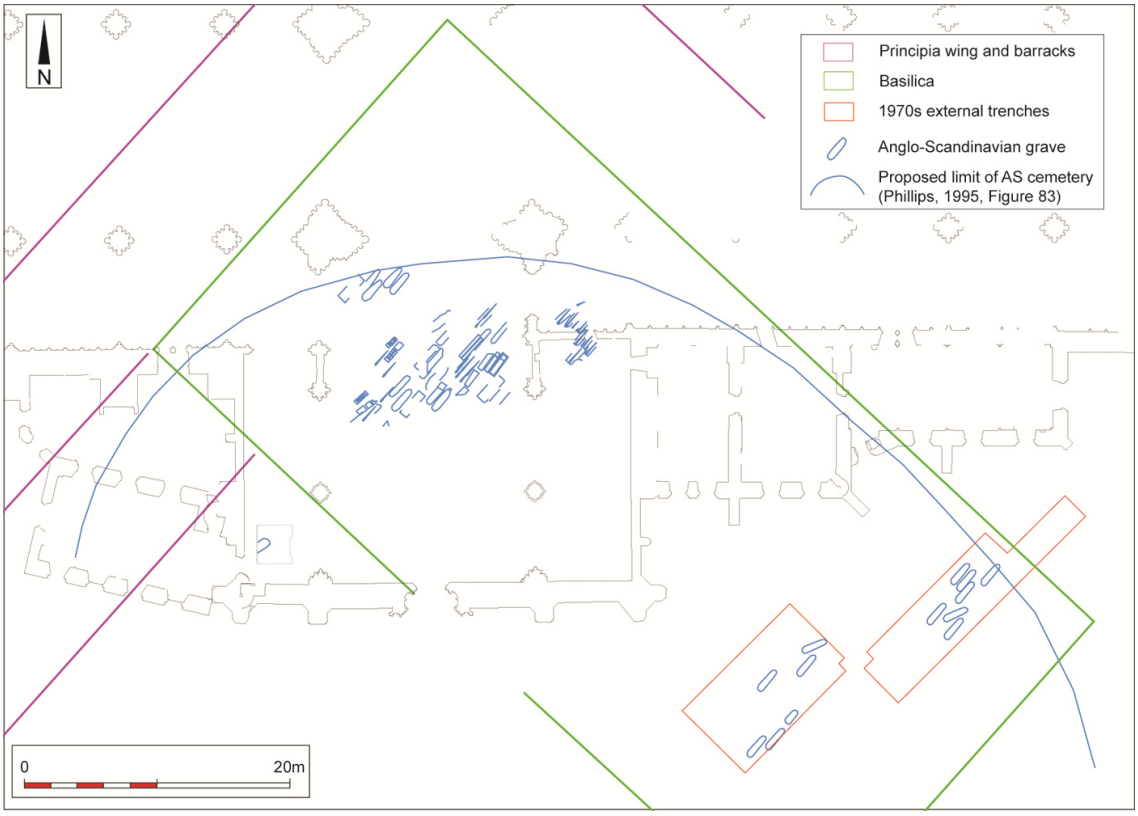

Figure 6 Anglo-Scandinavian burials at York Minster

Derived from Phillips, 1995, Figure 83

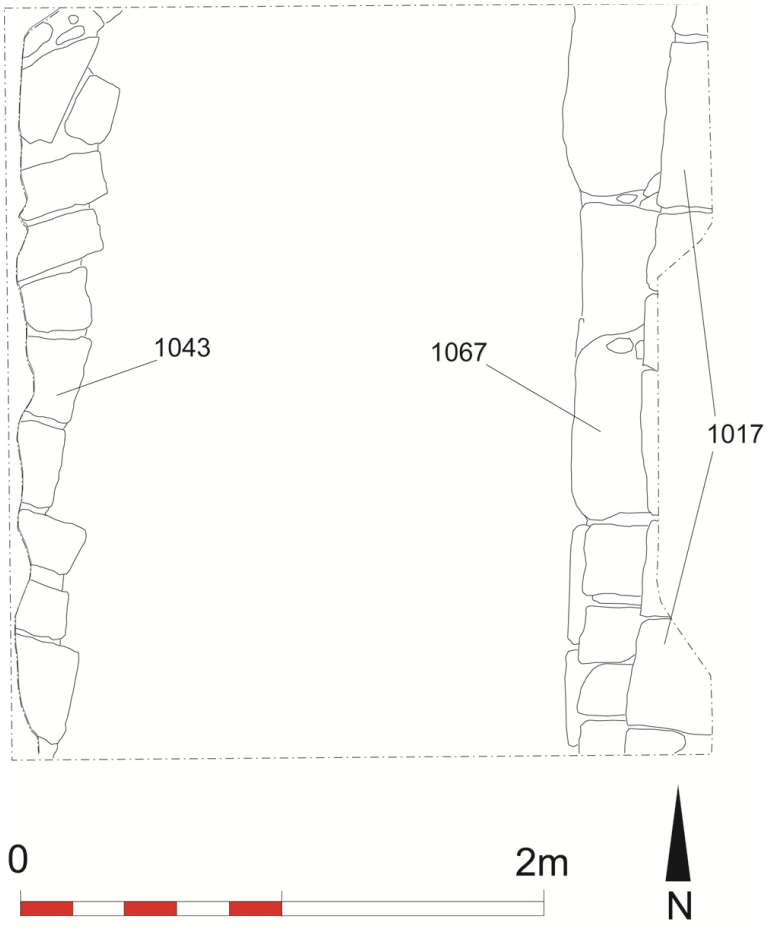

Figure 7 13th century foundations

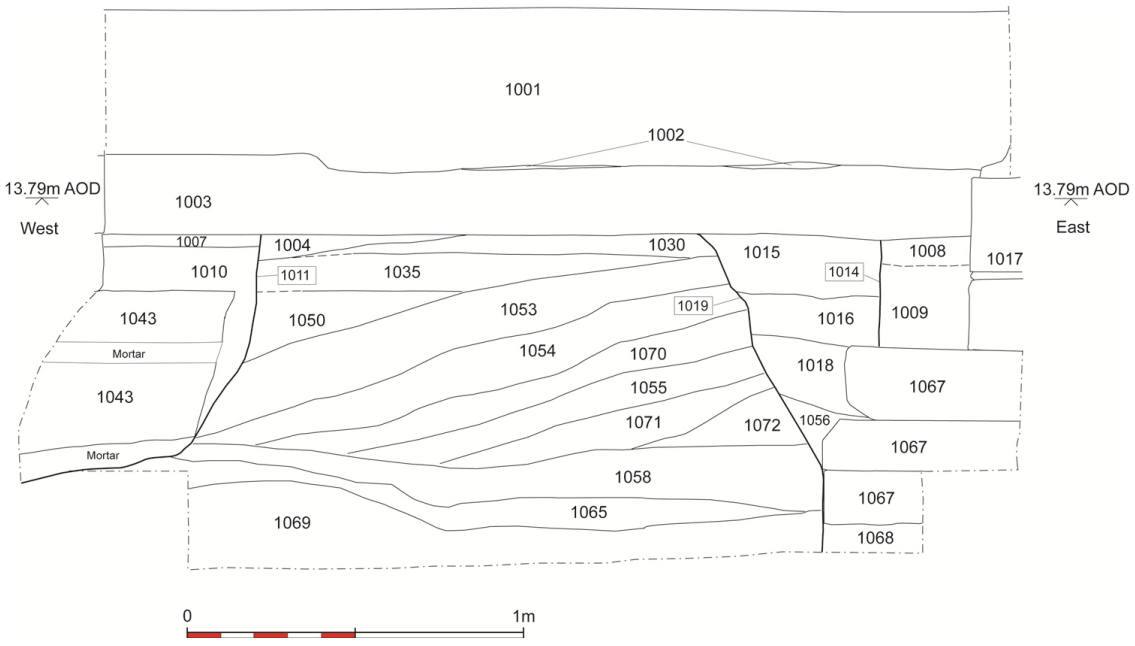

Figure 8 South facing section

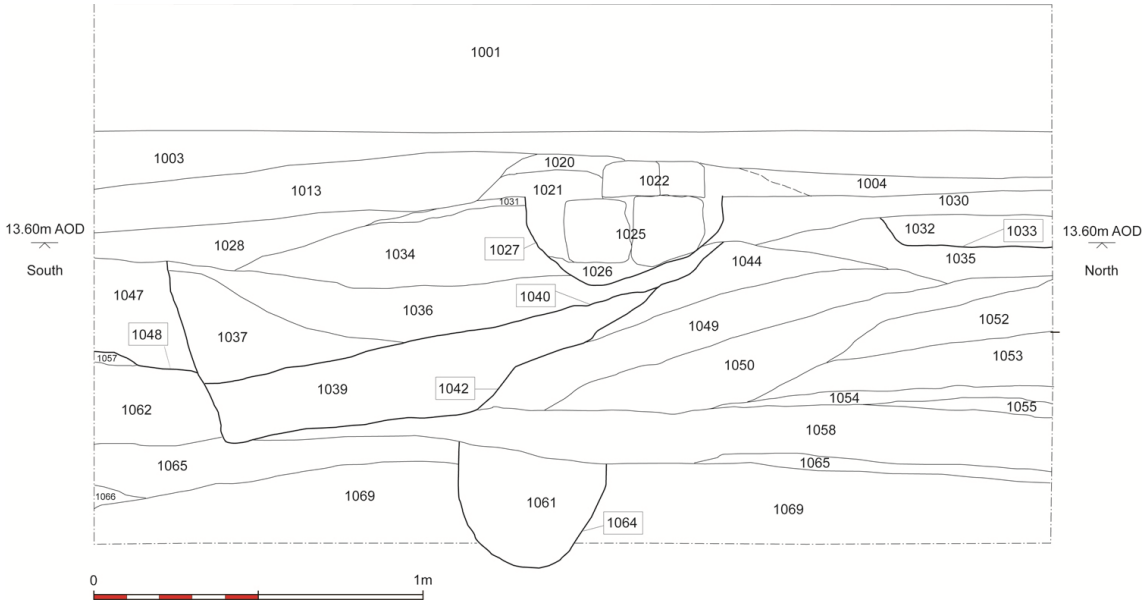

Figure 9 East facing section

0.80m from western limit of excavation, reconstructed from plans

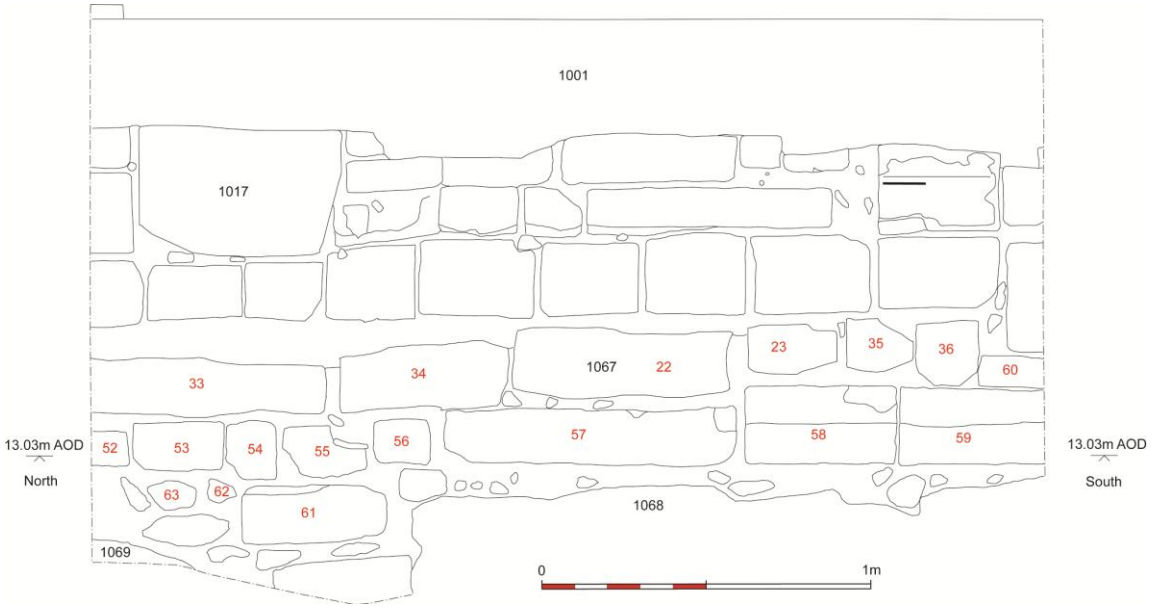

Figure 10 West facing elevation of arcade foundation, with removed stones numbered in red

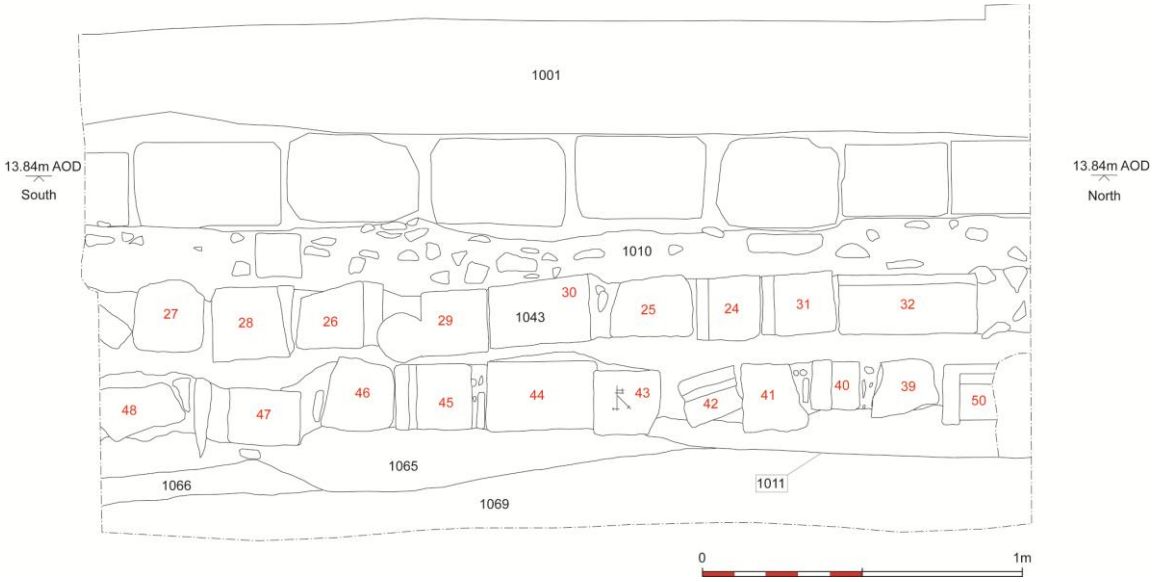

Figure 11 East facing elevation of west wall foundation, prior to stone removal, with removed stones numbered in red

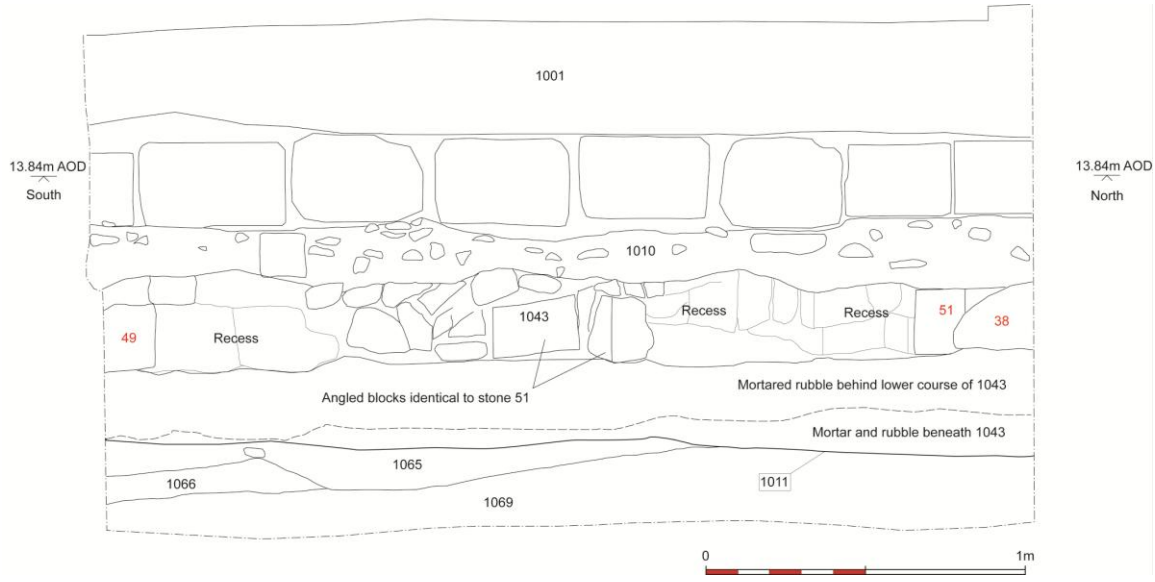

Figure 12 East facing elevation of west wall foundation, after stone removal, with obscured stones in upper course shown numbered in red

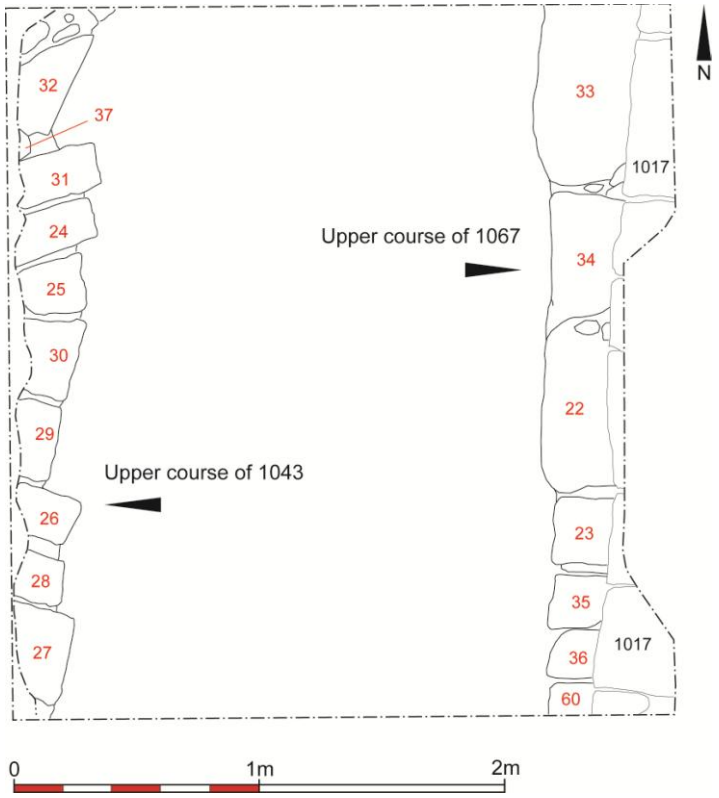

Figure 13 Upper courses of C13th foundations with removed stones in red

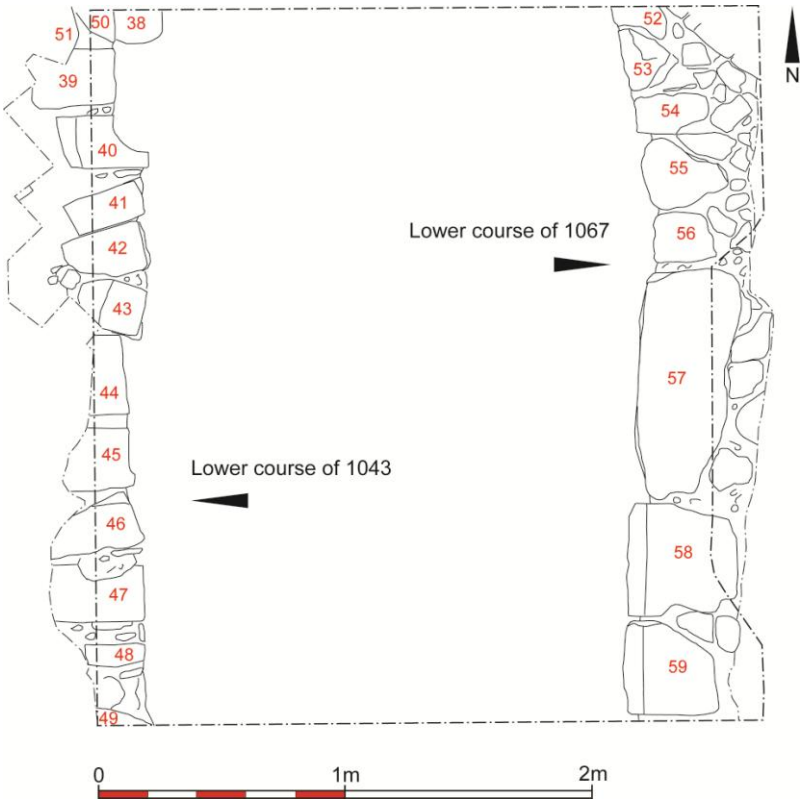

Figure 14 Lower courses of C13th foundations with removed stones in red

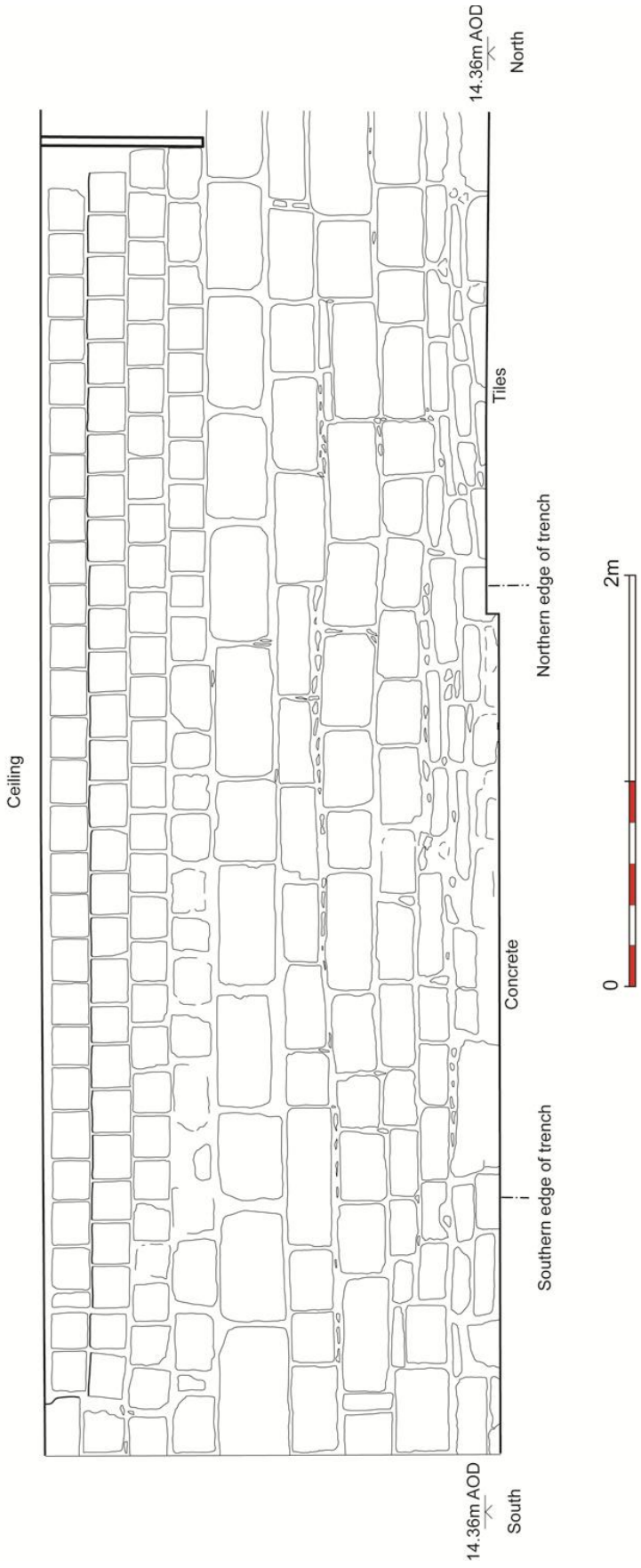

Figure 15 East facing elevation of west wall foundation

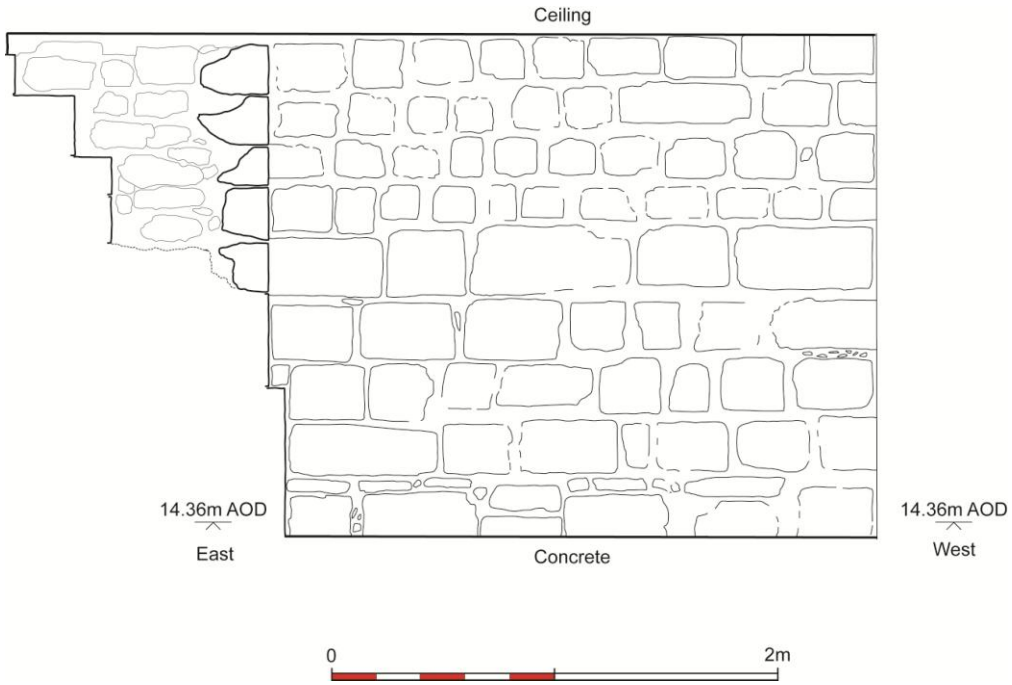

Figure 16 North facing elevation of south wall foundation (M Johnson)

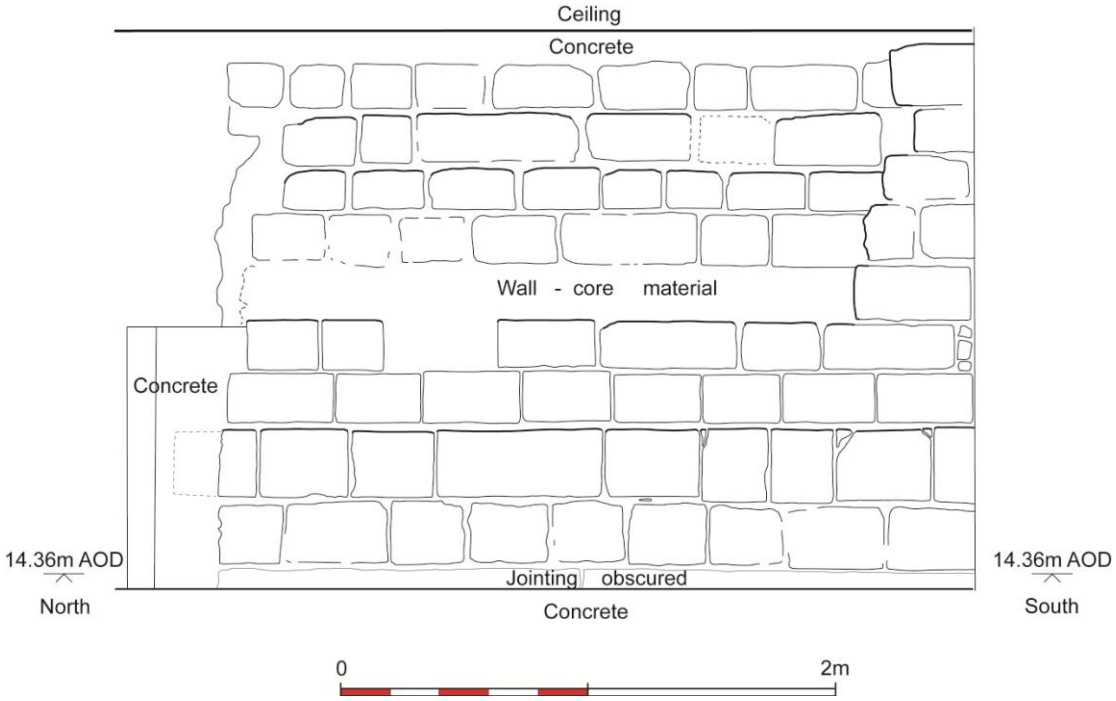

Figure 17 West facing elevation of arcade foundation (M Johnson)

Plate 1 Phase 1 dark earth 1069 with post holes 1063 and 1064

Plate 2 Phase 1 demolition spread 1065 overlying dark earth 1069, with postholes 1063 and 1064, and C13th South Transept west wall foundation 1043, looking south-west

Plate 3 Phase 2 dark earth, looking north

Plate 4 Phase 3 demolition deposit, showing angle of deposition, looking north

Plate 5 Phase 4 charnel pit backfill, looking south

Plate 6 Phase 5 Anglo-Scandinavian cist tomb, truncated by C13th South Transept west wall construction cut, looking south

Plate 7 Capstone 1022 of cist tomb, in situ, showing truncation, looking south

Plate 8 Grave fill 1023 within lining 1025, showing truncation, south-east at top.

Plate 9 Burial 1024 within cist lining 1025, showing truncation, south-east at top.

Plate 10 Cist lining 1025, looking south-east

Plate 11 Charnel deposit 1016 in C13th construction cut 1019

Plate 12 Charnel deposit 1009 in C13th construction cut 1014

Plate 13 C13th arcade foundation construction cut 1019, looking south-east

Plate 14 Section 1 (south facing), looking north

Plate 15 Section 3 (north facing), looking south

Plate 16 Northern end of elevation 2 (west facing) prior to removal of the projecting part of 1067, looking east.

Plate 17 Southern end of elevation 2 (west facing) prior to removal of the projecting part of 1067, looking east

Plate 18 Southern end of elevation 4 (east facing) prior to removal of the projecting part of 1043, looking west

Plate 19 Northern end of elevation 4 (east facing) prior to removal of the projecting part of 1043, looking west

Plate 20 Elevation 2 (west facing) after removing the upper stones of 1067

(Image taken by Stuart Harrison)

Plate 21 Elevation 4 (east facing) after removing the upper stones of 1043

(Image taken by Stuart Harrison)

Plate 22 Elevation 2 (west facing) after removing the lower stones of 1067

(Image taken by Stuart Harrison)

Plate 23 Elevation 4 (east facing) after removing the lower stones of 1043

(Image taken by Stuart Harrison)

Plate 24 C13th South Transept foundations exposed in the 1970s, looking south

(Image taken by Stuart Harrison)

Plate 25 Same view as Plate 24, showing 1970s soil section above 2012 lift shaft trench

(Image taken by Derek Phillips, Negative No. YM 3492)

Plate 26 North end of west facing C13th South Transept arcade foundations, looking east

(Image taken by Stuart Harrison)

Plate 27 South end of west facing C13th South Transept arcade foundations, looking east

(Image taken by Stuart Harrison)

Plate 28 South end of east facing C13th South Transept west wall foundations, looking west (Image taken by Stuart Harrison)

Plate 29 North end of east facing C13th South Transept west wall foundations, looking west (Image taken by Stuart Harrison)

Plate 30 Obverse of sceatta of Archbishop Eanbald II, from Phase 2 dark earth 1058

Plate 31 Reverse of sceatta of Archbishop Eanbald II, from Phase 2 dark earth 1058

APPENDIX 2: POTTERY BY A.J. MAINMAN

Only a small assemblage of pottery was recovered from the excavation which provided little in the way of useful dating evidence or other types of information. The hand-collected assemblage was augmented by material sieved from soil samples, but that added little.

The material from the lower deposits was scrutinised carefully against the site matrix and the following observations can be made. The lowest context (1069) produced three sherds of Roman grey ware, one finer than the other. All were abraded. The next context in the sequence which produced pottery was context 1058 from which two very abraded sherds of probable Roman date were recovered. Two further sherds, one of which was samian, were recovered from 1054. The second sherd was a small sandy grey ware which was either Roman (more likely) or 10th century Torksey-type ware. Context 1053 produced another grey ware of uncertain date and a scrap of Roman pot or tile. Context 1055 contained two Roman sherds, one oxidised and the other reduced.

Above these deposits context 1051 contained two very small sherds of the same uncertain grey ware together with three sherds of definitely Roman pottery (a colour-coated ware, a grey ware and a white ware). Contexts 1049 and 1050 produced a further sherd of colour-coated ware (1050) and two sherds of oxidised Roman pottery heavily covered with mortar (1049).

While context 1036 produced only a single sherd of Roman grey ware, from 1037 was recovered a small oxidised over-fired gritty sherd which might be late 9th/early 10th century York ware. Above these context 1031 produced another type of oxidised sherd of uncertain date.

Higher up the sequence further small sherds of Roman pottery were found in contexts 1009 (1 samian, 2 uncertain grey wares, probably Roman) and 1008 (1 grey ware, probably Roman).

Pottery of medieval date was limited to two featureless, unglazed sherds of possible 13th/14th century date from context 1016, a later (ie 15th/16th century) green glazed rim from context 1003, a sherd of Humber ware of similar date from context 1015, and from 1010 a sherd of Ryedale ware of 16th/17th century date. The only sherd of any size was from context 1056 and was a burned and blackened sherd with a form and appearance of 11th/12th century gritty ware but was uncharacteristically heavy with unusual grog or iron inclusions, which raises some questions about this attribution.

The pottery, therefore, offers little help in understanding the sequence of building modification observed in the excavation and provided no clear Anglian or Anglo-Scandinavian material other than the sherd of possible York ware and possibly some of the undiagnostic grey wares.

Context	Quantity	Dating	Details
1003	1	15th-16th century	Rim from green glazed jug with pinched spout. Probably Hambleton-type ware.
1008	1	probably Roman	Body sherd of grey ware with calcitic flecks. Probably Roman.
1009	1	Probably Roman	Three small sherds, all probably Roman, includes samian and two grey wares.
1010	1	16th-17th century	Fine hard white ware with a washy thin lead glaze. Type of late Ryedale ware
1015	1	14th-15th century	Humber ware (or just possibly an earlier splashed ware of 12th century date - small sherd)
1016	1	13/14th century?	1 sandy pale oxidised sherd. 1 white ware, possibly York Glazed ware type. Both featureless and unglazed.
1031	1	?Roman	1 oxidised sandy sherd of uncertain date, probably Roman
1036	1	Roman	Roman grey ware jar rim
1037	1	10th century?	Small unglazed over-fired gritty sherd - might be York ware
1049	2	Roman	Two sherds of oxidised Roman pottery heavily encrusted with mortar.
1050	1	Roman	1 sherd of Roman colour-coated pottery
1053	2	Roman (10th century?)	1 scrap (Roman) 1 grey ware (Roman or Torksey-type ware)
1054	1	Roman (?10th century)	1 abraded samian sherd 1 grey ware - likely Roman but possibly Torksey-type ware
1055	2	Roman	1 oxidised Roman sherd 1 Roman grey ware rim
1056	1	11/12th century?	Burned unglazed gritty ware jar sherd with unusual grog/iron inclusions. Uncharacteristically heavy.
1069	3	Roman	Roman grey ware base - abraded Roman grey sherd of similar fabric Roman grey ware sherd (fine)

Table 2:1 Pottery by context

APPENDIX 3: SMALL FINDS BY N.S.H. ROGERS

INTRODUCTION

22 small finds were originally assessed in June 2012 - all the metal finds within the 22 finds had been Xrayed, prior to assessment. A further 26 small finds were retrieved from samples and recorded in September 2012 – none has been Xrayed. An assessment of these new finds has been integrated into the original assessment here.

IRON

Twenty three of the small finds were made of iron, and all comprised nails and/or nail fragments. Apart from SF3, Context 1003 which is clearly a modern nail, none of the nails is datable by form; nails SF18 Context 1003, and SF19 Context 1061 were found to be attached to fragments of Roman brick but these do not necessarily date the nails to this period. Nails SF20 Context 1008 and SF21 Context 1037 are both attached to folded lead alloy strips – these strips do not appear to be from lead roofing but are perhaps anti-corrosion protection for the nail heads. The other notable feature of several of the nails is the presence of non-ferrous metal specks in the corrosion surrounding them – see in particular SF14 Context 1055 and SF17 Context 1021, but also SF5 Context 1016, SF9 Context 1047, SF24 Context 1009; these specks may derive from non-ferrous (?lead alloy) working in the area(s) in which the nails were deposited (see below).

COPPER ALLOY

There are two copper alloy objects: buckle SF6 Context 1041 has a simple D-shaped frame with attached buckle plates, and seems most likely to be of medieval date, although an earlier date is not impossible. Pin SF4 Context 1015 has a wire wound head, a form which typically dates from the 15th – 16th centuries, but has occasionally been recovered from deposits dating as early as the 13th century. Copper alloy fragment SF41, Context 1054 is unidentifiable.

LEAD ALLOY

Ten finds are of spillages and/or offcuts; total amounts are small (combined weight of all spillages = 154 gms) but all derive from lead alloy working which may have been undertaken on site.

SLAG

Four items of glassy slag with a total weight of 10g were recovered from the soil samples. It is not possible to link these fragments to a particular process through visual analysis.

GLASS

The four finds of glass comprise a Roman vessel fragment SF12 Context 1058, a chip of uncertain date SF25 Context 1037, and small fragments of blue/green colour (SF11 Context 1051; SF51, context 1058); it is possible SF11 may have been a (?Roman) bead but this cannot be more than speculation.

CONCLUSIONS

This small assemblage is dominated by fragments deriving from lead alloy working, and nails. The spillages and offcuts are small in amount – the earliest occurrence of this material is in the dark earth soils of Phase 2 (SF31, Context 1058 wt. 12gms), but most was found in the later deposits, with 114gms from Phase 3 deposits, and 28gms from Phase 4 levels. Retrieved from deposits of Phase 1 – Phase 4, the slag also derives from metalworking, but is of such a small quantity that it does not signify. The nails are all presumably structural, although it is possible that those found in association with charnel might derive from coffins.

The copper alloy objects are both personal items of dress of the medieval period which appear most likely to have been lost rather than being deposited in association with burials. Apart from the medieval dress fittings, the only other dating evidence provided by this assessment comes from the Roman vessel glass fragments SFs11, 12, 51 (which have not been dated by any specialist) and the modern nail SF3.

Find number	Context number	Material	Keywords
SF1	0		
SF2	1003	iron	nail
SF3	1003	iron	nail
SF4	1015	copper alloy	pin
SF5	1016	iron	nails
SF6	1041	copper alloy	buckle
SF7	1036	lead alloy	fragment
SF8	0		
SF9	1047	iron	nails
SF10	1050	lead alloy	spillage
SF11	1051	glass	fragments
SF12	1058	glass	vessel fragment
SF13	0		
SF14	1055	iron	nail
SF15	1003	iron	fragment
SF16	1008	iron	nail
SF17	1021	iron	nail
SF18	1003	iron, ceramic building material	nail fragment
SF19	1061	iron, ceramic building material	nail

SF20	1008	iron, lead alloy	nail
SF21	1037	iron, lead alloy	nail, sheet
SF22	1036	iron	nail
SF23	1029	iron	nail
SF24	1009	iron, mortar	nail
SF25	1037	glass	fragment
SF26	1058	silver	coin
SF27	1060	lead alloy	offcut
SF28	1065	lead alloy	offcut
SF29	1069	iron	nail
SF30	1058	iron	nail
SF31	1058	lead alloy	spillages
SF32	1044	lead alloy	spillages
SF33	1050	lead alloy	spillages
SF34	1050	iron	nails
SF35	1049	iron	nail
SF36	1049	lead alloy	spillages
SF37	1051	lead alloy	spillages, offcut
SF38	1053	lead alloy	spillages, offcut
SF39	1053	iron	nail
SF40	1054	lead alloy	spillages
SF41	1054	copper alloy	fragment
SF42	1036	lead alloy	spillages
SF43	1036	iron	nail
SF44	1037	iron	nail
SF45	1037	lead alloy	spillages
SF46	1054	iron	nail fragments
SF47	1060	slag	slag
SF48	1054	slag	slag
SF49	1061	slag	slag
SF50	1036	slag	slag
SF51	1058	glass	fragments

Table 3:1 Small finds by context

APPENDIX 4: COIN BY DR G. WILLIAMS AND I. MILSTED

INTRDUCTION: DR G. WILLIAM (BRITISH MUSEUM)

The coin appears to be a base-silver styca from the early part of the episcopate of Archbishop Eanbald II of York (796-840), issued by the moneyer Eadwine. Eadwine is not normally listed as a moneyer for Eanbald, although he is well known as a moneyer in the Northumbrian regal coinage at the time. This is not in itself a problem, since the other known moneyers of Eanbald II also issued regal coins, so there was clearly no strict distinction between moneyers issuing coins for the king and those issuing coins for the archbishop.

However, I am only aware of two other examples of this combination of authority and moneyer, both of which have previously been condemned as forgeries, one in the Fitzwilliam Museum, Cambridge, and one in the Museum of Antiquities, Newcastle upon Tyne. The Cambridge example (Grierson &Blackburn 1986, no. 1488) is identified as a cast forgery, while the Newcastle example (Pirie 1982, no. 450, see also Appendix 1)) is identified as a forgery on the basis of its metal content, being made of an alloy with a high content of both lead and bismuth (Pirie & Warren 1983). The similarity of the irregular shape of both coins as well as the designs on both sides suggests (working on the basis of photographs alone) that both were cast from the same mould. Both seem likely to be nineteenth-century forgeries created for the collectors' market feeding an interest in stycas stimulated by the discovery of the Kirkoswald hoard in Cumbria in 1808 (Grierson & Blackburn 1986, p. 338).

The find from York Minster is intriguing, in that (again, working from photographs alone) the obverse would normally be interpreted as a die duplicate of the other two, but not the other two. This means it cannot be a product of exactly the same mould, but may well be another imitation from the same source. I would recommend detailed examination of the edge of the coin, to see if there are any traces of a casting seam. Study of the weight of the coin might also be indicative, as these forgeries are normally slightly heavier than the real thing, and analysis of the metal content might also be interesting. On current evidence, however, the assumption must be that this is also a nineteenth-century forgery, unless there is anything in the context of the discovery which makes this impossible.

POST-ANALYSIS COMMENT: DR G. WILLIAMS (EDITED BY I. MILSTED)

Preliminary analysis of the coin's metal content suggests that it is predominantly silver, with some copper, lead, tin, zinc and a little bit of gold. This is broadly consistent with a coin of the early ninth century, and an unlikely mix for a nineteenth-century forgery. In addition, there is nothing which points to it being cast rather than struck, and apart from the very crisp appearance of the lettering nothing to suggest that it isn't genuine. On balance, therefore,

and considering also the information concerning the context (see below), I am now inclined to accept this as a genuine coin, pending the more detailed comparison of the metal analysis.

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E.J.E. Pirie & S.E. Warren, 'Bismuth alloy forgeries of early Northumbrian coins', in E. Aspinall and S.E. Warren (eds), Proceedings of the 22nd Symposium on Archaeometry, University of Bradford (Bradford 1983), 254-60.

THE STRATIGRAPHIC POSITION OF THE COIN: ID MILSTED

The coin was recovered from bulk-sieved sample #37 of context 1058 (Phase 2), interpreted as a 'dark earth' deposit of pre-conquest date. The sample, in accordance with standard YAT procedure, was taken from the heart of the deposit using clean tools, well away from any potential disturbance or any of the trench sections. The sample was processed at the Dickson Laboratory in Glasgow by Northlight Heritage. Context 1058 lies some 4m below the floor of the cathedral, and 1m below the depth reached during the engineering excavations of 1968-1972. The chances of sample contamination are therefore extremely minimal.

Stratigraphically, context 1058 overlies the Phase 1 postholes and dark earth deposits of probable post-Roman date. 1058 was sealed below 0.70m of stratified deposits (Phases 3 and 4) that were in turn cut by the Phase 5 burial, 1024. This burial was radiocarbon dated to AD 1036-1158 (at 95.4% confidence). This burial conformed stylistically and in position and alignment to the Anglo-Scandinavian burials discovered nearby in the 1960s, and the lower range of the radiocarbon date is taken to confirm this. Context 1058 therefore predates the 11th century at the very latest, and on the basis of the coin (if it is genuine) must post-date the late 8th century. Whilst it is technically possible that the coin came from within an unidentified later cut feature intruding into the dark earth, the latest cut features from the entire excavation date to c.AD 1220 (the construction cuts for the South Transept foundations in Phase 7), and as the excavation was conducted entirely by hand I am as confident as one can be that there were no other deeply intrusive features within the trench, and that the sample was taken from undisturbed sediment.

APPENDIX 5: CBM AND ARCHITECTURAL FRAGMENTS

BY J.M. MCCOMISH

1. CERAMIC BUILDING MATERIAL

A total of 65201g of Ceramic Building Material (CBM) was recovered from the site, most of which was of Roman date, though a small quantity of medieval roof tiles were also present. The CBM was recorded to standard YAT procedures.

1.1 ROMAN CBM

The Roman CBM accounted for 97.5% of the CBM, and was typical for York in terms of its dimensions and fabrics. There were five sherds of box flue tile, one with combed keying and one with finger drawn keying on one side. Seventy-one sherds of imbrex were present, which ranged in thickness from 13-26mm. One imbrex had a sixth legion stamp, which matches design 2460.37 of Collingwood and Wright's catalogue (1993, 153). One sherd was slightly unusual in terms of its form and has been classed as 'other'; it is unclear if this sherd was a flue tile or a tegula. Most of the Roman material was sherds which were too fragmented to determine the original form and have been classed as 'Rbrick' (an abbreviation of Roman brick). One of these sherds was pierced by a circular hole 5mm in diameter, which is unusual, and one sherd had a possible batch number in the form II, which is again rare. Two Rbrick sherds had signatures, one of which was a Betts type 5 (1985, 192-3) and the second was possibly a Betts type 26, though too little of the signature survived to be certain of this identification. There were 99 sherds of tegula which ranged in thickness from 17-34mm, one of which had a Warry (2006, 5) Type A2 lower cutaway which dates to AD 71-120, and one had a signature which might be a Betts (1985, 192) type 9 signature, but too little was present to be certain of this. In addition to the CBM there were five sherds of micaceous sandstone which were probably originally Roman stone roofing tiles.

1.2 MEDIEVAL CBM

The medieval material comprised 2.5% of the total volume. There were nine sherds of plain tile and three sherds of ridge tile, all of which were typical of York as a whole in terms of their dimensions and fabrics. No features of note were present on these tiles. These sherds almost certainly represent intrusive material.

Although the collection of CBM from the site was small there were a few features of interest, namely the cutaway, the brick pierced by a hole, the signatures, the batch number and the stamped imbrex. In addition, the presence of micaceous sandstone slabs (which probably originated from roofing tiles) is of interest; it has been stated that the principia building was roofed in tile throughout the Roman period, a conclusion largely based on the lack of

evidence for stone tiles (Phillips and Heywood 1995, 40, 198). The presence of stone tile on this site may, therefore, suggest that stone roofing was in fact used at some stage. The tile in York Minster's collections has been inadequately published to date (with only four pages of text in Phillips and Heywood 1995) and should there ever be the opportunity, the entire collection of Roman material from the Minster, including that from the present site, should be published. The collection from this site would not, however, merit any further research in their own right, owing to the small number of sherds present.

A small selection of CBM has been retained, but the bulk was discarded in common with YAT policy. The CBM is summarised in terms of form and date on Table 3 below.

Context	Dating	Forms
1003	1-4th	Imbrex, Rbrick
1006	1-4th	Imbrex
1007	1-4th	Imbrex, Rbrick
1008	1-4th	Rbrick, Tegula
1010	1-4th	Imbrex, Rbrick
1013	1-4th	Tegula
1015	13-16th	Plain, Rbrick, Tegula
1016	1-4th	Stone peg?, Imbrex, Other, Rbrick, Tegula
1018	1-4th	Rbrick, Stone Peg?, Tegula
1021	1-4th	Rbrick
1030	1-4th	Rbrick
1032	1-4th	Imbrex
1034	1-4th	Imbrex, Rbrick, Tegula
1035	1-4th	Rbrick
1036	1-4th	Imbrex, Rbrick
1037	1-4th	Imbrex, Rbrick
1039	1-4th	Imbrex, Rbrick, Tegula
1041	1-4th	Rbrick
1044	1-4th	Imbrex, Rbrick, Tegula
1045	1-4th	Imbrex, Rbrick, Tegula
1046	1-4th	Rbrick
1047	1-4th	Rbrick
1049	1-4th	Flue, Imbrex, Rbrick, Tegula
1050	1-4th	Rbrick
1051	1-4th	Flue, Rbrick, Tegula
1052	1-4th	Rbrick

1053	1-4th	Imbrex, Rbrick
1054	1-4th	Imbrex, Rbrick, Tegula
1055	1-4th	Rbrick, Tegula
1056	13-16th	Plain, Rbrick, Ridge, Tegula
1058	13-16th	Flue, Imbrex, Plain, Rbrick, Ridge, Tegula
1059	1-4th	Imbrex, Rbrick, Tegula
1060	13-16th	Imbrex, Plain, Rbrick, Tegula
1061	1-4th	Rbrick, Tegula
1062	1-4th	Rbrick
1065	1-4th	Rbrick, Tegula
1068	13-16th	Plain, Rbrick
1069	13-16th	Imbrex, Plain, Rbrick, Stone peg?

Table 5:1 Summary of CBM data by context.

2. ARCHITECTURAL FRAGMENTS

A total of 26 architectural fragments (AFs) were recorded from the site, many of which were insufficiently diagnostic to be closely datable; the AF catalogue is given in Table 4, and the information is summarised on a context-by-context basis below, relating to phasing information provided by I. Milsted.

2.1 ROMAN CONTEXTS

Contexts 1062 and 1065 were both phased to the Roman period on the basis of the stratigraphy; three Afs were recovered from these contexts, (AFs 8-9 and 13). Both AFs 9 and 13 were fragments of millstone grit, a stone which was often used for Roman foundations, but which was not quarried for building works in the medieval period. The geology of these AFs is therefore suggestive of a Roman date. AF8 was a magnesian limestone block with a tapering trapezoidal shape in plan, and rectangular cross-section; the size of this block suggests that it represents a fragment of Roman wall-facing, such as that seen in the Multangular Tower (the western corner tower of the legionary fortress).

2.2 ANGLO-SCANDINAVIAN CONTEXTS

Context 1025 was the partial remains of a cist burial of Anglo-Scandinavian date. Five AFs were recovered from this burial (AFs 16-19 and 21); given the date of the burial all these stones almost certainly represent re-used Roman material, though only two were diagnostic enough to be dated as Roman. Three of the AFs were in magnesian limestone, and two oolitic limestone (both types of stone were widely used in Roman buildings in York). AFs 16, 19 and 21 were of rectangular shape in both cross-section and plan, with some striated

tooling surviving on AF 16. The two remaining stones (AFs 17-18) were a tapering trapezoidal shape in plan and rectangular cross-section, and their size suggests that they were Roman wall-facing stones (see AF8 above).

Context 1036 contained a single worn block of magnesian limestone (AF10) which had clearly been re-used as mortar was present on all surfaces. This context is dated as probably Anglo-Scandinavian, suggesting that the stone was re-used Roman material, though the AF is not sufficiently diagnostic to confirm this date.

2.3 MEDIEVAL CONTEXTS

Contexts 1010, 1018, 104, 1063 AND 1067 were all interpreted as being of 13th century date. Context 1010 contained AFs 1-7 and AF11-12. All of these were badly broken blocks of magnesian limestone, and where tooling survived it was striated. One of the blocks was from a jamb originally, but the remainder were too fragmentary to determine the original function. The heavy striated tooling and lack of claw tooling on any of these fragments suggests that these AFs were of 12th century date. Some of the AFs had clearly been re-used as there was mortar on faces which would originally have been exterior faces.

Context 1018 contained AF20 which was originally form a door jamb. The shape and tooling would suggest that this AF is of 12th century date.

Context 1043 contained AF15 and AF24-26; AF 15 and AF 25 were magnesian limestone blocks with a slightly dished profile; the original function of these blocks is unclear. AF 24 was a block of walling, possibly from a foundation given its size, and the striated tooling present would suggest a 12th century date. AF26 was a chamfered block, again with striated tooling.

Context 1067 contained AFs 22-23 both of which were blocks from walling, with striated tooling present.

Context 1068 contained a single block of magnesian limestone with striated tooling. The tooling would suggest a 12th century date.

2.4 CONCLUSION

Most of the AFs were severely fragmented and did not merit any further research; in keeping with YAT discard policies such fragments were not retained. As the original function of AF15 and AF 25 are unclear they should be seen by an architectural historian to determine their original use.

Find	Material	Context	Date term	Details	W	T	H
AF1	Magnesian Limestone	1010	12th	Block of magnesian limestone with two worked faces (F1-F2), all other sides broken off. Striated tooling on both faces. Badly battered. Possibly part of a jamb originally.	110	100	60
AF2	Magnesian Limestone	1010	12th	Magnesian limestone block, part of two faces surviving at right angles to one another (F1-F2). Striated tooling on F1 and F2. Very battered.	180	210	100
AF3	Magnesian Limestone	1010	12th	Magnesian limestone block with three dressed faces, (F1-F3) forming two sides and a top or base of a chamfered block. All other sides broken off. Striated tooling on F2. Badly chipped.	180	150	65
AF4	Magnesian Limestone	1010	12th	Magnesian limestone block with two worked faces present (F1 and F2) which are at right angles to one another. All other sides broken off. Some striated tooling on F1. Badly chipped.	160	100	230
AF5	Magnesian Limestone	1010	12th	Magnesian limestone block, one worked face (F1), all other surfaces broken off. Striated tooling on F1. All surfaces covered in mortar, including F1, clearly re-used.	90	170	120
AF6	Magnesian Limestone	1010	12th	Magnesian limestone block with two worked faces present (F1-F21), all other faces broken off. Striated tooling on F1 and F2.Badly chipped.	240	105	170
AF7	Magnesian Limestone	1010	12th	Magnesian limestone block, part of one face surviving (F1), striated tooling on F1. Very faint.	150	70	220

AF8	Magnesian Limestone	1065		Magnesian limestone block, part of two faces present (F1-F2), rectangular in cross-section, trapezoidal in plan. No tooling, surfaces very worn. No tooling surviving.	115	135	71
AF9	Millstone Grit	1065	Roman	Block of millstone grit, very badly eroded, no clear surfaces present. Geology suggests that this is of Roman date.	210	170	170
AF10	Magnesian Limestone	1036		Magnesian limestone block, three faces present (F1-F3) forming the corner of a block. Very worn, no tooling present. Mortar on all faces suggesting re-used.	75	35	75
AF11	Magnesian limestone	1010	12th	Magnesian limestone, part of three faces present (F1-F3), forming the corner of a block. All surfaces very worn, no tooling surviving.	145	70	82
AF12	Magnesian limestone	1010	12th	Magnesian limestone block, part of two faces present (F1 andF2) at right angles to one another. All other surfaces broken off. Striated tooling on F1 and F2. Reused as mortar present on all surfaces.	205	250	90
AF13	Millstone Grit	1062	Roman	Millstone grit, block, possibly two worked faces present, but so eroded and battered that it is impossible to be sure. Geology suggests a Roman date.	230	160	120
AF14	Magnesian Limestone	1068	12th	Magnesian limestone block, part of two faces present (F1-F2) at right angles to one another. Reused as mortar present on all surfaces. Some striated tooling on F2.	190	160	100
AF15	Magnesian Limestone	1043	12th	Magnesian limestone block, five worked faces present, (F1-F5), sixth side broken off. F3, the frontal face has	220	180	205

				a slightly dished shape, and the function is unclear. Striated tooling on F1-F3. Mortar on all faces, but particularly on the base F5.			
AF16	Magnesian Limestone	1025	Roman	Worked block of magnesian limestone, roughly rectangular in cross-section and plan, with part of four dressed faces (F1-F4) present, forming a corner of a block. Front face 125x235mm in size and rectangular in shape. Striated tooling an all surfaces. Was numbered AF4 on site, but renumbered as AF 16 in post-excavation.	235	170	125
AF17	Magnesian Limestone	1025	Roman	Roughly dressed magnesian limestone block, rectangular in cross section, trapezoidal in plan. Front face 111x230mm in size. No clear tooling. Was numbered as AF3 on site, renumbered as AF17 in post-excavation.	230	210	111
AF18	Oolitic Limestone	1025	Roman	Roughly worked block of oolitic limestone. Rectangular in cross section and trapezoidal in plan. Front face 110x200mm in size. No clear tooling. Was numbered AF5 on site but renumbered as AF18 in post-excavation.	200	270	110
AF19	Magnesian Limestone	1025	Roman	Roughly shaped rectangular block of magnesian limestone. Roughly rectangular in cross section and plan. Possibly part of one original face present, but difficult to be sure as the fragment was badly damages. No tooling visible. Was numbered Af2 on site,	350	310	120

				renumbered AF19 in post-excavation.			
AF20	Magnesian limestone	1018	12th	Chamfered and rebated block, with seven worked faces present (F1-F7). Striated tooling on all worked surfaces. Clearly reused as mortar was present on F1, F2 and F5 all of which would have been visible surfaces originally. Mortar also present on F6 and F7. Clearly from a jamb. Part of a socket for a hinge visible. Was numbered Af1 on site, renumbered AF20 in post-excavation.	340	305	140
AF21	Oolitic limestone	1025	Roman	Block of oolitic limestone, roughly worked, rectangular in cross section and plan. No tooling present. Was numbered AF5 on site, renumbered AF 21 in post-excavation	290	250	120
AF22	Magnesian Limestone	1067	12th	Magnesian limestone block, large, roughly squared, only one face (F1) with striated tooling, but the tooling was only over a small area of the face. Recorded as stone fragment 4 on site.	660	480	185
AF23	Magnesian Limestone	1067	12th	Magnesian limestone block, six roughly dressed faces surviving (F1-F6), striated tooling on F6. Recorded as stone fragment 5 on site.	370	270	180
AF24	Magnesian Limestone	1043	12th	Magneisan limestone block, five faces surviving (F1-F5), sixth side (an end) broken off. Long rectangular block in plan, almost square in cross-section. Striated tooling on all five faces. Mortar on three faces, clearly showing re-use.	665	205	175
AF25	Magnesian Limestone	1043	12th	Magnesian limestone block, part of one face surviving	325	205	210

				(F1), all other sides broken off. Mortar on all surfaces showing reuse. Striated tooling on F1. F1 has a slightly curving profile, possibly a jamb,. Recommend retention and review by an architectural historian to determine the original function. Recorded as stone fragment 3 on site.			
AF26	Magnesian Limestone	1043	12th	Chamfered magnesian limestone block, three faces present (F1-F3), F1 and F2 being at right angles to one another with a chamfer at the junction, and F3 being the base. All other sides broken off. Striated tooling on F1 and F2. Recorded as stone fragment 1 on site.	285	240	205

Table 5:2. Architectural Fragment catalogue.

2.5 REFERENCES

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APPENDIX 6: FOUNDATION STONE REMOVAL

BY S.A. HARRISON FSA

The excavation of the lift shaft trench revealed the 13th century foundations of the South Transept arcade and west wall. These projected into the trench and had to be removed prior to the installation of the lift. Each stone was numbered and recorded in elevation and plan prior to removal (Figures 10-14). The numbering sequence continued from that used during the excavation (see appendix 5). The Cathedral Archaeologist, Stuart Harrison, recorded each block after removal, and his report follows. Some stones had already been recorded by J McComish.

AF20 CONTEXT 1018 (Found as AF1 and recorded as AF20 by J. McComish, Appendix 5)
This stone has a small 6cm chamfer on the external vertical angle and a 6.6cm rebate on the inner jamb. Within the rebate jamb and set into the upper bed face of the stone is a tee-shaped 1cm deep socket for a hinge pintle. This suggests that the stone is either a window with shutters or a doorjamb. The size of the socket tends to suggest it was for a window hinge pintle. The bed of the stone has patches of white mortar with charcoal inclusions. The side of the rebate also has traces of a plastered surface 3-4mmm thick, also white with charcoal flecking.

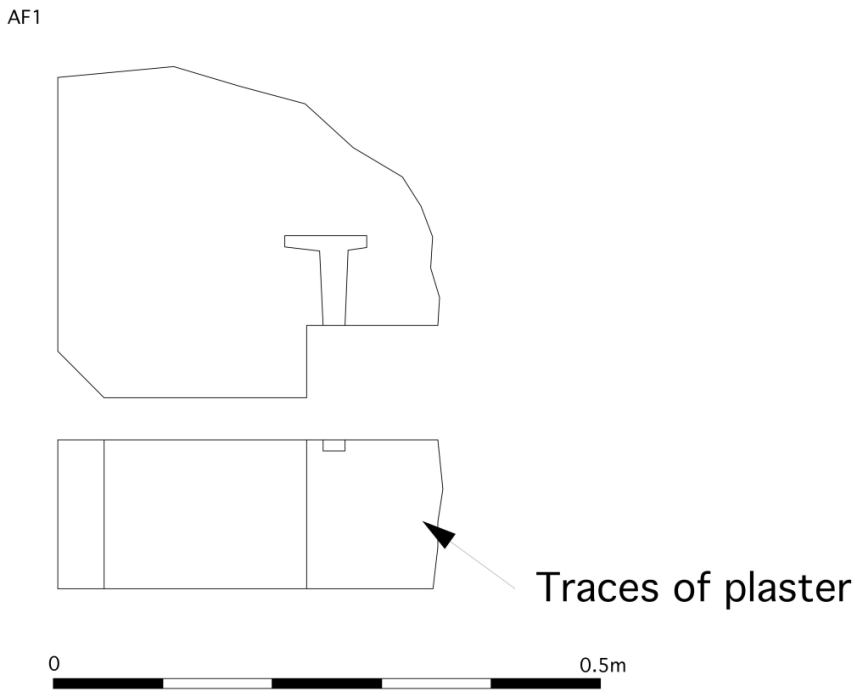

Figure 18 Architectural fragment 20 (formerly AF1)

The tooling is bolster on the bed faces but fine striated on the visible faces which are better finished. This type of tooling is typical of that used by the masons who built the new choir of archbishop Roger 1154-81.

Plate 32 AF20 (was AF1) Showing striated tooling, plaster on rebate and socket for hinge pintle

DESCRIPTION OF STONES REMOVED FROM FOOTINGS

(AF22-26 also recorded by J McComish)

AF22

A large block with no apparent worked surface 68cm x52cm x 24cm

AF23

An ashlar block which has no good tooled face 39cm x 22cm-29cm x 28cm

AF24

A well finished ashlar block with diagonal tooling 66.5cm x 18cm x 20cm

AF 25

A block worked with a concave curved face that is diagonally tooled. The side faces are tapered radially. Such curved blocks often originated in the curved shells of stair turrets but the unusual feature with this one is the radial side joints taper in the wrong direction. 32.5cm x 20.5cm x 25cm

AF26

A block worked with a 5cm chamfer on one edge. It is diagonally tooled 29cm x25cm x 20.5cm

AF27

Rubble roughed out block with no worked faces 38cm x 24cm 23cm

AF28

An ashlar block with a small squared face area showing diagonal tooling. 23cm x 24cm x 38cm

AF29

A block with a large roll moulding on the main angle attached to a squared tail block. The piece is finely finished but not of the highest striated quality. The side return face below the roll shows coarser diagonal tooling. Marked on this is a setting out line but this is not parallel with the front face. On the bed face there is a layer of original bedding mortar 8-10mm thick which is white with charcoal flecking.

The purpose of this piece was a wall shaft, probably from a corner location. The blocks would have alternated in orientation to correctly course with the wall. Numerous identical blocks make up the foundation wall above but are turned with the moulding facing into the wall core. A pallet load of these are in the Yorkshire Museum store and may have come from the same foundation in the 1970s excavations.10.1cm x 21cm

AF30

An ashlar block with a damaged main face. Only part of the finished surface remains with diagonal tooling 32.7cm x 20cm x 32cm

AF31

An ashlar block with basic tooling on some faces of diagonal type. It seems probable that the best finished face is obscured by mortar. 61cm x 20cm x 20cm

AF32

A large block with a worn 5cm chamfer worked on the two upper edges around a corner. It forms a right angle block of triangular shape. The rear face forming the hypotenuse seems to be broken which may indicate the block was rectangular originally. 53cm x 53cm x 21cm

AF33

A very large block with no apparent faced areas at all. 65cm x52cm x 20cm

AF34

Rough block with no good finished faces 54cm x 42cm x 21cm

AF35

An ashlar block which is well finished with pronounced diagonal tooling. 42cm x 16cm x 26cm

AF 36

A large featureless block with no apparent worked faces.
43cm x 16-18cm x 22cm deep

AF37

A small block, apparently a fragment of an ashlar with fine striated tooling on what remains of the facing. 23cm x12-18cm x 18cm

AF38

Ashlar block with a band of mortar onside of the main face 9.5cm wide. Diagonal tooling. 27.5cm x 21.6cm x 21cm deep

AF39

What appears to be an ashlar block with pronounced diagonal tooling on the face. It is 23cm x 17cm and the edges are damaged

AF40

A block with a concave hollowed curved section. It seems likely to have formed part of an eaves cornice. On each side face is a vertical setting out line and aligned with it on the underside is mortar bedding with a distinct edge. This shows the underside of the block overhung the wall face below it.
The tooling is vertical on the curved face and diagonal on the straight faces. 35.5cm x 21cm x 16.3cm x 440cm deep

AF41

An ashlar block showing a band along the lower edge 7.5cm deep of finished surface and rough dressed above. Diagonal tooling on face. 33.5cm x 20cm x 23cm deep

AF42

A block with a roll moulding along the angle, probably part of a jamb. It appears to be a straight piece and there is no sign of any curvature. The tooling on the roll is straight and on the other faces diagonal. 20.2cm x 16cm x 315cm It relates to AF 50.

AF43

An ashlar block with a finely finished face. The tooling is diagonal broad bolster. Very finely incised into the face is a mason's mark of the type used by the masons working on the twelfth century choir. 22cm x 22cm x 33cm deep

AF44

A moulded jamb block with a pair of large rolls separated by a squared fillet on the centre. The junctions between the rolls and angles retain traces of white plaster 34cm x 22cm x 230 deep.

AF45

A block with a raised 3.5cm chamfer worked on the left side and a 4.5cm side strip. The face to the right of the chamfer is plastered over but where it has lost facing the underlying stone shows fine diagonal tooling. The plaster is 4mm thick and not very polished. The purpose of this stone is not easy to determine but it might be that the chamfer was set horizontally and was an extension to the abacus of a capital. 25cm x 21cmx 34.5cm deep

AF46

A rough ashlar block with a finer dressed 6cm band along the lower edge on the side face. The tooling on the main face is fairly coarse in character, possibly for plastering. 34cm x 24 x 25cm deep

AF47

Ashlar block with a coarsely tooled diagonal finish, possibly for plastering. 34cm x 17.5cm x 23cm deep

AF48

Ashlar block with prominent claw tooling set diagonally on the main face. 45cm x 26.5cm x 24cm deep

AF49

Ashlar block with a 9cm chamfer worked on one vertical edge. The main face retains what may be traces od decayed plaster. Main face 24cm to chamfer x 20cm x 26cm deep

AF50

A block 20cm high with a roll moulding rising from a plain base block 4.6cm high. The base block is 16.6cm long. The stone appears to have been part of a jamb forming the base block. The minor arches and arcades of the twelfth century choir are notable for the use of plain base springer blocks. 17cm x 16.6cm

The tooling is striated on the main faces with some horizontal on the roll moulding. The block is very well finished. AF42 is probably from the same feature.

AF51

A very well finished angled block. The two main faces meet at an angle of 45 degrees and the faces slope back at an angle of 104 degrees or 76 sloped back from vertical. There is a finely inscribed mason's mark on the face. This may have been part of a pinnacle caphouse of polygonal form with eight sides tapering in a conical form. Two other examples were observed in the west footing but not removed. Base lengths 18cm and 24cm sloping face 20.5cm

AF52

Rubblestone irregular shape.30cm x 13cm x 23cm deep

AF53

Rubblestone irregular shape 28cm x 15cm x 25cm deep

AF54

Rubblestone irregular shape. 34cm x 14cm x 20cm deep

AF56

Rubblestone irregular shape 28cm x 17cm x 20cm deep

AF57

Large irregular block with a flat upper surface tapering from 38cm to 29cm over length of 90cm. Possibly peck tooling on upper face but difficult to be sure because of mortar.

AF58

A block similar to AF59 with the same mason's zed mark on the lower face. The chamfered face is degraded and only a small area retains the original tooled finish. Apparently a base plinth block. 48cm x 21cm x 43cm deep

AF59

A plinth block with a well-worked chamfer showing good diagonal tooling. Zed mason's mark on main lower face. Similar to AF58. 52cm x 20.5cm x 42cm deep

AF61

Irregular-shaped block with only one straight face. This is 9.5cm deep and the upper bed rises to 17.5cm over the front to back length of 48cm. Overall length 60cm

AF62

Small pieces of rubblestone.

SCHEMATIC SCALE DRAWINGS OF STONES REMOVED FROM FOOTINGS

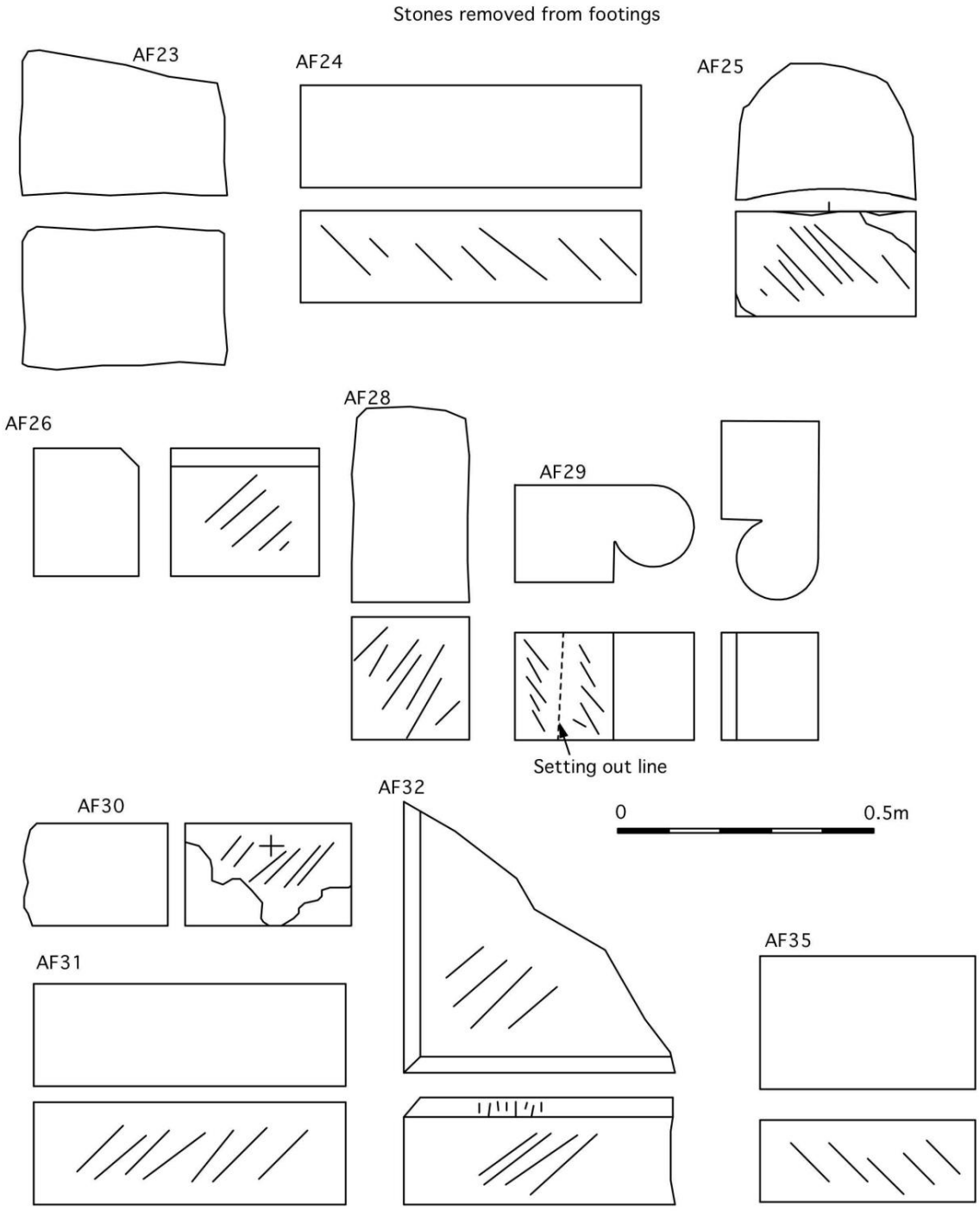

Figure 19 Stones removed from the 13th century footings

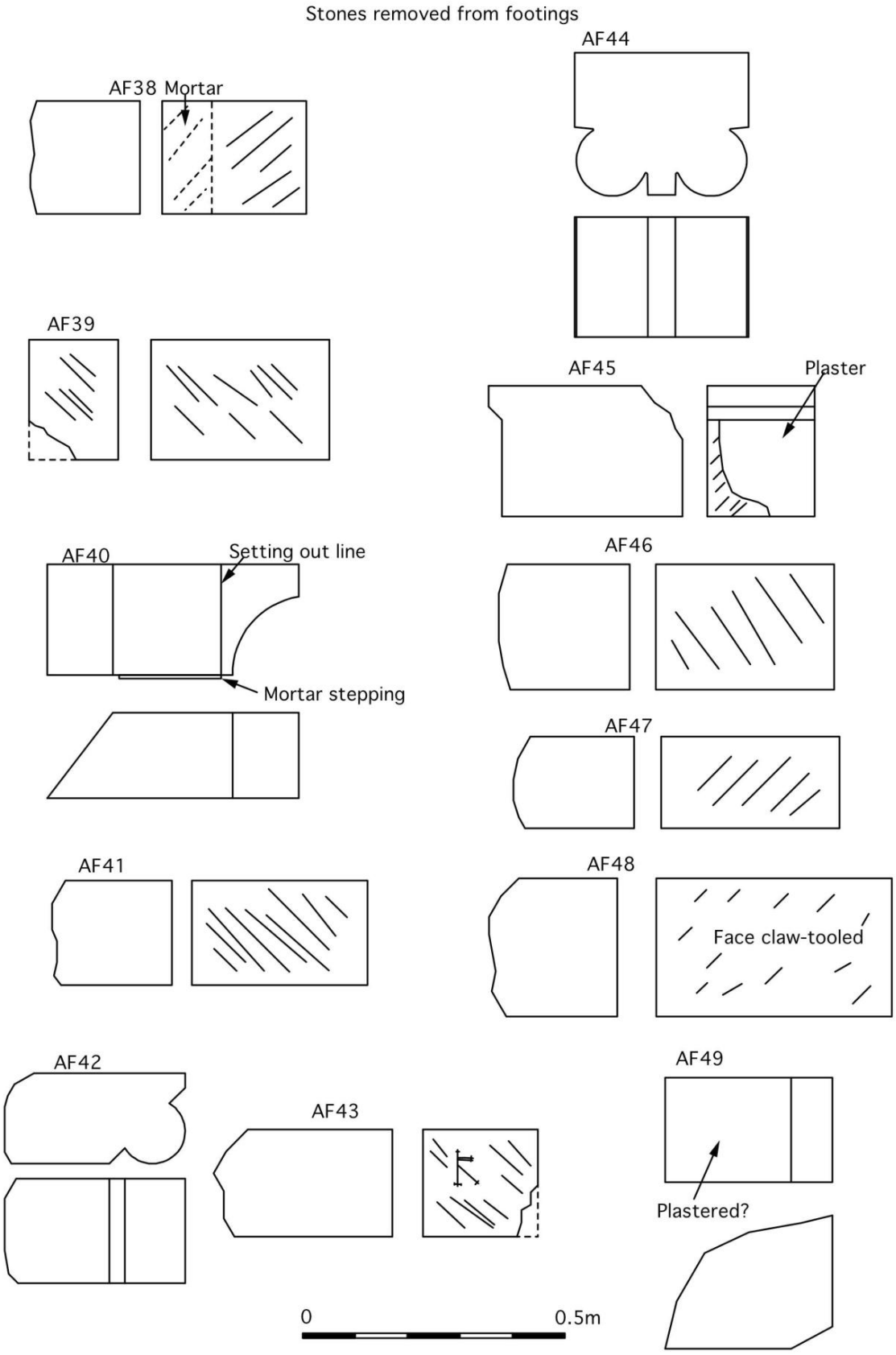

Figure 20 Stones removed from the 13th century footings

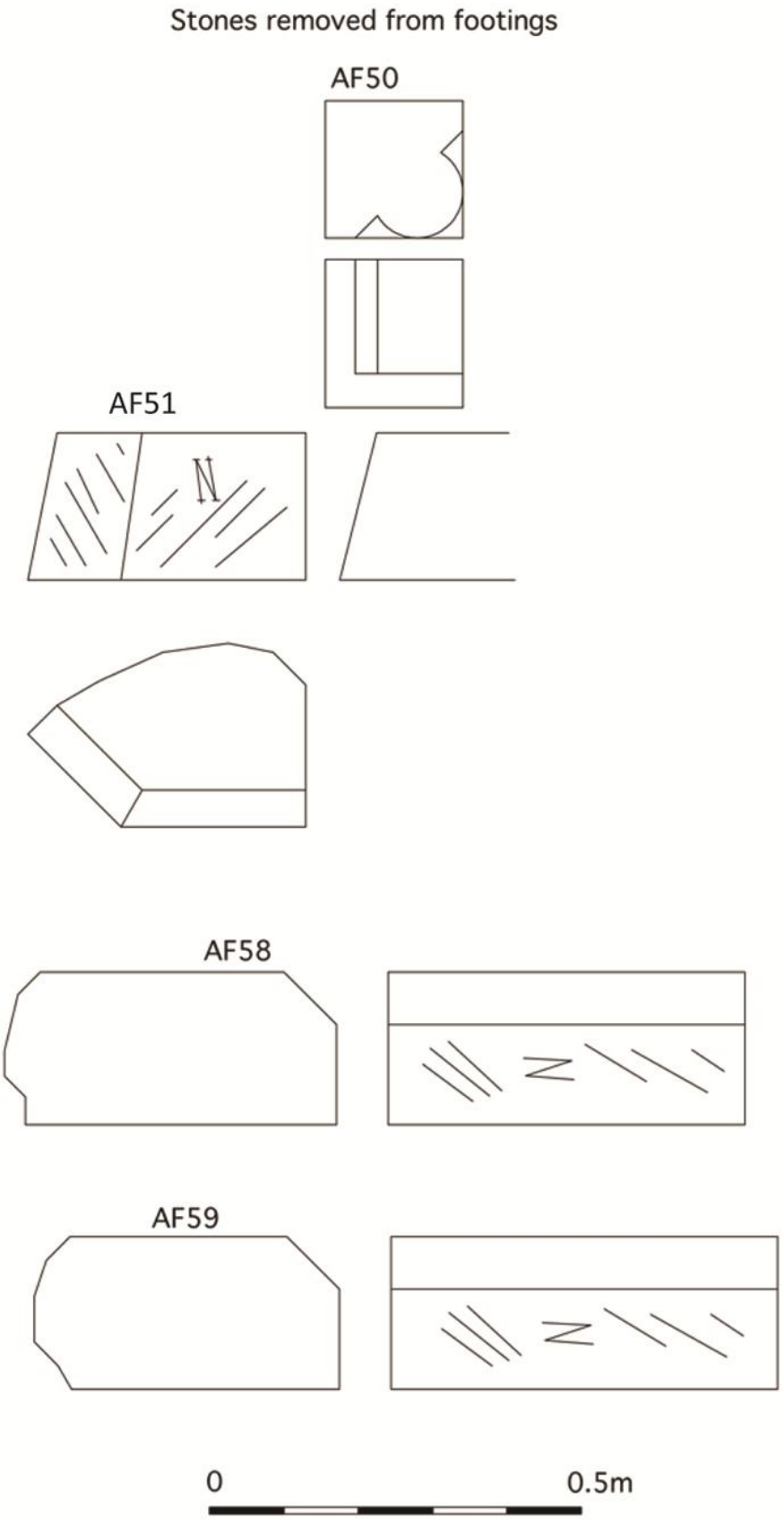

Figure 21 Stones removed from the 13th century footings

Plate 33 Finely inscribed mason's mark on stone AF30

Plate 34 Finely inscribed mason's mark on stone AF43

Plate 35 Finely inscribed mason's mark on stone AF51

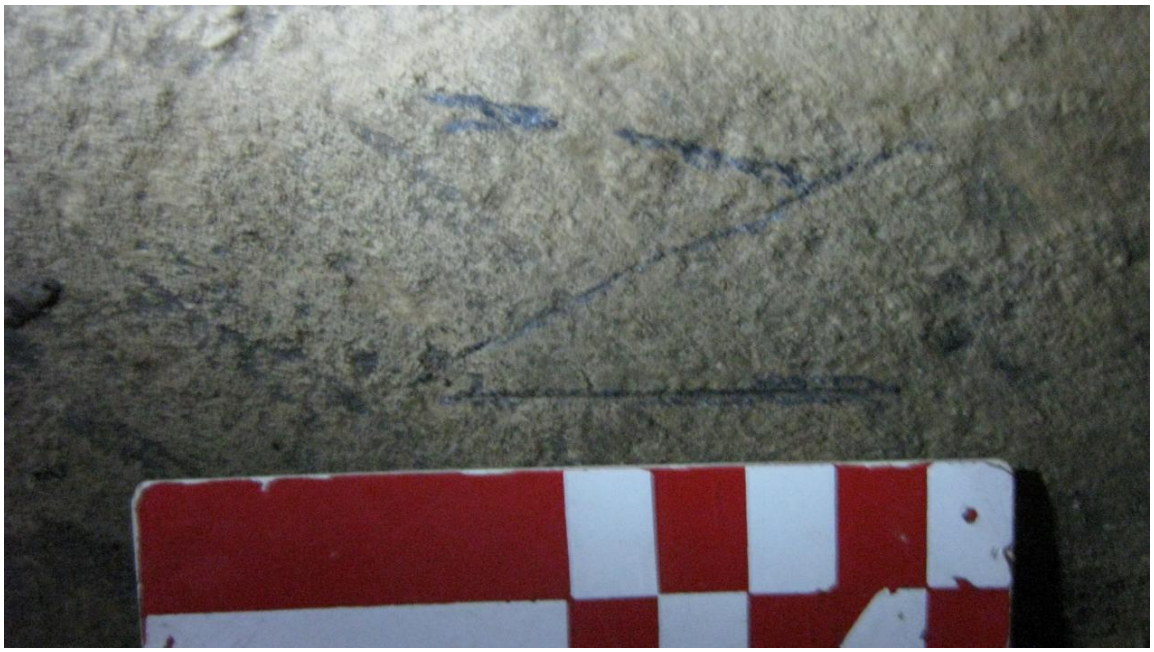

Plate 36 Finely inscribed masons' mark on stone AF58

Plate 37 Finely inscribed masons' mark on stone AF59

INTERPRETATION AND CONCLUSIONS

As far as could be ascertained all the blocks appear to be of the type of magnesium limestone used in the eleventh and twelfth-century church, though it should be borne in mind that some of them are largely coated with decayed mortar.. The characteristic tooling and in some cases mason marks suggest a twelfth-century source for much of the material. Notably the mark on AF43 was also observed on a ashlar stone in the eastern footing. The types of ashlar tend to be long rectangular blocks that were a feature of that period rather than the more squared blocks of the eleventh century period. We know that archbishop Roger after completing the new choir remodelled the transepts. This included the demolition of the apses on their east sides and their replacement with square-planned structures. That on the east side of the south transept partly remains and shows similar ashlar blocks. It is also clear that the new structure was plastered and painted with red imitation ashlar joints. In this respect it is therefore notable that two pieces of the stones retain traces of plastered faces. Moreover the plaster seems to have been carefully applied to leave the well-dressed ashlar faces or architectural features exposed.

One stone AF44 has a paired roll arrangement with a central squared fillet set between them. It is likely to be earlier in date and probably originated in the cathedral of archbishop Thomas or that of Thurstan. Such stones could easily be recycled into the later phase of building and when Roger constructed the new eastern transept chapels it is likely that much debris from the demolition of the earlier choir was available for reuse.

The presence of the well-finished corner shafts also suggest a twelfth century origin and the sheer quantity of these reused in the upper walling of the footing gives an indication that the internal corners of the new structure featured such shafts. The inevitable conclusion must be that this material was spoila from the demolition of the earlier transepts reused in the thirteenth century foundations, in particular that part of the building erected during Roger's episcopate. In that respect it adds considerably to the similar material recovered from the same source in the earlier excavations by Derek Phillips.

APPENDIX 7: HUMAN BONE BY DR A CAFFELL AND DR M HOLST

YORK OSTEOARCHAEOLOGY LTD. REPORT 2112

SUMMARY

In July 2012 York Osteoarchaeology Ltd was commissioned by York Archaeological Trust for Excavation and Research Ltd (YAT) to carry out an assessment of a large assemblage of disarticulated human remains, and the full analysis of a single articulated skeleton, recovered during archaeological excavations at York Minster, York, North Yorkshire (NGR SE 6029 5233).

The single articulated burial consisted only of a pair of feet, as the grave had been truncated by the construction of the 13th century transept of York Minster. However, the bone that survived was in excellent condition, with minimal fragmentation and virtually no surface erosion. The skeleton was an adult of unknown sex, who had a minor cortical defect in one of their joint surfaces.

Disarticulated human bone was found in thirty contexts, but the majority (92.8% of the identified bones, 96.2% of the fragments) derived from three contexts. The total number of bones identified was 1,427, and the total number of fragments was 3,661. Context 1016 and 1009 were probably once a single deposit of bone (1016), some of which had later been disturbed and redeposited (1009). Context 1037 may contain bone from the original Anglian cemetery.

On the whole the disarticulated bone was well preserved, with good preservation of surface detail, and relatively little fragmentation. Many bones were complete, or nearly so. The majority of bones present were adult, but a small number were non-adult remains. It was felt that the potential data to be obtained from full analysis was reasonably promising, considering the limitations associated with disarticulated human remains. Through further analysis it should be feasible to gain an insight into the demography of the population as there were well preserved pelvic and skull bones present. Metric and non-metric analysis could be carried out, and frequencies of pathological conditions and dental disease could be calculated to gain an insight into health and diet. Although the data collected would not be as rich and informative as that obtained from articulated individuals, it would still provide information on the individuals buried at York Minster in the 10th to 12th centuries. This is a time period when there is a particular dearth of human remains in York.

1.0 INTRODUCTION

In July 2012 York Osteoarchaeology Ltd was commissioned by York Archaeological Trust (YAT) to carry out an assessment of a substantial assemblage of disarticulated human remains, and the full analysis of a single articulated skeleton, recovered during archaeological excavations at York Minster, York, North Yorkshire (NGR SE 6029 5233).

The single articulated burial (Skeleton 1, Context 1024) was found within a cist grave that had been truncated by a 13th century foundation trench. The burial is believed to date to the 11th century, but a sample of bone has been taken for radiocarbon dating.

Disarticulated human bone was recovered from thirty contexts (Table 7:1). These contexts relate to the possible Anglian demolition of the *Principia*, disturbance of the Anglo-Saxon cemetery, and construction of the 13th century transept of the Minster. Two of the largest contexts of disarticulated bone were Contexts 1016 and 1009. These contained bone from the 10th/11th century and 12th century cemeteries disturbed by the construction of the 13th century transept of York Minster. Context 1016 was associated with the earliest phase of construction, and was deposited first with the bones placed randomly. Context 1009 was related to a later phase of construction involving disturbance of Context 1016 and re-deposition of the bone, this time carefully arranged along the line of the wall. These two contexts will be discussed below as the first charnel group. Context 1037 was the third largest context, found in a pit cut by the 11th century inhumation burial (Skeleton 1). These remains may derive from an Anglian cemetery pre-dating the Anglo-Saxon cemetery identified in the 1960s. This will be discussed as the second charnel group. The remaining contexts all contained relatively small quantities of human remains.

Context	Context Description	Phase Description
1003	Disturbance/Levelling	Modern
1006	Construction spread	C13th transept construction
1007	Construction backfill of C13th transept west wall	C13th transept construction
1008	Construction backfill of C13th transept arcade wall	C13th transept construction
1009	Deposit of charnel in construction cut of C13th arcade wall	C13th transept construction
1013	Construction spread	C11th cathedral construction
1015	Construction backfill of C13th arcade wall	C13th transept construction
1016	Deposit of charnel in construction cut of C13th arcade wall	C13th transept construction
1018	Slumping in C13 arcade wall construction cut	C13th transept construction
1021	Dump of mortary waste	C11th Cist burial
1023	Grave backfill (overlay inhumation 1024)	A/S cemetery
1028	Dump	C11th cathedral construction
1029	?Robber backfill	? A/S disturbance of ?Anglian cemetery
1031	Levelling/dump	? A/S disturbance of ?Anglian cemetery
1032	Backfill of ?disturbed grave	? A/S disturbance of ?Anglian cemetery
1034	Dump	? A/S disturbance of ?Anglian cemetery
1035	Dump of mortary waste	?Anglian demolition of Principia
1036	Charnel pit backfill	? A/S disturbance of ?Anglian cemetery
1037	Charnel	? A/S disturbance of ?Anglian cemetery
1039	Refuse pit backfill	? A/S disturbance of ?Anglian cemetery
1049	Pitched deposit of demolition waste	?Anglian demolition of Principia
1050	Pitched deposit of demolition waste	?Anglian demolition of Principia
1051	Levelling/dump	?Anglian demolition of Principia
1053	Dump	?Anglian demolition of Principia
1055	Pitched deposit of demolition waste	?Anglian demolition of Principia
1056	Construction backfill	C13th transept construction
1057	Dump of mortary waste	?Anglian demolition of Principia
1058	?'Dark Earth'	?Early Anglian
1062	Rubbly demolition deposit	?Late Roman
1069	?'Dark Earth'	?Late Roman

Table 7:1 Contexts containing disarticulated bone

Three fragments of cremated bone were found amongst the bone from Context 1037.

1.1 AIMS

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

The aims of the assessment of the disarticulated remains included quantification of the material, assessing its condition and potential for further analysis regarding the standard osteological data collected (as recommended by Mays et al. 2002).

1.2 METHODS

The skeleton was analysed in detail, assessing the preservation and completeness, as well as attempting to determine the age, sex and stature of the individual. All pathological lesions were recorded and described.

The disarticulated remains were assessed partly following English Heritage guidelines (Mays *et al.* 2002). An inventory does not normally form a part of a standard assessment, but in this case a basic inventory was created. Recording disarticulated human remains is complicated by the fact that a single bone can be present as several fragments. Consequently, all the bone from each context in turn was laid out together, and any obvious parts of the same bone were matched. This was only feasible within the time available because the amount of fragmentation was relatively minimal, and because the bones had been roughly pre-sorted into bone type prior to the assessment. Both a count of the bone fragments and a count of the probable number of bones represented were made for each bone element. Crania were treated slightly differently, as they are made up of multiple bones that may (or may not) be fused together, and because several individual crania had been identified on site in three of the contexts. A small number of additional crania were identified during the assessment. Each individual cranium was treated as a single entity and given a lower case letter attached to the context number (e.g. 1009a), so that they could be distinguished. Cranial fragments that could not be matched to a specific cranium were recorded separately as bones/ fragments.

An estimate was made of the minimum number of individuals (MNI) represented by each bone element, based on a count of duplicated long bone ends, or distinctive anatomical feature for other bones. This was frequently lower than the number of bones thought to be present, as not all bones were complete. This data was used to give an indication of the MNI within each context, but cannot be used to give the MNI for the assemblage as a whole.

An overall assessment of the condition of the bone within each context was made. An observation was made on the completeness of the bones, the degree of fragmentation, and the amount of surface erosion. The potential of the remains to supply osteological information on age, sex, stature and cranial metrics was assessed, and a note was made of the types of pathological conditions that were present.

2.0 OSTEOLOGICAL AND PATHOLOGICAL ANALYSIS: ARTICULATED SKELETON

Osteological analysis is concerned with the determination of the identity of a skeleton, by estimating its age, sex and stature. Robusticity and non-metric traits can provide further information on the appearance and familial affinities of the individual studied. This information is essential in order to determine the prevalence of disease types and age-related changes. It is crucial for identifying sex dimorphism in occupation, lifestyle and diet, as well as the role of different age groups in society. Summaries of the osteological and palaeopathological data are given in Table 7:2, with a detailed catalogue provided in Appendix A.

Sk No	C (%)	SP	F	Age	Age Group	Sex	Stature (cm)	Dental Pathology	Pathology
1	<10%	0	min	18+	a	?	-	-	Cortical defect in proximal right first foot phalanx

Key: SP = Surface preservation: grades 0 (excellent), 1 (very good), 2 (good), 3 (moderate), 4 (poor), 5 (very poor), 5+ (extremely poor) after McKinley (2004); C = Completeness; F = Fragmentation: min (minimal), sli (slight), mod (moderate), sev (severe), ext (extreme)
Non-adult age categories: f (foetus, <38weeks *in utero*), p (perinate, c. birth), n (neonate, 0-1m), i (infant, 1-12m), j (juvenile, 1-12y), ad (adolescent 13-17y)
Adult age categories: ya (young adult, 18-25y), yma (young middle adult, 26-35y), oma (old middle adult, 36-45y), ma (mature adult, 46+y), a (adult, 18+y)

Table 7:2 Summary of osteological/palaeopathological data of the articulated skeleton

2.1 PRESERVATION

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

Surface preservation, concerning the condition of the bone cortex, was assessed using the seven-category grading system defined by McKinley (2004), ranging from 0 (excellent) to 5+ (extremely poor). Excellent preservation implied no bone surface erosion and a clear surface morphology, whereas extremely poor preservation indicated heavy and penetrating erosion of the bone surface resulting in complete loss of surface morphology and modification of the bone profile. The degree of fragmentation was recorded, using categories ranging from 'minimal' (little or no fragmentation of bones) to 'extreme' (extensive fragmentation with

bones in multiple small fragments). Finally, the completeness of the skeletons was assessed and expressed as a percentage: the higher the percentage, the more complete the skeleton.

Skeleton 1 was less than 10% complete, consisting solely of both feet. The right foot was missing three tarsals and all intermediate and distal phalanges, while the left foot was missing all three rows of phalanges. The bones were all intact and surface preservation was excellent, although the left talus had some mortar attached to the superior and medal sides that had obscured the bone surface.

2.2 ASSESSMENT OF AGE

Age was determined using standard ageing techniques, as specified in Scheuer and Black (2000a; 2000b) and Cox (2000). For non-adults age is estimated using the stage of dental development (Moorrees *et al.* 1963a; 1963b), dental eruption (Ubelaker 1989), measurements of long bones and other appropriate elements, and the development and fusion of bones (Scheuer and Black 2000b). In adults, age is estimated from stages of bone development and degeneration in the pelvis (Brooks and Suchey 1990, Lovejoy *et al.* 1985) and ribs (modified version of methods developed by İşcan *et al.* 1984; 1985 and İşcan and Loth 1986 provided in Ubelaker 1989), supplemented through examination of patterns of dental wear (Brothwell 1981, Miles 1962).

The foot bones of Skeleton 1 had completed development. The proximal ends of the phalanges and first metatarsal, and the heads of the second to fifth metatarsals were all fused. This indicated the individual was probably older than c. sixteen to eighteen years, and was therefore an adult. Unfortunately, it was not possible to provide a more precise age estimate as the relevant parts of the skeleton were not present.

2.3 SEX DETERMINATION

It was not possible to determine the sex of Skeleton 1 as the pelvis and skull were not present.

2.4 METRIC ANALYSIS

It was not possible to conduct any of the standard metric analyses for Skeleton 1 as the relevant parts of the skeleton were absent.

2.5 NON-METRIC TRAITS

Non-metric traits are additional sutures, facets, bony processes, canals and foramina, which occur in a minority of skeletons and are believed to suggest hereditary affiliation between skeletons (Saunders 1989). The origins of non-metric traits have been discussed extensively

in the osteological literature and it is now thought that while most non-metric traits have genetic origins, some can be produced by factors such as mechanical stress (Kennedy 1989) or environment (Trinkhaus 1978). Thirty post-cranial (bones of the body and limbs) non-metric traits were selected from the osteological literature (Finnegan 1978) and recorded.

Skeleton 1 had a variation in the shape of the joint between the talus and calcaneus in both feet, whereby there are double (rather than single) facets between the two bones. This trait was observed in both calcenei (*double anterior calcaneal facets*) and in the left talus (*double inferior talar facet*); the right talus had been lost post-mortem.

2.6 PATHOLOGY

Pathological conditions (disease) can manifest themselves on the skeleton, especially when these are chronic conditions or the result of trauma to the bone. The areas to which muscles attach can also provide information on muscle trauma. All bones were examined macroscopically for evidence of pathological changes.

Skeleton 1 had a small roughly square depression in the centre of the proximal joint surface of their right proximal first foot phalanx (big toe). The margins were smooth and rounded, and the floor of the lesion was slightly rough and porous. This was probably a cortical defect, a small developmental error that occurred when the joint surface was forming.

2.7 CONCLUSION

The surviving bone from Skeleton 1 was in excellent condition with perfect preservation of surface detail and no fragmentation. Unfortunately, most of the skeleton had been truncated and only the feet survived. It was possible to determine that the individual was an adult, and that they had a common variation in joint shape along with a minor developmental anomaly in one of their joint surfaces.

3.0 ASSESSMENT OF DISARTICULATED BONE

In total, 1,427 bones and 3,661 bone fragments were assessed, and the numbers per context can be seen in Table 7:3. Note that for three contexts (1009, 1016 and 1037) the total number of bones includes individual crania counted as a single bone, although in reality each was made up of several bones. The vast majority of these bones and fragments derived from three contexts: Context 1016, which contained 40.6% of the bones and 46.3% of the fragments; Context 1037, which contained 32.9% of the bones and 29.0% of the fragments; and Context 1009, which contained 19.2% of the bones and 20.9% of the fragments. The remaining 7.2% of the bones and 3.8% of the fragments were distributed

between the remaining 27 contexts. It should be borne in mind that the bone and fragment count was conducted rapidly and full analysis may refine these numbers.

Context	SP	F	Completeness	No. Bones*	No. Frags	MNI
1003	1	mod	50-100%	21	36	4
1006	2	mod	10-40%	2	8	1
1007	2	min	90-100%	4	4	2
1008	3	sli	30-100% (most 50%+)	16	18	3
1009	1-4	min-mod	30-100% (most 70%+)	274	764	20
1013	0	sli	70%	1	1	1
1015	1	min	100%	2	2	1
1016	0-4	min-mod	30-100% (most 70%+)	580	1694	32
1018	2	min-mod	5-100% (most c. 100%)	5	5	2
1021	1	mod	30%	1	4	1
1023	0	min	100%	3	3	1
1028	1	min	90%	1	1	1
1029	1	min	100%	1	1	1
1031	0	min-sev	5-100%	3	3	1
1032	0	min	100%	5	5	1
1034	0	sli	30-100% (most 100%)	7	9	1
1035	1	mod	c. 30%	2	2	1
1036	1	sli	40-100% (most 60%+)	8	14	2
1037	0-1	min-sli	most 80%+	470	1063	9
1039	0	sev	5-100% (most <20%)	5	5	1
1049	2	min	100%	1	1	1
1050	1	min	c. 90%	2	3	1
1051	1	mod	40-100%	2	4	1
1053	0	mod	30%	1	1	1
1055	3	sli	30%	1	1	1
1056	4	mod	30%	1	1	1
1057	3	sli	40%	1	1	1
1058	1	sli	60-90%	2	2	1
1062	1	sli	40%	1	1	1
1069	3	sli	50-80%	4	4	1

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

MNI = minimum number of individuals

* For the purposes of this count, a cranium was counted as a single bone, even though it is made up of multiple bones

Table 7:3 Number of bone elements and fragments per context

The surface preservation was scored using the same method as for the articulated skeleton (McKinley 2004, see Section 2.1). It was not possible to provide a preservation score for each bone, so an overall score for the whole context was provided based on the condition of the majority of the bones. It can be seen from Table 7:3 that most of the contexts contained

bone with excellent, very good, or good surface preservation (grades 0, 1 or 2), and the remainder contained bone with moderate to poor preservation (grades 3 or 4). The majority of the bone from Context 1037 was in very good or excellent condition. The bone from Contexts 1009 and 1016 showed a greater range of preservation (from excellent to poor), but most of the bone was in good to moderate condition (grades 2-3). Bones from some contexts had deposits of mortar adhering (including contexts 1009, 1016 and 1037). These deposits were mostly fairly thin, but were enough to obscure the surface detail where they occurred. One scapula and rib from Context 1037 were encased in a larger block of mortar.

An estimate was made as to the amount of fragmentation observed (see Table 7:3). As with surface preservation, an observation was made about the amount of fragmentation typically observed within the context as a whole rather than by individual bone. Over half the contexts contained bone with only minimal or slight fragmentation, and only two contexts contained bone that was severely fragmented. The bone from Context 1037 had experienced minimal to slight fragmentation, whereas from Contexts 1009 and 1016 the bone displayed a range of fragmentation from minimal to moderate but the majority was slightly fragmented.

The completeness of the bones was assessed and expressed as a percentage (see Table 7:3). Again, this referred to the completeness typically observed and not to individual bones. The majority of contexts contained bones that were 100% (or approaching 100%) complete. Most of the bones in Context 1037 were over 80% complete, and most of the bones in Contexts 1009 and 1016 were over 70% complete.

Details of the bones found in each context are provided in Appendix B, and details of the crania are provided in Appendix C. A summary of the bones found, grouped by skeletal element, is presented in Table 7:4. Long bones from the leg made up 20.0% of the bones identified, followed by long bones from the arm (15.0% of the bones identified) and skull (13.0% of the bones identified). Bones from the spine and ribs each made up 10-11% of the sample, and bones from the hands and feet made up 8.4% and 10.7% of the sample respectively. The shoulder and pelvic bones made up 4.3% and 5.5% of the sample. Other bones identified less frequently included the hyoid bone and ossified thyroid cartilage (both from the neck region), the sternum and manubrium (breastbone), and the patella (kneecap).

Bone Type	Bones		Bone Frags	
	n	%	n	%
skull	186	13.0%	987	27.0%
hyoid/thyroid	4	0.3%	6	0.2%
spine	149	10.4%	180	4.9%
ribs	159	11.1%	480	13.1%
manubrium/sternum	9	0.6%	11	0.3%
shoulder (clavicle/scapula)	62	4.3%	149	4.1%
arm long bones	216	15.1%	325	8.9%
hands	120	8.4%	120	3.3%
pelvis (os coxa)	79	5.5%	192	5.2%
leg long bones	285	20.0%	467	12.8%
patella	5	0.4%	5	0.1%
feet	153	10.7%	152	4.2%
Un-ID	0	0.0%	587	16.0%
Total	**1427**		**3661**	

Table 7:4 Frequency of bone types present (grouped)

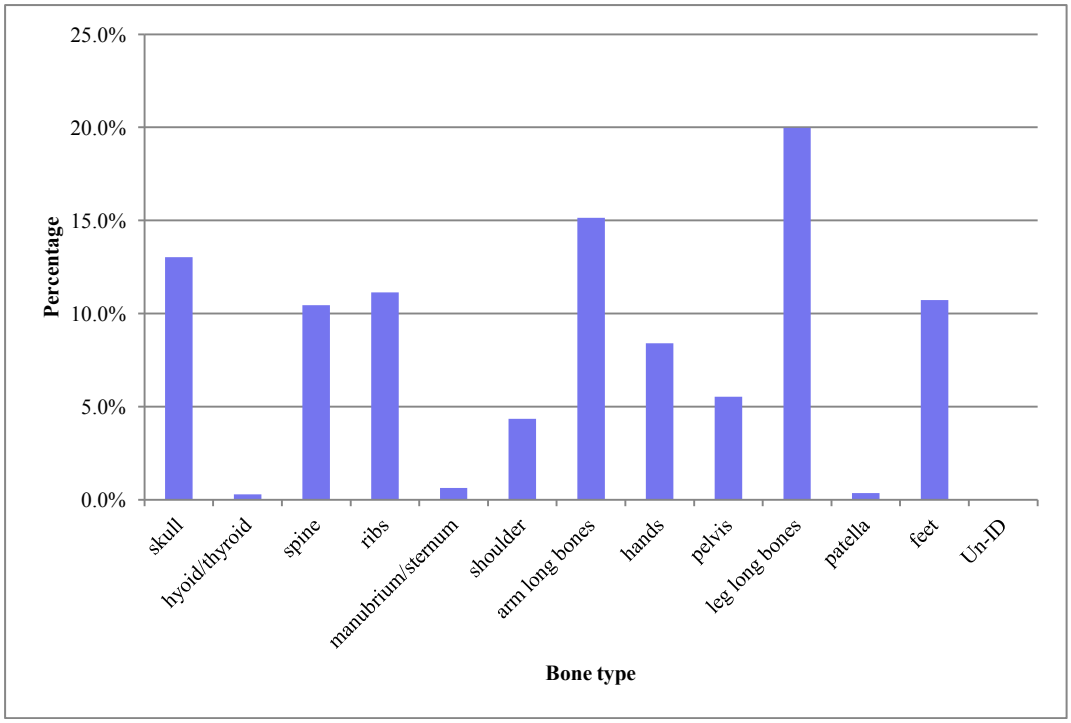

Figure 22 Frequency of bone types present (grouped)

Femora and tibiae were the long bones most frequently represented (number 120 and 108 respectively), followed by humeri (103), radii and fibulae (57 each) and ulnae (56). Thus the larger bones with thicker cortices were more likely to be present.

The pattern of bone representation varied considerably between the three main contexts (Table 7:5 and Figure 23). Contexts 1009 and 1016 had a similar pattern, dominated by long bones from the arms and legs and bones from the skull, whereas Context 1037 was dominated by bones from the hands, feet and torso (spine and ribs).

Bone Type	1009		1016		1037	
	n	%	n	%	n	%
skull	52	19.0%	75	12.9%	40	8.5%
hyoid/thyroid	0	0.0%	1	0.2%	3	0.6%
spine	22	8.0%	43	7.4%	74	15.7%
ribs	21	7.7%	67	=11.6%	57	12.1%
manubrium/sternum	0	0.0%	2	0.3%	7	1.5%
shoulder (clavicle/scapula)	12	4.4%	32	5.5%	13	2.8%
arm long bones	63	23.0%	118	20.3%	23	4.9%
hands	2	0.7%	5	0.9%	102	21.7%
pelvis (os coxa)	23	8.4%	41	7.1%	11	2.3%
leg long bones	74	27.0%	168	29.0%	29	6.2%
patella	0	0.0%	0	0.0%	4	0.9%
feet	5	1.8%	28	4.8%	107	22.8%
Total	**274**		**580**		**470**	

Table 7:5 Frequency of identified bones present (grouped) for contexts 1009, 1016 and 1037

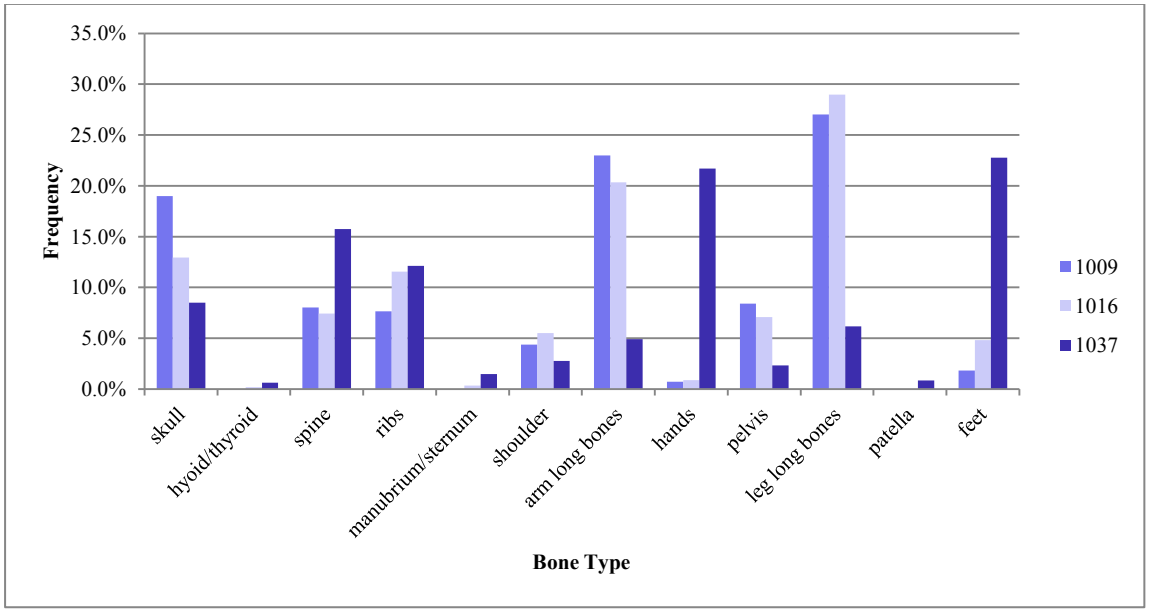

Figure 23 Frequency of identified bones present (grouped) for contexts 1009, 1016 and 1037

The three largest contexts contained individual crania, numbering 46 in total (three of which were non-adults). Most of these were excavated as individual crania, and a small number were pieced together during the assessment when it was obvious that the fragments matched. Fragments belonging to the previously identified crania were also discovered among the disarticulated cranial fragments. It is possible that further individual crania might be recognised on full analysis, if fragmented crania could be pieced together. It was also suspected that fragments belonging to crania from Context 1016 may have been present in Context 1009, and vice versa. This possibility should be investigated during full analysis.

The crania were graded according to how intact they were. The more intact they were then the greater the potential to determine sex or take measurements. However, it would still be possible to obtain data on sex from many of the more fragmented crania, and depending on the severity of fragmentation some measurements may still be feasible. Nine crania were fully intact, nine had intact vaults but lost or fragmented faces, and one had an intact left half (face included), but damaged right half. Overall around nineteen crania were intact enough to calculate the cranial index, which describes cranial shape. The presence of a dentition was also noted: eighteen crania had at least a partial maxillary dentition, and four had loose teeth associated (although there is no guarantee that these belonged to the cranium in question). It may prove feasible to match at least some of the disarticulated mandibles with the crania, thus improving the potential to study dental disease.

A rough indication of the minimum number of individuals in each context was made, based on a count of duplicated long bone ends or other distinctive anatomical features. The data provided here gives an indication of the number of individuals represented by each bone (Appendix B), and in each context overall (see Table 7:3). Context 1016 contained a minimum of 32 individuals, Context 1009 contained a minimum of twenty individuals, and Context 1037 contained a minimum of nine individuals. Most of the remaining contexts contained a minimum of one individual. A detailed analysis would refine these estimates and take proper account of age and sex where appropriate.

It is important to note that these estimates cannot be used to calculate the MNI represented by the total disarticulated remains. This is particularly pertinent with Contexts 1009 and 1016, as this appears to have been one deposit originally before it was disturbed by the later episode of construction. Thus bones of the same individual could be present in both contexts, and this was suspected to be the case during the assessment. For example, a left femur with a distinctive shape and pathological condition was noted in Context 1016, and a similar right femur was observed in Context 1009. Long bones (none duplicated) displaying extensive woven bone formation were observed in both contexts, and could feasibly be the remains of a single individual. It is likely that the incomplete bones (long bones and crania in particular) observed in one of these two contexts matched incomplete bones in the other context, and it would be worth investigating this possibility during full analysis.

Detailed data on age-at-death was not collected, but a note was made when non-adult bones were observed. A small number of non adult bones (or possible non-adult bones) were present in sixteen Contexts: 1003, 1006?, 1008?, 1009, 1013, 1016, 1018, 1034, 1036, 1037, 1049, 1050, 1051, 1058, 1062 and 1069. These ranged in age from small enough to be foetus/neonate/infant to adolescent.

Likewise, detailed data on pathological lesions was not collected, but if pathology was obviously present then the type of lesion was recorded. Any particularly unusual pathological lesions were noted in a little more detail. Pathological lesions were observed in a small number of bones from eleven contexts (Table 7:6).

Pathology Type	Number of Contexts	Contexts
Developmental	3	1009, 1037, 1051
Metabolic	2	1016, 1037
Trauma	3	1009, 1016, 1032
Infection	4	1009, 1016, 1018, 1037,
Joint disease	5	1003, 1008, 1009, 1028, 1037
Neoplastic	0	1058
Dental Disease	3	1009, 1016, 1037
Other	4	1016, 1037, 1049

Table 7:6 Type of pathological lesions observed

The developmental conditions observed included spinal anomalies (transitional vertebrae and cleft neural arches), *os acromiale* of the scapula, a small sternum, and a possible cyst in a cranium. Metabolic conditions included *cribra orbitalia*, and possible bowing of long bones suggestive of healed rickets. Traumatic lesions included healed fractures to ribs, long bones, and feet, as well as peri-mortem injuries. The latter occurred in three crania, all from Context 1016: two crania each had one large blade injury and a second smaller blade injury, and a third had a potential blunt-force injury. Infectious disease observed included periosteal reactions (woven bone and lamellar bone deposits on the bone surfaces) on long bones and ribs, sinusitis, and endocranial bone formation (bone formation inside the skull). At least two femora and a fibula probably had osteitis (infection of the bone cortex itself). Joint disease was seen in the spine (both the vertebral bodies and apophyseal facets) and extra-spinal joints. Schmorl's nodes were seen in vertebral bodies. A pair of vertebrae had lesions typical of DISH. One non-adult femur(?) had extensive destructive lesions coupled with bone formation, possibly the result neoplastic disease (although some form of infection should also be considered). Dental disease observed included calculus, caries, abscesses, ante-mortem tooth loss, heavy wear, as well as developmental anomalies such as retained deciduous teeth, impaction, hypoplastic teeth, and additional teeth. Other conditions included ossified cartilage, entheseal changes, suspected hyperostosis frontalis interna (HFI), bones from an adult individual that seemed particularly small, and a non-adult frontal bone that appeared wide. It is likely that full analysis would discover more subtle pathological lesions.

4.0 POTENTIAL AND RECOMMENDATIONS

Obviously, disarticulated bone cannot provide the level of data that could be obtained from fully articulated skeletons. However, analysis of the disarticulated human remains from York Minster could still provide relevant information to further the understanding of the burials that were disturbed during the construction of York Minster. The date and location of the remains

make them particularly interesting, even though they are disarticulated, as there is little existing data on human remains from this period (10th-12th century) in York, and little is known about the population buried at the Minster.

A full analysis would catalogue each bone individually, recording the parts present, condition, and any relevant data relating to age-at-death, sex, non-metric traits, and pathological conditions. The typically excellent or very good surface preservation, minimal to slight fragmentation and relative completeness of the bones means that the amount of data that could be obtained during analysis is high. Furthermore, a proper estimate of the minimum number of individuals represented could be obtained.

It is likely that a reasonable age estimate could be provided for many of the non-adult bones, establishing whether the individuals present were foetus/neonates, infants, juveniles or adolescents. The stage of development could be examined, intact long bone diaphyses could be measured, and where dentitions are present the stage of development and eruption of the teeth could be used to estimate age. The minimum number of non-adults present could be calculated, and represented as a proportion of the total MNI.

For adults, the techniques used to estimate age and sex are focussed primarily on the pelvis (os coxae and sacra) and skull (cranium and mandible). Six contexts contained pelvic bones, but only five contained parts that could be used for age or sex estimation: 1003 (1 os coxa), 1009 (6 sacra, 23 os coxae), 1016 (11 sacra, 41 os coxae), 1036 (2 os coxae) and 1037 (5 sacra, 11 os coxae). For age estimation, auricular surfaces survived more frequently than pubic symphyses, but the latter were present. In Contexts 1009, 1016 and 1037 it is highly likely that os coxae could be paired and articulated with the sacra, thus improving the accuracy and usefulness of the data collected. The possibility that parts of the same pelvis might be distributed between Contexts 1009 and 1016 should also be considered. The preservation of the pelvic bones was generally good, so the potential to derive data on age and sex is promising.

Individual crania were present in Contexts 1009 (16 crania identified), 1016 (21 crania) and 1037 (nine crania). Additional cranial fragments were also present in these contexts, along with mandibles, and it may prove possible to associate mandibles with crania. It is suspected that some of the cranial fragments from Context 1009 belong to crania from Context 1016, and vice versa. Some crania were fully intact, and most others were at least partially intact or relatively complete (even if fragmented), meaning that the potential to estimate sex is good. Data on age obtained from the skulls will be restricted to dental wear, which is less reliable as it is influenced by diet. Adult cranial fragments and/or mandibles were also present in

Contexts 1003, 1008, 1021, 1055, 1057, although these have more limited potential to provide data on age or sex. It may be possible to derive age estimates from the sternal ends of ribs, which were present in seven contexts (1009, 1016, 1032, 1034, 1035, 1037, and 1039).

The large number of intact or partially intact crania means that it will be possible to take cranial measurements and calculate the cranial index for many of these individuals. The presence/absence of non-metric traits could also be recorded in all crania, and frequencies for each trait produced. Non-metric traits could also be recorded in all post-cranial bones (where traits occur), and frequencies could be calculated much as they would be for articulated burials. Intact long bones could be measured, and potentially be used to give an indication of stature. However, since the sex of the individual is required for stature calculation, and this data will be unavailable for disarticulated bone, the information on stature produced will be of limited use. Metrical analysis of the shape of the bone shafts should be possible for many femora and tibiae (platymeric and platycnemic indices).

Pathological conditions could be recorded in full and prevalence rates by bone element produced. This is the standard method for analysing the prevalence of pathological conditions in populations of articulated skeletons, so the data produced will be relatively useful. What will be lacking is the ability to investigate pathology by age and sex (unless the conditions observed happen to affect the skull or pelvis, when it may be possible to derive age and sex estimates). The ability to diagnose the pathological condition will also be impaired to an extent, as the distribution of lesions throughout the skeleton is normally considered during diagnosis. However, despite these limitations, useful data on pathology could still be generated. Joint surfaces tended to be well preserved, so the frequency of joint disease could be studied. Data on dental disease in particular may be feasible to produce, and it should be possible to investigate whether there are different patterns of dental disease in males and females. The drawback here will be the lack of reliable information on age-at-death, as dental disease usually increases with age. Data on dental health can in turn inform on diet and oral hygiene.

Biomolecular analysis of small bone fragments could provide data on general diet and health. For example, stable isotope analysis could provide data on diet and migration, and analysis of proteins preserved in dental calculus could inform on diet and diseases that cannot be diagnosed in dry bone. Radiocarbon dating of the bone from the disarticulated Contexts 1009, 1016 and 1037 may help to establish the date of the remains disturbed by the 13th century Minster construction activities.

In conclusion, the potential for obtaining useful data on demography and pathology in this population is relatively good, considering the limitations imposed by the disarticulated nature of the remains. Full analysis should allow an insight into the demography of the population buried at York Minster, providing some data on the proportion of adults and children, males and females, and individuals from different age groups. It should be possible to conduct some form of metric analysis, particularly of the intact crania to investigate patterns of cranial shape, and femora and tibiae to investigate patterns of long bone shape. The frequencies of both cranial and post-cranial non-metric traits could be calculated. Finally, the types and frequencies of pathological conditions present could shed light on the living environment and diet of this population. The contexts that hold the most potential for full analysis are the three largest Contexts: 1009, 1016 and 1037.

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APPENDIX A: OSTEOLOGICAL AND PALAEOPATHOLOGICAL CATALOGUE – ARTICULATED SKELETON

Full descriptions of pathological lesions can be found in the skeletal recording forms.

Skeleton Number	1
Date	11th century(?)
Preservation	Excellent (Grade 0), minimal fragmentation
Completeness	<10% Right foot (4 tarsals, 5 metatarsals, 5 proximal phalanges) & left foot (7 tarsals, 5 metatarsals)
Age	18+ years (adult)
Sex	Unknown
Stature	-
Non-Metric Traits	Double anterior calcaneal facets (bilateral); double inferior talar facet (L)
Pathology	Small roughly square depression in the centre of the proximal joint surface of the right proximal first foot phalanx. Margins of lesion clear, smooth and rounded. Floor of lesion roughened and slightly porous. Probable cortical defect.
Dental Health	0 tooth positions, 0 teeth present

Table 7:7 Catalogue of articulated skeleton data

APPENDIX B: CATALOGUE OF DISARTICULATED BONE (TABLE 7:8)

Bone	1003			1006			1007			1008		
	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI
Skulls:												
Individual crania												
Frontal	1	1	1									
Parietal				1	1	1						
Temporal	1	3	1							3	3	3
Occipital	1	1	1	1	3	1				1	1	1
Sphenoid												
Zygoma										1	1	1
Maxillae	1	1	1									
Mandibles												
Loose teeth										1	1	1
Cranial fragments		7	2		4	1						
Hyoid												
Thyroid cartilage												
Manubria												
Sterna												
Ribs	2	2	1							2	2	2
Vertebrae:												
Atlas												
Axis	1	1	1									
Cervical												
Thoracic							1	1	1	1	1	
Lumbar										3	3	
Sacra												
Coccyx												
Vertebra												
Upper limb:												
Clavicles												
Scapulae	1	1	1									
Humeri	4	7	4									
Radii												
Ulnae	2	2	1									
Carpals												
Metacarpals	1	1	1				3	3	2			
Prox. Phalanges	1	1	1									
Int. Phalanges												
Dist. Phalanges												
Lower limb:												
Os coxae	1	1	1									
Femora	1	2	1									
Patellae												
Tibiae	2	2	2							1	1	1
Fibulae										1	1	1
Tarsals	1	1	1							1	1	1
Metatarsals										1	1	1
Prox. Phalanges												
Int. Phalanges												
Dist. Phalanges												
Sesamoids												
Long Bone Frags												
Un-ID Frags		2									2	
Total	**21**	**36**	**4**	**2**	**8**	**1**	**4**	**4**	**2**	**16**	**18**	**3**

Bone	1009			1013			1015			1016		
	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI
Skulls:			20									26
Individual crania	16	209								21	192	
Frontal	2	2								12	20	
Parietal	10	5									12	
Temporal	2	5								11	15	
Occipital	4	6								5	11	
Sphenoid	1	1								3	11	
Zygoma	2	2								4	2	
Maxillae	6	3								8	11	
Mandibles	6	8								9	15	8
Loose teeth	3	3								2	2	
Cranial fragments		8									99	
Hyoid												
Thyroid cartilage										1	2	1
Manubria										1	1	1
Sterna										1	2	1
Ribs	21	62								67	189	
Vertebrae:												
Atlas												
Axis										1	1	1
Cervical	2	2								2	2	
Thoracic	9	9	2							20	22	
Lumbar	4	5								8	9	
Sacra	6	8	6							11	26	11
Coccyx												
Vertebra	1	1								1	1	
Upper limb:												
Clavicles	4	5	2							6	6	4
Scapulae	8	20	5							26	68	16
Humeri	31	40	16							54	92	23
Radii	15	16	11	1	1	1				34	48	16
Ulnae	17	28	9							30	48	15
Carpals												
Metacarpals	1	1	1							2	2	1
Prox. Phalanges										3	3	1
Int. Phalanges												
Dist. Phalanges	1	1	1									
Lower limb:												
Os coxae	23	48	15							41	117	22
Femora	31	46	14							74	110	32
Patellae												
Tibiae	29	46	15							62	92	29
Fibulae	14	39	6							32	64	14
Tarsals	1	1	1				2	2	1	9	9	
Metatarsals	1	1	1							17	17	3
Prox. Phalanges	2	2	1							2	2	1
Int. Phalanges												
Dist. Phalanges	1	1	1									
Sesamoids												
Long Bone Frags		9									51	
Un-ID Frags		121									320	
Total	**274**	**764**	**20**	**1**	**1**	**1**	**2**	**2**	**1**	**580**	**1694**	**32**

Bone	1018			1021			1023			1028		
	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI
Skulls:												
Individual crania												
Frontal												
Parietal												
Temporal												
Occipital	1	1	1									
Sphenoid												
Zygoma												
Maxillae												
Mandibles				1	4	1						
Loose teeth												
Cranial fragments												
Hyoid												
Thyroid cartilage												
Manubria												
Sterna												
Ribs												
Vertebrae:												
Atlas												
Axis												
Cervical										1	1	1
Thoracic	1	1	1									
Lumbar												
Sacra												
Coccyx												
Vertebra												
Upper limb:												
Clavicles												
Scapulae												
Humeri	1	1	1									
Radii												
Ulnae												
Carpals												
Metacarpals	2	2	1									
Prox. Phalanges												
Int. Phalanges												
Dist. Phalanges												
Lower limb:												
Os coxae												
Femora												
Patellae												
Tibiae												
Fibulae												
Tarsals												
Metatarsals												
Prox. Phalanges							1	1	1			
Int. Phalanges							1	1	1			
Dist. Phalanges							1	1	1			
Sesamoids												
Long Bone Frags												
Un-ID Frags												
Total	**5**	**5**	**2**	**1**	**4**	**1**	**3**	**3**	**1**	**1**	**1**	**1**

Bone	1029			1031			1032			1034		
	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI
Skulls:												
Individual crania												
Frontal												
Parietal												
Temporal												
Occipital												
Sphenoid												
Zygoma												
Maxillae												
Mandibles												
Loose teeth												
Cranial fragments												
Hyoid												
Thyroid cartilage												
Manubria												
Sterna												
Ribs							1	1	1	3	4	1
Vertebrae:												
Atlas												
Axis	1	1	1									
Cervical												
Thoracic				1	1	1						
Lumbar												
Sacra												
Coccyx												
Vertebra												
Upper limb:												
Clavicles												
Scapulae				1	1	1						
Humeri												
Radii												
Ulnae												
Carpals												
Metacarpals							1	1	1			
Prox. Phalanges										1	1	1
Int. Phalanges												
Dist. Phalanges												
Lower limb:												
Os coxae												
Femora												
Patellae							1	1	1			
Tibiae												
Fibulae							1	1	1			
Tarsals				1	1	1				1	1	1
Metatarsals										2	2	1
Prox. Phalanges							1	1	1			
Int. Phalanges												
Dist. Phalanges												
Sesamoids												
Long Bone Frags												
Un-ID Frags											1	
Total	**1**	**1**	**1**	**3**	**3**	**1**	**5**	**5**	**1**	**7**	**9**	**1**

Bone	1035			1036			1037			1039		
	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI
Skulls:									9			
Individual crania							9	269				
Frontal												
Parietal												
Temporal												
Occipital												
Sphenoid												
Zygoma												
Maxillae							1	1				
Mandibles							4	10				
Loose teeth							26	26				
Cranial fragments												
Hyoid							1	1	1			
Thyroid cartilage							2	3	2			
Manubria							3	3	3			
Sterna							4	5				
Ribs	1	1	1				57	214		1	1	1
Vertebrae:												
Atlas							4	4	4			
Axis							4	4	4			
Cervical							8	8				
Thoracic							35	38				
Lumbar							17	18				
Sacra							5	8	5			
Coccyx							1	1				
Vertebra								3				
Upper limb:												
Clavicles							6	8	3			
Scapulae				1	2	1	7	36	4	1	1	1
Humeri				1	2	1	10	15	6			
Radii							7	16	4			
Ulnae							6	6	4			
Carpals							21	21	3			
Metacarpals							28	28	5	1	1	1
Prox. Phalanges							26	26				
Int. Phalanges							13	13				
Dist. Phalanges							14	14				
Lower limb:												
Os coxae				2	4	2	11	21	6	1	1	1
Femora				1	1	1	12	16	6			
Patellae							4	4	3			
Tibiae				3	5	2	10	19	6			
Fibulae	1	1	1				7	18	5	1	1	1
Tarsals							34	35	4			
Metatarsals							31	31	7			
Prox. Phalanges							24	24				
Int. Phalanges							9	8				
Dist. Phalanges							6	5				
Sesamoids							3	3	1			
Long Bone Frags												
Un-ID Frags								80				
Total	**2**	**2**	**1**	**8**	**14**	**2**	**470**	**1063**	**9**	**5**	**5**	**1**

Bone	1049			1050			1051			1053		
	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI
Skulls:												
Individual crania												
Frontal												
Parietal				1	2	1	1	2	1			
Temporal												
Occipital												
Sphenoid												
Zygoma												
Maxillae												
Mandibles												
Loose teeth												
Cranial fragments												
Hyoid												
Thyroid cartilage												
Manubria												
Sterna												
Ribs												
Vertebrae:												
Atlas												
Axis												
Cervical												
Thoracic												
Lumbar												
Sacra												
Coccyx												
Vertebra												
Upper limb:												
Clavicles												
Scapulae										1	1	1
Humeri												
Radii												
Ulnae	1	1	1									
Carpals							1	1	1			
Metacarpals												
Prox. Phalanges												
Int. Phalanges												
Dist. Phalanges												
Lower limb:												
Os coxae												
Femora												
Patellae												
Tibiae				1	1	1						
Fibulae												
Tarsals												
Metatarsals												
Prox. Phalanges												
Int. Phalanges												
Dist. Phalanges												
Sesamoids												
Long Bone Frags												
Un-ID Frags								1				
Total	**1**	**1**	**1**	**2**	**3**	**1**	**2**	**4**	**1**	**1**	**1**	**1**

Bone	1055			1056			1057			1058		
	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI	Bones	Frags	MNI
Skulls:												
Individual crania												
Frontal												
Parietal												
Temporal												
Occipital												
Sphenoid												
Zygoma												
Maxillae												
Mandibles	1	1	1				1	1	1			
Loose teeth												
Cranial fragments												
Hyoid												
Thyroid cartilage												
Manubria												
Sterna												
Ribs				1	1	1						
Vertebrae:												
Atlas												
Axis												
Cervical												
Thoracic												
Lumbar												
Sacra												
Coccyx												
Vertebra												
Upper limb:												
Clavicles												
Scapulae												
Humeri										1	1	1
Radii												
Ulnae												
Carpals												
Metacarpals												
Prox. Phalanges												
Int. Phalanges												
Dist. Phalanges												
Lower limb:												
Os coxae												
Femora										1	1	1
Patellae												
Tibiae												
Fibulae												
Tarsals												
Metatarsals												
Prox. Phalanges												
Int. Phalanges												
Dist. Phalanges												
Sesamoids												
Long Bone Frags												
Un-ID Frags												
Total	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**1**

Bone	1062			1069			Total No. Bones		Total No. Fragments	
	Bones	Frags	MNI	Bones	Frags	MNI	n	%	n	%
Skulls:										
Individual crania							46	3.2%	670	18.3%
Frontal							15	1.1%	23	0.6%
Parietal				1	1	1	14	1.0%	23	0.6%
Temporal							17	1.2%	26	0.7%
Occipital							13	0.9%	23	0.6%
Sphenoid							4	0.3%	12	0.3%
Zygoma							7	0.5%	5	0.1%
Maxillae							16	1.1%	16	0.4%
Mandibles							22	1.5%	39	1.1%
Loose teeth							32	2.2%	32	0.9%
Cranial fragments							0	0.0%	118	3.2%
Hyoid							1	0.1%	1	0.0%
Thyroid cartilage							3	0.2%	5	0.1%
Manubria							4	0.3%	4	0.1%
Sterna							5	0.4%	7	0.2%
Ribs	1	1	1	2	2	1	159	11.1%	480	13.1%
Vertebrae:										
Atlas							4	0.3%	4	0.1%
Axis							7	0.5%	7	0.2%
Cervical							13	0.9%	13	0.4%
Thoracic							68	4.8%	73	2.0%
Lumbar							32	2.2%	35	1.0%
Sacra							22	1.5%	42	1.1%
Coccyx							1	0.1%	1	0.0%
Vertebra							2	0.1%	5	0.1%
Upper limb:										
Clavicles							16	1.1%	19	0.5%
Scapulae							46	3.2%	130	3.6%
Humeri				1	1	1	103	7.2%	159	4.3%
Radii							57	4.0%	81	2.2%
Ulnae							56	3.9%	85	2.3%
Carpals							22	1.5%	22	0.6%
Metacarpals							39	2.7%	39	1.1%
Prox. Phalanges							31	2.2%	31	0.8%
Int. Phalanges							13	0.9%	13	0.4%
Dist. Phalanges							15	1.1%	15	0.4%
Lower limb:										
Os coxae							79	5.5%	192	5.2%
Femora							120	8.4%	176	4.8%
Patellae							5	0.4%	5	0.1%
Tibiae							108	7.6%	166	4.5%
Fibulae							57	4.0%	125	3.4%
Tarsals							50	3.5%	51	1.4%
Metatarsals							52	3.6%	52	1.4%
Prox. Phalanges							30	2.1%	30	0.8%
Int. Phalanges							10	0.7%	9	0.2%
Dist. Phalanges							8	0.6%	7	0.2%
Sesamoids							3	0.2%	3	0.1%
Long Bone Frags							0	0.0%	60	1.6%
Un-ID Frags							0	0.0%	527	14.4%
Total	**1**	**1**	**1**	**4**	**4**	**1**	**1427**		**3661**	

APPENDIX C: CATALOGUE OF DISARTICULATED CRANIA (TABLE 7:9)

Cranium	No. Frags	Intact?	Dentition?
1009a	11	1	y
1009b	3	1	y
1009c	36	1	y
1009d	1	2	n
1009e	11	2	y
1009f	8	3	n
1009g	9	2*	y
1009h	22	3	n
1009i	32	3	t
1009j	31	3	n
1009k	17	3	t
1009l	8	3	n
1009m	1	3	n
1009n	5	3	n
1009o	8	4	n
1009p	6	4	n
1016a	12	2	y
1016b	1	1	y
1016c	1	2	n
1016d	1	1	y
1016e	3	2	t
1016f	19	3	n
1016g	14	3	n
1016h	3	2*	y
1016i	30	3	n
1016j	10	3	t
1016k	16	4	n
1016l	6	3	n
1016m	15	3	n
1016n	4	3	n
1016o	5	4	n
1016p	5	4	n
1016q	9	4	n
1016r	18	4	n
1016s	12	4	n
1016t	4	4	n
1016u	4	4	n
1037a	2	1	y
1037b	21	1	y
1037c	1	1	y
1037d	21	1	y
1037e	51	2	y
1037f	51	2	y
1037g	44	2	y
1037h	36	2	y
1037i	42	3	y

Key: No. Frags = number of bone fragments present within each cranium; in some cases the cranium was essentially intact but there were a handful of very small fragments present

Intact?: 1 – cranium intact; 2 – vault intact, face lost or damaged; 2* - crania where the face was intact but the vault damaged, or one side of the cranium was intact and the other damaged; 3 – vault partially intact; 4 – vault fragmented

Dentition?: y = dentition present; n = dentition absent; t = loose teeth present, but no guarantee that they belong to the cranium

APPENDIX 8: RADIOCARBON DATING RESULTS BY SUERC

Laboratory Code	SUERC-42241 (GU28348)
Submitter	Christine McDonnell York Archaeological Trust 47 Aldwark York YO1 7BX
Site Reference	York Minster
Context Reference	1024
Sample Reference	YMM/DC/2012/001
Material	Bone : Human foot bone
$\delta^{13}C$ relative to VPDB	-19.9 ‰
$\delta^{15}N$ relative to air	11.3 ‰
C/N ratio (Molar)	3.2
Radiocarbon Age BP	929 ± 19

The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standards, background standards and the random machine error.

The calibrated age ranges are determined using the University of Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.1 (Bronk Ramsey 2009). Terrestrial samples are calibrated using the IntCal09 curve while marine samples are calibrated using the Marine09 curve.

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or Telephone 01355 270136 direct line.

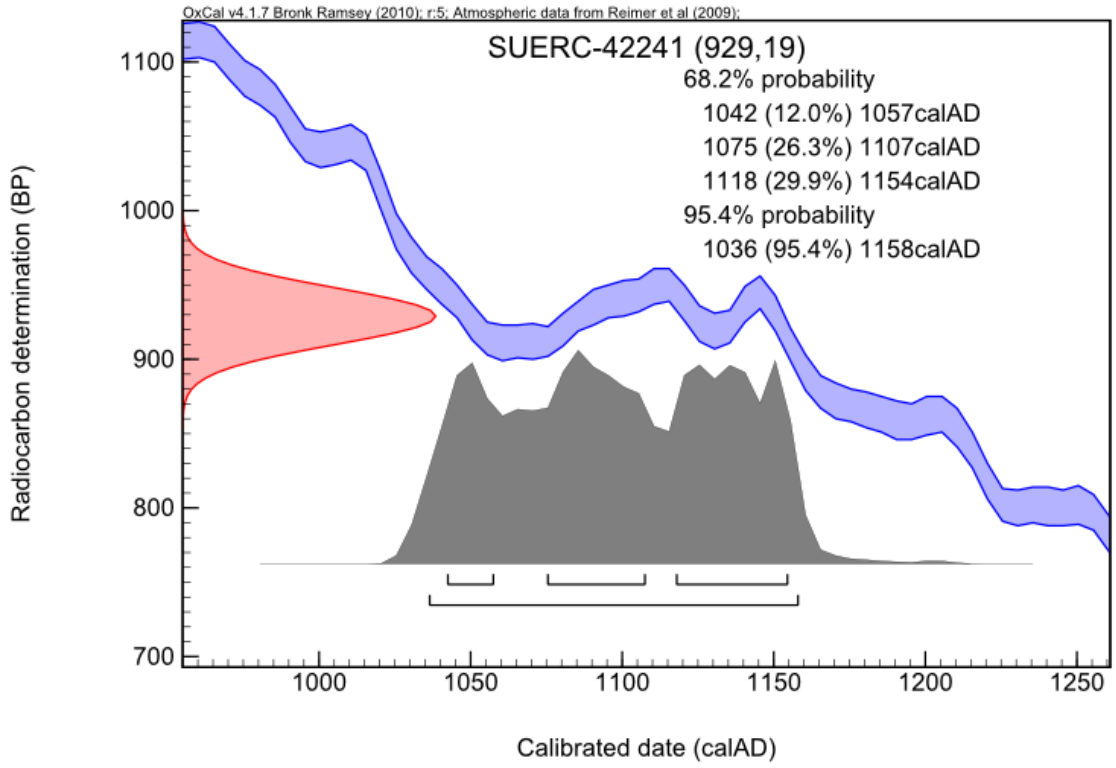

Figure 24 Calibrated radiocarbon date

APPENDIX 9: ANIMAL BONE BY C RAINSFORD

HAND-COLLECTED BONE

The faunal remains from the South Transept Lift Shaft, York Minster, were assessed with a view to providing a preliminary characterisation of the species composition and preservation condition of faunal material from the various phases. 454 fragments were recovered from 42 contexts at the site, which provides a well-stratified sequence from the demolition of the Roman Principia to the construction of the 13th century cathedral. In addition, 72 amphibian bones were recovered from within the human charnel. The assemblage was assessed in full.

METHODS

All material was identified to the lowest taxonomic level possible, and identifications were confirmed by comparison to reference specimens from the Department of Archaeology, University of York. Where identification to taxon was not possible (eg. for ribs, vertebrae, and shaft or cranial fragments without identifiable features), fragments were counted as unidentified, although note was made of approximate body part and relative size (large, medium, small). Fish were not identified beyond the level of "fish", and elements were quantified as "cranial", "vertebra" or "ribs and rays". No attempt was made to separate sheep and goats, and the category "caprine" should be taken as referring to both species throughout. However, this are likely to primarily represent sheep, as goat elements are rarely recovered from York apart from in deposits of horncores. Basic age data (adult / sub-adult / juvenile) and level of fragmentation (completeness relative to whole bone) was recorded for each identifiable bone, and any further taphonomic information was recorded by means of notes for each context. Bone was defined as "adult" if fully-fused or teeth with wear; "sub-adult" if unfused; and "juvenile" if showing a poorly-mineralised bone texture and / or clearly juvenile size.

For each context, the overall assemblage condition was recorded using a qualitative scale (very good / good / reasonable / poor / variable), and the overall fragmentation was also recorded ("mostly complete" (A), "moderately fragmented" (B) or "highly fragmented" (C)). Brief taphonomic descriptions, including colouration and weathering, were also made for each context.

Bone was kept bagged by context following analysis. Data were stored as Excel spreadsheets. NISP (Number of Identified Specimens) has been used as a descriptive quantification method throughout. The assistance of Terry O'Connor in identification of bird bone and other problematic elements is gratefully acknowledged.

RESULTS

The assemblage comprised 452 fragments from 42 contexts at the site. Of this, 168 fragments (37%) were identified to taxon. Material was present from all phases at the site, but phases 1 (late Roman), 3 (?Anglian), 4 (Anglian) and 7 (13th century) were the only phases to each contain more than 20 identified fragments (see Table 9:1).

SPECIES REPRESENTATION

Domestic Mammals

The assemblage is dominated throughout by the three major domesticates – cattle, caprines and pigs. Overall, these comprise almost 87% of the identified assemblage, with bird species contributing a further 9%, and other mammalian species only making up a small minority of the overall assemblage. Cattle tend to be most frequent, comprising 42% of assemblage overall, with caprine and pig at 24% and 20% of assemblage respectively. The dominance of cattle is a typical pattern for York assemblages (Bond & O'Connor 1999, p378). It is notable that pig and caprines occur with almost equal frequency until phase 7 (13th century), when caprines become more frequent. This is again a typical pattern within York assemblages, where the frequency of sheep increases from the 12th century onwards (see Fig. 53, Bond & O'Connor 1999, p382).

In terms of age distribution of the major domesticates, elements from sub-adult and juvenile animals are present throughout the sequence. 19% of identified cow elements for which age could be attributed were recorded either as sub-adult or juvenile, with most noted as sub-adult (15%) (Table 9:2). 14% of caprine elements were recorded as juvenile, and a further 7% as sub-adult, although this amounted to very few individual elements. That the populations of caprine and cattle are mostly adult is unsurprising in the city of York, where the proportion of young animals remains low until the post-medieval period (Bond & O'Connor 1999, p384). By contrast, 79% of pig elements which were given an age were recorded as sub-adult or juvenile. The vast majority of these were sub-adult (57%), although the proportion of juveniles was also relatively high (22%). There appears to be a slight concentration of younger caprines and pigs in phases 1-4 (Post-Roman / Anglian period), although this could be due to the smaller quantities of material in the later phases. Previous excavations at York Minster also recovered a notably high proportion of very young pig, including some of only a few weeks old, from deposits dated to the 5th century AD (Rackham 1995, Gerrard 2007). While pigs are frequently culled when they reach their full meat-weight, often when still skeletally sub-adult, evidence for a high proportion of very young animals is more difficult to explain in terms of husbandry and economic value. The evidence from York Minster has been argued to represent a practice of consuming suckling pig which was continued from the Roman period and may be both an example of conspicuous consumption

and a referencing of Roman high-status consumption practices (Gerrard 2007). It is possible that the material from this assemblage indicates a similar pattern, although the small size of the assemblage makes this difficult to judge.

OTHER TAXA

Few other mammalian species were present in the assemblage. 2 elements of dog were identified, from phases 4 and 7, and cat was present in phase 3. Red deer and roe deer were represented by one element each, both from contexts within phase 7 (13th century). Most notably, context [1036] from phase 4 (Clearance / disturbance of Anglian cemetery) contained two fragments of bone from a large whale. These are very rare within animal bone assemblages within York. Although these were not identified to element, it is likely that they were lower portions of the mandible. Whalebone and ivory was used in decorating sword hilts and pommels in the early Anglo-Saxon period. It is therefore possibly that this material represents debris from craft-working activities, although no direct evidence of working was found on the bones.

The assemblage of bird bones is also relatively small, and the species diversity similarly restricted. The majority of identified bird elements are from chicken or goose, with one element of duck from phase 7. The only other taxon identified was a swan (*Cygnus sp.*), represented by 1 element deriving from phase 3 (Demolition of Principia, possibly Anglian). No fish were identified within the assemblage.

While the majority of material from the Minster represents standard domestic waste, showing similar composition to the majority of assemblages from the city of York, the presence of red and roe deer in the 13th century, and of swan and whalebone in the Anglian period, suggest a variety of contributing sources. The possible presence of a higher proportion of young pigs in the post Roman and Anglian period may also represent a higher status component to the assemblage in this period.

Amphibian bones were recovered from within four human skulls from 3 contexts. Two of these contexts, 1009 and 1016, are from phase 7 (13th century cathedral construction) and are described as construction backfills. The remaining context, 1037, contains two skulls containing amphibian bones and derives from phase 4 (Clearance / disturbance of Anglian cemetery). The amphibian bones recovered appear to come primarily from frogs (*Rana temporaria)*.

Skull C, context 1009, contained the vast majority of these amphibian bones. 60 fragments were recovered, of which all but two were identified to element or body area. This gave a

minimum number of three individual frogs, based on the urostyle. Three distinct sizes of frog were also recognisable in the more frequent elements, and this may correspond to the age of the frog. Skull B, context 1016, contained only 8 elements with an MNI of 2, based again on the urostyle. Two different sizes of frogs were again recognisable. The remaining skulls, D & E, from context 1037, contained only 3 fragments between them. Only one of these, from Skull D, was identified.

Frogs and other amphibians hibernate over the coldest months (in the case of the common frog, late October to early spring), and prefer to hibernate in dark, enclosed spaces. A defleshed skull is likely to have provided an attractive and protected location. It is clear that more than one frog hibernated, quite probably simultaneously, within skulls B and C. Whether frogs also hibernated in Skulls D & E is more difficult to judge, owing to the scant nature of the faunal evidence. However, it indicates that skulls B & C at minimum were accessible for at least some time during the autumn months, and the fact that a number of frogs died *in situ* may indicate that the skulls were reburied during the frogs' hibernation period.

TAPHONOMY

Subjective assessment was made of the condition of the material from York Minster, in addition to a more thorough recording of specific taphonomic features affecting individual elements. The condition of the material was primarily recorded as "good" or "reasonable", with overall fragmentation recorded primarily as "B – moderately fragmented". Of the identified material, 44% was considered 75% or more complete relative to the whole bone, and 38% was considered 25% or less complete. Given the state of preservation of the bones, this did not indicate exceptional fragmentation or an unusual degree of completeness. The majority of contexts were recorded as containing bone with a slightly battered appearance, indicating either taphonomic (weathering) or diagenetic damage to surfaces and edges. Root etching was also recorded for a number of contexts. Notably, the condition does not appear to vary extensively between phases, with only phase 8 (modern material) demonstrating more variability in taphonomic pathways and a higher degree of fragmentation.

Carnivore gnawing was only recorded for a few elements (9, 5% of identified assemblage), but these were scattered throughout the assemblage, indicating a low level of carnivore gnawing throughout the time period in question. Rodent gnawing was noted on elements from phases 1 and 4, with the gnawing in phase 4 identified as mouse gnawing, indicating the small-scale presence of rodent scavengers in the vicinity. Burning was extremely infrequent, with only two instances noted in the entire assemblage.

As is the case for most assemblages from York, evidence for butchery was present throughout the assemblage. This is likely to relate primarily to the dismantling of carcasses for meat, but the occasional example can be tied to craft-working practices. Evidence of craft-working was present in phase 7, from which a fragment of cow skull with clear evidence for removal of the horn was recovered. Horn-working is a well-known activity in medieval York, and a number of sites are known from medieval York with substantial quantities of cattle and goat horncore, indicating that horn was being worked in these locations. However, the fact that in this instance the skull was present rather than the horncore suggests that horn was not being worked in the near vicinity.

Phase	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Cow	11	6	27	6		2	18	2	**72**
Caprine	4	4	13	11			9		**41**
Pig	5		14	9	1	1	2	1	**33**
Red deer							1		**1**
Roe deer							1		**1**
Dog				1			1		**2**
Cat			1						**1**
Whale				2					**2**
Chicken	1	1	3	2					**7**
Duck							1		**1**
Goose			2	2			2		**6**
Swan			1						**1**
Total ID	*21*	*11*	*61*	*33*	*1*	*3*	*35*	*3*	***168***
Unid	37	34	87	63	1	2	50	12	**286**
Total	**58**	**45**	**148**	**96**	**2**	**5**	**85**	**15**	**454**

Table 9:1 Species representation by phase from the South Transept Lift Shaft, York Minster. All frequencies given are NISP.

	Adult		**Sub-adult**		**Juvenile**		**Total**
	Q	%	Q	%	Q	%	
Cattle	45	82	8	15	2	4	55
Caprine	23	79	2	7	4	14	29
Pig	5	22	13	57	5	22	23

Table 9:2 Age distributions of domestic mammals from the South Transept Lift Shaft, York Minster. All frequencies given are NISP. "Total" refers to total age-attributable elements, and all percentages are given relative to this total.

BONE RECOVERED FROM SAMPLES

The faunal bone recovered from samples taken from the South Transept Lift Shaft was assessed with a view to providing a preliminary characterisation of species composition. Hand-collected material from the excavations was assessed and reported separately (see Part I of this report). While material from samples is more inclined to reflect spatial biases, representing material recovered from a restricted area of site, it is not subject to the same well-rehearsed biases as material recovered by hand-collection. In particular, methods of flotation or sieving through a fine mesh (5mm or less) are able to recover consistently bones of smaller-bodied mammals, birds, fish and amphibians. The presence of these taxa in samples can be significant in assessing past ecology or consumption practices at the site.

An assemblage of over 4000 fragments was recovered from 48 samples, taken from 17 contexts from the South Transept Lift Shaft excavations. The assemblage was assessed in full.

METHODS

The majority of material was identified to the lowest taxonomic level possible, and identifications were confirmed by comparison to reference specimens from the Department of Archaeology, University of York. However, due to time constraints, a number of taxa were identified only to genus or family level. No distinction is made between wood mouse and house mouse species (*Apodemus sp.* & *Mus sp.*). The majority of mouse elements in the assemblage were considered to be largely consistent with wood mouse (*Apodemus sp.*), with one positive identification of house mouse (*Mus sp.,* Phase 1, sample no. 40). Of the shrew species, only common shrew (*Sorex araneus*) was positively identified. However, some of the elements identified only as “shrew” may represent other shrew species. Bird species identified as “small passerines” (blackbird / thrush and smaller) are generally not identified to species level, as the order is highly speciated and the effort required to distinguish the morphologically-similar species was not considered worth the information which this would yield. Similarly, fish belonging to the family Cyprinidae or Salmonidae were not identified beyond family level, as identification on morphological characteristics is problematic on most elements of these families. Further work is clearly possible to fully identify the small mammal species and passerines to the lowest possible taxonomic level, but was considered to add little present research value for the time required.

Basic age data (adult / sub-adult / juvenile) was recorded for each identifiable bone. Bone was defined as “adult” if fully-fused or teeth with wear; “sub-adult” if unfused; and “juvenile” if showing a poorly-mineralised bone texture and / or clearly juvenile size. Taphonomic information was recorded for identifiable elements and samples where this was considered significant.

Bone was kept bagged by sample following analysis. Data were stored as Excel spreadsheets. NISP (Number of Identified Specimens) has been used as a descriptive quantification method throughout. The assistance of Terry O'Connor in provision of lab space and identification of problematic elements is gratefully acknowledged.

RESULTS

The assemblage as a whole comprises 4044 fragments of bone. Of this, 350 fragments (8.6%) were identified to some taxonomic level. The low frequency of identified fragments indicates the very high degree of fragmentation in the assemblage, with the majority of material comprising small (<10mm) fragments of unidentifiable mammal bone. Bone was recovered from phases 1-5, with the majority of identified material deriving from phases 1-3, and phase 3 (Demolition of Principia) yielding the largest assemblage (Table 9:3). This largely reflects the intensity of sampling at the site, although the identified fraction in phase 4 is notably lower than in the previous phases (4.6% compared to 8-10% in phases 1-3; Table 1), potentially indicating a decrease in the frequency of small species from this point.

A small fraction of the assemblage (c. 20%) comprised bones from mammals larger than rat, and this material complements the material retrieved by hand-collection. The remainder of the assemblage was composed of mammals rat-size and smaller (micromammals), birds, amphibians and fish. The species diversity of the hand-collected material was relatively restricted, and previous excavations at the Minster did not recover any microfaunal bone. This assemblage therefore has the potential to add to our current picture of the site.

MACROMAMMALS

The larger mammal species represented in the assemblage were almost entirely cow, sheep and pig, with one cat tooth present in samples from phase 1. Of the three main domestic species, pig was by far the most frequent, with more than double the quantity of fragments recovered than that of either cow or sheep (37 fragments compared to 16, 14; Table 9:4). Pig elements occurred consistently across the samples, in contrast to elements from sheep and cow which were present in fewer samples overall. This contrasts significantly to the patterns noted in the hand-collected material, where cow was the dominant species within the assemblage, and pig and sheep comprised a similar proportion of the assemblage. The increased frequency of smaller-bodied species compared to larger-bodied species in samples compared to hand-collected material is not unusual, as the smaller the species, the less likelihood of its recovery through hand-collection. However, the increased frequency of pig compared to sheep is more difficult to explain. One possible explanation is that the high frequency of sub-adult pigs produced a greater number of unfused epiphyses, which may have been missed during hand-collection. However, it is likely that the frequency of pigs at the site, particularly in the earlier phases, is higher than was initially recognised.

In general, a higher proportion of sub-adult animals were recorded for all the domestic species than was recorded for the hand-collected material. In particular, 10 of the 11 fragments where age was attributed for pig were recorded as sub-adult or juvenile. This includes three elements which derived from foetal pigs. This corresponds to the conclusions reached from the hand-collected material, where sub-adult and juvenile pigs were noted to occur with high frequency. However, the presence of foetal piglets may argue against Gerrard's (2005) suggestion of feasting within the basilica, as these animals would have been too small for consumption as suckling pig. Instead, this may support Rackham's (1995) suggestion of pig-keeping in the area, although it is worth noting that these theories are by no means mutually exclusive.

MICROFAUNA

The microfaunal assemblage appears relatively diverse, with the micromammal assemblage in particular appearing diverse throughout phases 1-3. Mice and voles were the most frequent taxa throughout the assemblage (Table 9:4). Mouse elements largely appeared consistent with wood mice (*Apodemus sp.*), although house mouse (*Mus sp.)* also identified from phase 1 (see Methods, above). All three vole species were identified, with field vole (*Microtus agrestis*) most frequent, and bank vole (*Myodes glareolus*) and water vole (*Arvicola amphibius*) present in smaller quantities. Black rat (*Rattus rattus*), mole (*Talpa europaea*) and common shrew (*Sorex araneus*) were also present in these phases. This diversity indicates that in the early phases of the site, up to the demolition of the Principia, there is likely to have been a significant area of undisturbed ground in the vicinity to support these species.

The decrease in identified material in phases 4 and 5 has been noted above. It is particularly notable that micromammal elements decrease in frequency more than any other microfaunal taxon, with only mouse, field vole, and shrew present in phase 4 in small quantities. While it is important to bear in mind the spatial biases of sampling and the reduced sampling intensity in these phases, it is possible to argue that this decrease in the frequency of small furry species may be the result of a change in conditions or habitat in the area.

Bird species identified fell into two categories: larger birds for consumption (chicken, domestic goose, small wild goose) and small passerines. The latter were typically unidentified beyond the level of "passerine" (see Methods, above), but one corvid element was identified from phase 3, and one starling element from phase 4. There is little clear temporal patterning in the bird elements identified, with chickens and geese present in phases 1-4, and passerines present in phases 2-4. All the birds identified are common species within the city of York, and it is likely that they were present throughout the sequence at the site.

Amphibians also appear to have been present throughout the sequence at the site, represented relatively consistently in phases 1-4. Frog (*Rana temporaria*) is the only amphibian species positively identified from the site, and this corresponds to the evidence from the hand-collected material, where a number of frog elements were recovered from within human skulls (see Part I, this report). In general, these skulls derived from later in the sequence at the site, with the majority of evidence from phase 7 (13th century cathedral construction). The evidence from the samples indicates that frogs were present in the area in the early phases of the site, while the evidence from the skulls may indicate that the area provided an effective habitat for frogs more or less continuously throughout the sequence.

FISH

Fish were present in small quantities throughout the assemblage (phases 1-5), with the majority deriving from phases 3 and 4. The majority of the assemblage is composed of elements from herring (*Clupea harengus*) and eel (*Anguilla anguilla*), a pattern which is typical of York in the early post-Roman / Anglo-Saxon period. The remainder of the assemblage comprises small freshwater species (cyprinids, salmonids, pike (*Esox lucius*)), and 2 elements of small gadid. All of these are again typical species for an assemblage from early medieval York. In contrast to the assemblage of micromammal discussed above, it is notable that fish are less frequent in the earliest phases (1 & 2) compared to phases 3 & 4 (Table 1). Attitudes to fish consumption in Roman and post-Roman Britain are ambiguous, but there is some evidence that consumption of fish, particularly marine fish, was associated with high status in Roman Britain (Richards & Hodges 1998), and were certainly consumed with greater frequency than in the preceding Iron Age (Locker 2007). In these circumstances, it is interesting that, if “Romanised” feasting was taking place within the remains of the Principia (Gerrard 2007), the aspect of Romanised lifestyle which was preserved was the consumption of young pig rather than fish.

FURTHER WORK

As outlined above (Methods), further work is possible to fully identify material from the assemblage to the lowest taxonomic level possible. As a well-recovered assemblage from a significant site within the city, this assemblage is likely to have further interpretive value, particularly when set in context with other assemblages of the same date recovered from across York. No further work is currently recommended.

Phase	Samples taken	Quantity	ID	%ID	macromammal	micromammal	bird	amphib	fish
1	15	792	66	8.33	18	25	6	13	4
2	5	334	31	9.28	9	11	5	2	4
3	29	1851	197	10.64	34	87	22	16	38
4	9	1049	49	4.67	7	14	11	6	11
5	2	18	7	38.89		3	2		2
TOTAL	**60**	**4044**	**350**	**100**	**68**	**140**	**46**	**37**	**59**

Table 9:3 Taxon representation and quantification by phase, South Transept Lift Shaft, York Minster. "Samples taken" refers to the total number of samples taken from that phase, and is given as a measure of sampling intensity. "Quantity" describes the overall fragment count from each phase, and "ID" describes the total fraction which was identified to some taxonomic level. "%ID" describes the percentage of material from each phase which was identified to some taxonomic level, and is given to 2 decimal places. All quantities are given as fragment counts or NISP values.

Taxon	Phase 1	Phase 2	Phase3	Phase 4	Phase 5	TOTAL
Cow	5	2	5	4		**16**
Pig	9	6	19	3		**37**
Sheep	3	1	10			**14**
Cat	1					**1**
Mouse / vole	8	1	35	5	1	**50**
Mouse	2	3	15	6		**26**
Bank vole	1	1	1			**3**
Field vole	3	1	20	1	1	**26**
Water vole	2	1	2			**5**
Mole			3			**3**
Rat / vole	5	1	3	1		**10**
Black rat	1	1	1			**3**
Shrew sp.			5	1	1	**7**
Common shrew	3	2	2			**7**
Chicken		2	6	2		**10**
Small wild goose	1					**1**
Goose			1			**1**
Corvid			1			**1**
Passerine		2	4	1		**7**
Starling				1		**1**
bird unspecified	5	1	10	7	2	**25**
Frog	8	1	7	1		**17**
amphibian unspecified	5	1	9	5		**20**
Herring		1	21	3	1	**26**
Eel	1	1	4	2		**8**
Cyprinid	1		2	1	1	**5**
Salmonid	1		1			**2**
Gadid			1	1		**2**
Pike			4			**4**
fish unspecified	1	2	5	4		**12**
TOTAL	**66**	**31**	**197**	**49**	**7**	**350**

Table 9:4 Taxon representation by phase, South Transept Lift Shaft, York Minster. All figures given are NISP values.

Phase	Context	Sample Nos.	Description	Fragment count
5	1023	2	grave fill	18
4	1031	6	levelling	53
4	1036	9, 10	backfill	218
4	1037	12, 13	charnel	711
4	1039	14	backfill	67
3	1044	15, 16	levelling / surface	296
3	1049	22, 23	spread	113
3	1050	24, 25	trample / demolition	213
3	1051	26, 27	levelling	340
3	1053	28, 29	dump	210
3	1054	30, 31	trample / demolition	457
3	1055	32, 33	trample / levelling	222
2	1058	36, 37	dumped soil	334
1	1060	40, 41	backfill	313
1	1061	38, 39	backfill	106
1	1065	44, 45	dump	71
1	1069	48, 49	accumulation	302

Table 9:5 List of samples from which bone was retrieved, South Transept Lift Shaft, York Minster.

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APPENDIX 10: ENVIRONMENTAL AND SAMPLE PROCESSING

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SUMMARY

Analysis of samples representing activity spanning the late Roman to Anglo-Scandinavian period at York Minster has revealed evidence of the destruction of the Roman principia and levelling of the rubble by the Anglian community. Introduction of industrial and domestic midden material formed an integral part of the levelling process and enabled interpretation of later, Anglo-Scandinavian activities via tracking the redistribution of this material. Periods of rapid sediment accumulation have been highlighted and a picture of the environmental conditions prevailing during each phase of activity has emerged.

INTRODUCTION

A total of 16 bulk samples taken as part of the York Minster lift shaft excavation were submitted for general biological analysis (GBA), and 15 bulk samples (BS) for processing and finds recovery. The GBA samples were selected from particular contexts anticipated to provide suitable material for dating purposes and to gain an understanding of the complicated stratigraphy of the site. The deposits included demolition, levelling, posthole and 'dark earth' deposits ranging in date from late Roman to Anglo Scandinavian periods.

METHODOLOGY

BULK SAMPLE PROCESSING

Bulk samples were received within 10 litre plastic tubs, sealed to exclude light and air. They were floted for the recovery of environmental evidence and artefacts using standard methods and a *Siraf* flotation system including a bespoke pumped recycled water system with four settling tanks. Samples were disaggregated by agitating in water over a 500µm diameter mesh supported over a flotation drum. Light, primarily organic materials that floated as wash-over (flots) were retained on 500µm and 1mm calibrated mesh diameter *Endicot* sieves whilst other materials larger than 500µm that did not float remained on the mesh as the retent.

Wet retents were spread out on plastic trays and examined visually before being tagged and dried. The flot material was wrapped in blue acid-free paper, tagged and recorded before being air dried on trays in a warm drying room.

Once dried, the retents were sieved using 4mm and 2mm *Endicot* sieves and sorted using magnified illuminated lamps for all categories of artefacts and ecofacts. A magnet was employed to locate magnetized stone and metals.

Sorting of flots was undertaken using a *Nikon 93756* binocular microscope at variable magnifications of between x8 and x40 with associated *Schott KL-1500 LCD* cold light source. Sorted materials were bagged and labelled for submission to specialists and weighed (where relevant) using an *Ohaus CS200* digital scale calibrated to 0.01g. Sorted residues were also weighed on a digital scale, bagged and stored pending decision regarding disposal.

BOTANICAL MATERIAL IDENTIFICATION

Botanical material from each sorted flotation retent was added to the corresponding flot before being sorted through a 500µm, 1mm and 4mm sieve. Charcoal >4mm was 50% or 100% identified in each case depending on volume in order to characterise the assemblage present. Charcoal identification in all cases was undertaken with reference to Schweingruber (1990) using the reflected light of a Zenith metallurgical microscope at X63 magnification. The botanical assemblage was 100% analysed for carbonised cereals, seeds and other macroplant remains. Cereal identification was achieved with reference to Jacomet (1987). Seed identification was undertaken with reference to Beijerinck (1947), Cappers (2006) and the Dickson botanical reference collection. Plant nomenclature follows Stace (1997) except cereals, which conform to Zohary & Hopf (2000).

MOLLUSCS, MARINE BIVALVES AND OTHER SHELL IDENTIFICATION

Molluscs were sorted initially by shape before specific identification and habitat criteria were achieved using Cameron & Kerney 1979, Evans 1972 and Claassen 1998 and modern reference materials. Molluscs were tallied and relative abundances of identifiable taxa noted. Marine bivalves were generally fragmented, although occasional entire specimens were observed. Identification was undertaken as specifically as preservation would permit with reference to literature and modern reference materials and tallied numerically.

RESULTS

The results from the analysis of the GBA samples are discussed in detail by set for each sample and the results shown in the tables below. The results of the sorted residues for the GBA and BS samples are represented in Table 10:1. The results of the flot analysis for the GBA samples are listed in Table 10:2 and the general flot assessment for the BS are listed in Table 10:3 with the results tallied as an abundance scale.

SET 1 DARK EARTH/ACCUMULATED SOIL

Context 1069 [048] Accumulated deposit (Phase 1 late Roman)

Interpreted as a large accumulation deposit, this sample was very dark, suggesting a significant organic component, although demolition material was also present. Domestic refuse material including oyster shell and bone was noted. This deposit delineates the lower limit of excavation. Sample analysis recorded the presence of mortar, limestone, pottery and charcoal with an abundance of molluscs.

The charcoal assemblage was fairly limited with only 9 fragments of oak (*Quercus*) recorded. None were from round wood, implying that the charcoal was from the burning of larger trunks or structural timbers from the principia

One carbonised cultivated/black oat (*Avena sativa/strigosa*) cereal grain was the only carbonised seed from the late Roman samples. Uncarbonised seeds were also present in low numbers with only two entire elder (*Sambucus nigra/racemosa*) seeds and two fragments recorded. The sample also contained three indeterminate bud scales, although these delicate plant remains may be modern contaminants. The scarcity of the botanical assemblage can add little to the interpretation of this context, other than to concur with background scatter of Roman period occupation and abandonment. However, they also support the proposition that the area was relatively free of dumped domestic midden during the Roman period and suggest fairly rapid accumulation of deposits.

The mollusc assemblage was very varied and abundant with numerous taxa identified. Most of the terrestrial molluscs are indicative of moist, heavily vegetated and sheltered habitats. They are primarily synonymous with gardens and similarly vegetated habitats, in particular garden snails (*Helix aspersa*) which are associated with places with anthropogenic input. The assemblage is also strongly suggestive of calcareous soils. The mollusc assemblage reflects the natural vegetation within this area during the late Roman occupation, suggesting damp vegetation on good soils.

SET 3 DEMOLITION DUMPING

Demolition deposits of probable Roman date containing rubble and plaster deriving from the principia.

Context 1065 [044] Demolition deposit (Phase 1 late Roman).

Interpreted during excavation as a demolition dump and associated spread, this sample was described as a compacted, friable yellow brown silty, coarse mortar sand containing

fragments of limestone and CBM. Laboratory analysis also indicated an abundance of mortar and limestone with shell fragments and some charcoal.

The environmental component within the sample was not extensive, with only one fragment of charcoal >4mm recovered, identified as oak (*Quercus*). The only seeds within the sample were uncarbonised elder (*Sambucus nigra/racemosa*) and a limited number of molluscs were identified as garden snails (*Helix aspersa*). This may be an artefact of preservation as both the seeds and molluscs are of very robust and the dry, mortar soil would not have been conducive to preservation of fragile organics. This proposition would be supported by the abundance of indeterminate mollusc fragments recovered. However, it is also considered likely that this deposit accumulated rapidly during the destruction of the principia such that the natural seed bank in the soils would remain low.

SET 4 POSTHOLE

Structural posthole, probably Roman, possibly post-Roman.

Context 1060 [040] Backfill deposit (Phase 1 late Roman).

This sample was interpreted during excavation as the backfill of a posthole comprising firm, brown grey silty sand including fragments of CBM and limestone.

The charcoal assemblage was moderately abundant and included fragments of alder (*Alnus*) and poplar/willow (*Populus/Salix*), although oak (*Quercus*) predominated. All of the fragments were from trunk wood.

The macrofossil assemblage was fairly limited, with some uncarbonised elder (*Sambucus nigra/racemosa*) seeds and one fragment of carbonised hazel (*Corylus*) nutshell fragment. This was the only sample in the late Roman set to contain hazel nutshell, which highlights the fact that the Romans maintained a clean occupation area around the principia that was relatively free of domestic background detritus scatter.

Terrestrial molluscs were fairly abundant and the taxa present indicate a damp well vegetated habitat with calcareous soils. Slender herald snails (*Carychium tridentatum*) are very abundant within this sample and can be found deep within leaf litter in woodland or within dense vegetation. The molluscs would support the proposition that the area around the principia had become overgrown following abandonment. The sample also included a small amount of oyster (*Ostrea edulis*) shell and was the only sample in the late Roman date range to contain any marine shell. The shells may have had decorative, industrial or ritual function, or have been domestic discard. However, given the relative absence of others indicators of domestic midden, it is more likely that the shell here came from shell collected for a particular function within the principia.

SET 5 POSTHOLE

Structural posthole, probably Roman, possibly post-Roman.

Context 1061 [038] Backfill deposit (Phase 1 late Roman).

Interpreted as the backfill of a posthole, this was firm brown grey silty sand containing fragments of CBM and limestone. Analysis of the flot from the bulk sample indicated abundant molluscs but very little carbonised organic or building materials.

No charcoal greater than 4mm was recovered, but a small amount of smaller, indeterminate charcoal was noted. No carbonised plant remains or seeds were present, but some uncarbonised elder (*Sambucus nigra/racemosa*) seeds were recovered. The assemblage is entirely supportive of demolition waste deposits.

The mollusc assemblage was particularly abundant and varied, many of them associated with dense vegetation in sheltered paces such as dense grass, hedgerows, woodland or scrub. Most prefer moist shaded conditions so the assemblage reflects the proposed wasteland scrub. The presence of possible wall whorl snails (cf *Vertigo pusilla*) corroborates this.

SET 6 DARK EARTH

A layer of undifferentiated soil, labelled 'dark earth'.

Context 1058 [036] Dumped soil (Phase 2 post Roman).

This sample was interpreted as an extensive deposit of dumped soil, described as a firm, dark brown grey, slightly clayey sandy silt with patches of brown sandy mortar and charcoal flecks. The context has been attributed to the post Roman period and contained a large amount of CBM and molluscs, with some charcoal and seeds.

Two charcoal fragments were identified as oak (*Quercus*) and no carbonised seeds were found. Uncarbonised elder (*Sambucus nigra/racemosa*) seeds were present again but in much greater abundance than in previous samples. The sample also contained uncarbonised seeds of hemlock (*Conium maculatum*) and henbane (*Hyoscyamus niger*), both commonly found on rough, urban wasteground. Elder, hemlock and henbane are most commonly attributed to enhanced or manured soils, often associated with buildings and demolition sites and it is very likely that the increase in the notable abundance of elder in Phase 2 and the introduction of henbane and hemlock here are the result of change in soil conditions and abandonment of use. Hedge woundwort (*Stachys sylvatica*) is also found in the samples from this point and can be found in woodland margins, hedges and rough waste

ground. The absence of cereals or other food plants further supports the proposition that the land was not in direct popular use at this point in history.

The sample contained an abundance of indeterminate mollusc fragments, but also many whole terrestrial molluscs. The mollusc assemblage is indicative of dryer, open habitats including short grassland. One moss chrysalis snail (*Pupilla muscorum*) and some whorl snails (*Truncatellina* sp) particularly reflect a dry open environment and were not recorded in any of the other Minster samples. There may still have been a significant building rubble component to the soil at this time to support these taxa. The sample also contained one strawberry snail (*Trichia striolata*) which tends to be found in a damp shaded environment often associated with houses and gardens so could possibly indicate locally shaded, better vegetated crevices and patches. The sample did not contain any marine or freshwater examples, and no fragments of oyster shell were recovered.

This context has been interpreted as post Roman and from this point onwards the botanical assemblages became more abundant and varied within the samples examined. The term 'dark earth' to which this sample is attributed is used to describe deposits of dark coloured loam often mixed with building material. This is frequently interpreted as evidence of a sharply reduced urban occupation in late Roman towns (Palliser 2000) and could indicate a reason for this rapid increase in weeds that are strongly indicative of the enriched, anthropogenic soils that parallel abandonment

SET 7 TIPPING DEMOLITION DEPOSITS

The lower part of a series of limestone and CBM-rich rubble deposits, interpreted as evidence for the systematic demolition of the principia and in-situ re-dressing of the stone. *Context 1055 [032] Trample/levelling deposit (Phase 3 Anglian).*

This was described as brown grey very coarse sandy silt, part of a trample/rubble spread sequence. The sample contained a high abundance of CBM with mortar and limestone fragments, consistent with demolition debris. It also contained metal fragments and an abundance of charcoal.

The charcoal assemblage was dominated by oak (*Quercus*) with 17 fragments counted. Plum/cherry (Prunoideae), poplar/willow (*Populus/Salix*) and alder (*Alnus*) were also recorded. None of the fragments were round wood and may include structural elements including partitions, fencing or sundries. As the sample is associated with the demolition of the principia, it is likely that the abundance of oak charcoal especially reflects this destruction including the burning of structural timbers.

No carbonised plant remains were found, but a large number of uncarbonised elder (*Sambucus nigra/racemosa*) seeds were recovered, associated with hemlock (*Conium maculatum*), henbane (*Hyoscyamus niger*) and hedge woundwart (*Stachys sylvatica*), as before. This would suggest continuation of the enriched soil conditions and open waste ground habitat observed in the earlier, Phase 1 Romano period occupation to imply they are closely consecutive. Seeds of common nettle (*Urtica dioica*) found further support the interpretation that this area is not particularly being used yet, although natural sedimentation is occurring slowly and importation of deposits to increase soil depth is in progress.

The mollusc assemblage included both excentric vallonia (*Vallonia excentrica*) and costate vallonia (*Vallonia costata*), both of which suggest a fairly dry, open grassy environment. Most of the other molluscs reflect variable habitats although primarily damp vegetation or grassland. One European stream valvata (*Valvata piscinalis*) which is found in freshwater streams, rivers and lakes supports the interpretation of imported levelling or inundation from a fresh water source, probably the river nearby. Fragments of oyster (*Ostrea edulis*) shell were also fairly common within the sample and corroborate the interpretation of trampled levelling material.

Context 1054 [030] Trample/dump deposit (Phase 3 Anglian).
This soft, mid brown grey, slightly clayey coarse sandy silt was interpreted as a trample/dump deposit. Charcoal fragments were abundant and the sample also contained metal fragments and slag, with CBM with some mortar recorded.

Oak (*Quercus*) dominated the charcoal assemblage with 27 fragments identified, with a single fragment of poplar/willow (*Populus/Salix*) the only other taxon identified. Some of the oak fragments were from round wood, although trunk wood was also recorded. The trunk wood charcoal may in part reflect this destruction with the burning of structural timbers. However, the sample also contained slag and metal, suggesting dumping of industrial waste. Consequently, at least the smaller branch wood (round wood) oak could have been used in industrial processes such as metal working and associated industry. Oak has a long association with industrial furnaces as the specific properties of the wood enable high temperatures to be achieved for sustained periods (Tylecote 1962).

This sample contained poorly preserved carbonised cereal grain fragments of oat or rye (*Avena/Secale*) and hazel (*Corylus*) nutshell but no other carbonised plant macros. The condition of the cereals suggests a degree of reworking or disturbance and reflects the interpretation of a trampled surface. The presence of food remains indicates that domestic midden including hearth waste was now becoming incorporated into the soil, whether for soil

improvement or disposal. Either way, one effect of this midden deposition would have been to greatly increase the nutrient status of the ground. Hence, a greater natural weed flora could be sustained.

Uncarbonised seeds of cabbage family (Brassicaceae) and fat hen (*Chenopodium album*) indicate that weeds associated with cereal crops were present and may reflect discard during the daily processing of cereals ahead of consumption, or colonists of the disturbed, midden-enriched urban waste ground environment. That scenario is certainly more plausible for the henbane (*Hyoscyamus niger*) seeds and black horehound (*Ballota nigra*) seeds also recorded.

The land molluscs reflect a well vegetated or grassy environment with sheltered areas. One type of ramshorn snail (*Anisus sp*), was found in the sample and is the only one recovered from the site. This freshwater taxon highlights importation or inundation from a local freshwater source, and the presence of willow (*Salix*) which prefers wetter habitats would substantiate this. Some fragments of oyster (*Ostrea edulis*) shell were also recovered, probably deposited with midden material but helping to enrich the soil as they degenerated over time.

Context 1053 [028] Dump deposit (Phase 3 Anglian).
This context was interpreted in the field as a rubble-rich dump of refuse material consisting of friable mid grey brown silty sand with limestone and CBM fragments with charcoal flecks. The sample also contained metal, possibly lead.

The charcoal assemblage was dominated by oak (*Quercus*) but contained a range of other taxa including hazel (*Corylus*), birch (*Betula*) and poplar/willow (*Populus/Salix*). None of the fragments were from round wood. As with the previous sample, this assemblage could be related to the destruction of the principia but may also include dumped refuse material from industrial and/or domestic processes.

The mollusc assemblage was similar to that of trample/dump deposit context 1054 [030], indicating a similar habitat. However, one narrow-mouthed whorl snail (*Vertigo angustior*) was found, which prefers a far wetter habitat than the other molluscs and is found in marshy grassland and among moss in wet hollows. The snail is commonly found as a result of flood inwash and suggests that at least some of the environmental material recovered has been introduced and re deposited.

Fragments of oyster shell and the only examples of blue/edible mussel (*Mytilus edulis*) found further support the interpretation of household waste being re deposited or dumped.

SET 9 LEVELLING/REFUSE DEPOSITS

Refuse dumping or levelling, associated with the demolition of the principia.
Context 1051 [026] Levelling deposit (Phase 3 Anglian).

The context was described in the field as dark brown grey coarse silty sand and hand collected finds included bone, shell, CBM and lead alloy spillages/fragments. Sample processing revealed that charcoal was abundant and that molluscs and seeds were also frequent. Some modern roots highlights the potential for stratigraphic disturbance.

One fragment of ash (*Fraxinus*) charcoal was the only one recovered from the proposed Anglian period samples. The dominant taxon was oak (*Quercus*) and one fragment of plum/cherry (Prunoideae) was also identified. Both oak and ash burn at high temperatures and their association with metal waste in this sample suggest that the wood may have been used for industrial fuel. Discarded possible food preparation waste including animal bones and shells within the hand collected finds assemblage suggests the levelling deposits also include domestic midden material.

Indeterminate, carbonised fragments of one cereal grain and two seeds of bean/pea (Fabaceae) were recorded, but no further evidence of crop processing was identified. This contradicts the more significant animal bone and shell assemblages recovered, suggesting at least the possibility of importation of animal bone from an industrial source, such as a butcher's shop or midden.

By contrast to the scarce carbonised assemblage, uncarbonised elder (*Sambucus nigra/racemosa*) seeds were abundant, reflecting the nutrient enriched status of the area, The remainder of the uncarbonised weed seeds community, including henbane (*Hyoscyamus niger*), hedge woundwort (*Stachys sylvatica*) and common nettle (*Urtica dioica*), also reflect this type of habitat ,although numbers of these taxa were reduced. These plants all produce robust seeds that remain viable within the soil seed bank for extended periods, especially the elder, so once established they will maintain a presence in undisturbed anthropogenic waste ground over time. The terrestrial mollusc assemblage suggests a damp, well vegetated grassy environment, although excentric vallonia (*Vallonia excentrica*) prefers a more open habitat. The sample also contained some oyster shell fragments and the only example of common periwinkle (*Littorina littorea*) found, with one

whole shell recovered. The marine shells are from types that are edible and are likely to be residual from domestic midden waste.

SET 10 TIPPING/DEMOLITION DEPOSITS

The upper part of a series of limestone and CBM-rich rubble deposits, interpreted as evidence for the systematic demolition of the principia and in-situ re-dressing of its stone.
Context 1050 [024] Trample deposit (Phase 3 Anglian).

Described in the field as friable, light brown sandy clay mottled with light brown sand, this sample is thought to be trample deposit incorporating the upper trampled spread (1049) and underlying levelling (1051) contexts. The sample examined contained both limestone and mortar. The hand collected finds included disarticulated human bone, oyster and snail shell and charcoal. The human bone may be residual from the Anglian cemetery or from clandestine burial, although the degree of disarticulation suggests a degree of re-deposition and reworking during levelling of deposits. Oak (*Quercus*) charcoal was moderately abundant with a total of 26 fragments identified. None of the fragments were round wood and structural demolition is a likely provenance for these finds. Two carbonised cereal grain fragments of oat /rye (*Avena/Secale*) were too poorly preserved to be further identifiable and were the only carbonised seeds within the sample. The presence of them indicates incorporation of domestic detritus and their state of preservation is in keeping with the suggested re-working of this trample horizon. The uncarbonised seed assemblage was dominated by elder, as in all samples examined, with henbane and hedge woundwort retaining a residual presence within the natural seed bank. One seed of black horehound (*Ballota nigra*) concurs with the enriched sheltered waste ground habitat interpretation. One fairy flax (*Linum catharticum*) seed was the only one found in any of the samples and is usually indicative of dry grassland. The seed may have been residual from the burning of turf, whether to bank a cereal processing fire or redeposited from the destruction of the Roman principia.

The terrestrial mollusc assemblage was dominated by rounded snail (*Discus rotundatus*). The species range indicates a damp sheltered habitat, usually synonymous with gardens, grassland and generally well vegetated areas. Some oyster (*Ostrea edulis*) fragments were also recorded. The entire assemblage together would concur with a trampled horizon incorporating demolition and domestic waste within enriched grassy waste ground soils.

Context 1049 [022] Spread deposit (Phase 3 Anglian)

This spread of material was described as light, orangey brown silty coarse sand and was interpreted as a spread of trampled material including mortar and angular limestone pebbles and cobbles.

Very little charcoal was present with only two fragments of oak (*Quercus*) recorded, but two fragments of carbonised hazel (*Corylus*) nutshell, one carbonised possible 6-row barley (cf *Hordeum vulgare* sl) grain and one indeterminate cereal grain fragment were identified, indicating a background scatter of domestic occupation detritus.

The uncarbonised seed assemblage concurred with the enriched waste land deposits interpreted for this phase of occupation, including henbane (*Hyoscyamus niger*) , fat hen (*Chenopodium album*) and especially elder (*Sambucus nigra/racemosa*), although numbers were reduced compared to previous samples examined, suggesting that this deposit may have accumulated fairly rapidly before becoming sealed.

No terrestrial molluscs were identified from this sample which only contained small snail fragments and some oyster (*Ostrea edulis*) shell remains. The fragmentary nature of shells concurs with the poor preservation of carbonised plant remains to highlight the likelihood of trampling of this deposit and the scarcity of taxa concurs with the interpretation of rapid sediment accumulation..

SET 13 LEVELLING DUMPS

Levelling or dumps of waste material, possible associated with the 'working surface' after the demolition of the principia.

Context 1044 [015] Levelling/surface deposit (Phase 3 Anglian).

This sample consisted of firm, dark grey brown slightly clayey sand with dark red brown clay patches, mortar lenses and angular limestone fragments. It was interpreted in the field as a levelling deposit or possible graveyard surface. The sample also contained what appeared to be modern roots.

Charcoal fragments were slightly more frequent than in the underlying spread (context 1049) and included oak (*Quercus*), hazel (*Corylus*) and plum/cherry (Prunoideae).

This sample contained the greatest number of carbonised cereal grains from the possible Anglian period samples, including one bread wheat, two cultivated /black oat (*Avena sativa/strigosa*) and two oat/rye (*Avena/Secale*) grains. Uncarbonised elder (*Sambucus*

nigra/racemosa) seeds were present but only in slightly higher numbers than in the underlying spread (1049) so still few, relative to the other Anglian samples. The presence of bread wheat and oats concurs with domestic food processing waste of Anglian period occupation in the vicinity, whilst the relative scarcity of weed seeds would suggest moderately rapid sediment accumulation. Together, these factors support the interpretation of a fairly rapid episode of dumping of materials including domestic waste for levelling.

Only two molluscs were recovered from this sample so can add little to the interpretation of this habitat. The garden snail (*Helix aspersa*) recovered is usually associated with anthropogenic activity, hence the common name. This mollusc is very large and robust so may be the result of preservation bias as smaller more fragile species may have become damaged and fragmented through trampling and fluctuating ground water conditions over time.

SET 14 REFUSE PIT

A refuse pit, possibly associated with the suggested clearance of the Anglian cemetery in the Anglo-Scandinavian period

Context 1039 [014] Backfill of pit 1042 (Phase 4 Anglo-Scandinavian).

Described in the field as reddish brown slightly sandy clay, this sample was very pitted and uneven and interpreted as a dump of material comprising the clayey backfill of pit 1042. Human bone, CBM and charcoal, limestone and mortar flecks were recorded from this fill.

This sample of Anglo Scandinavian period did not contain any charcoal large enough to identify, although indeterminate small fragments were noted. One carbonised grain each of cultivated /black oat (*Avena sativa/strigosa*) and oat/rye (*Avena/Secale*) were recovered, with one indeterminate cereal grain fragment. The uncarbonised seed assemblage was still dominated by elder (*Sambucus nigra/racemosa*) and henbane (*Hyoscyamus niger*) but now also included creeping/bulbous buttercup (*Ranunculus repens/bulbosus*) and poppy (*Papaver* sp), reflecting the general increase in variety of the urban weed flora with increasing population density and trade. Both species are commonly found in grassland or waste ground. One bud scale indentified as Scots pine (*Pinus sylvestris*) was also recovered.

The sample did not contain very many molluscs but species recorded indicate a very highly vegetated environment. Together the entire assemblage is indicative of redeposited demolition waste mixed with domestic midden and possibly cemetery deposits.

SET 15 CHARNEL PIT

A charnel pit, associated with the suggested clearance of the Anglian cemetery

Context 1037 [013] Deposit of pre conquest charnel pit 1040 (Phase 4 Anglo-Scandinavian).

This deposit was described in the field as firm, mid brown clayey coarse sand and contained mixed disarticulated bone. The hand collected finds included an iron nail, an iron nail head attached to a piece of lead sheeting and some possible 10th century pottery in addition to human bone. Analysis of the sample revealed further bone as well as an abundance of charcoal and seeds. Possibly modern roots were also recorded.

This deposit may indicate the clearance of or at least the disturbance of a putative Anglian period cemetery. It is clearly sealed beneath deposits of set 17 which are then cut by the later Anglo-Scandinavian cist burial (Phase 5).

The charcoal assemblage within the charnel pit was the most abundant of any deposits relating to these later phases. Oak (*Quercus*) was predominant although one fragment each of alder (*Alnus*), ash (*Fraxinus*) and poplar/willow (*Populus/Salix*) were recorded. The charcoal found would concur with the suggested interpretation of demolition and clearance of an Anglian cemetery including burning of either grave markers or coffin wood.

The absence of carbonised cereals further support the interpretation of cemetery decommissioning by implying that the charcoal found was not residual from domestic fuel waste. The large numbers of elder (*Sambucus nigra/racemosa*) and henbane (*Hyoscyamus niger*) seeds further support this proposition. Both species strongly favour enriched, disturbed anthropogenic soils such as generally typified historic cemeteries.

The majority of the terrestrial molluscs within this sample are not habitat specific, but most are commonly found in well vegetated damp areas such as gardens and grassland. As such they would inhabit an unkempt cemetery quite readily and are likely to reflect the background environment quite accurately.

Context 1036 [009] Backfill of charnel pit 1040 (Phase 4 Anglo-Scandinavian)

This context was described as firm, mid brown grey clayey coarse sand, with moderate limestone fragments and clay lumps. After flotation the sample was observed to also contain CBM and charcoal with some shell and small bone fragments. Roots, probably fairly modern, were also recorded.

The charcoal greater than 4mm totalled five fragments of oak (*Quercus*). No round wood was recorded.

The carbonised seed assemblage included one grain of probable bread wheat (*Triticum cf aestivum*) but no other carbonised seeds or plant macros. The wheat grain probably reflects a degree of redeposited Anglian midden deposits from earlier levelling. The uncarbonised assemblage included seeds of henbane (*Hyoscyamus niger*) and elder (*Sambucus nigra/racemosa*) in some abundance, as with the previous charnel pit fill (1037). Henbane is particularly associated with rough wasteland, especially soils that have been manured by rabbits or cattle (Stace 1997), but is also common on anthropogenic disturbed land including graveyards. The continued presence of both elder and henbane emphasise the continuation of enriched soils over time at this site, although now probably more as a result of burial decomposition than with domestic midden incorporation as in the earlier, Anglian period levelling. Nevertheless, it must be remembered that both seeds are particularly robust and may be relicts of a more varied seed bank population. One bud scale of Scots pine (*Pinus sylvestris*) was also found but adds nothing concrete to this investigation and could conceivably be a blown in modern contaminant.

The terrestrial mollusc assemblage includes those that prefer dryer calcareous soils and short grassland including excentric vallonia (*Vallonia excentrica*). The sample also contained some fragments of oyster (*Ostrea edulis*) shell. Given the association of this deposit with human remains, it is not possible to discount the possibility that the oyster shell may reflect the custom of placing such a shell into the mouth of the dead (James & Yeoman 2008).

SET 19 CIST TOMB

A stone-lined cist-type tomb on the Anglian/Anglo-Scandinavian alignment

Context 1023 [002] Grave fill of Anglo Scandinavian cist tomb (Phase 5 Anglo-Scandinavian).

The deposit was described in the field as light yellow brown silt sand with some small limestone fragments. The sample comprised an abundance of mortar type material and limestone fragments, with some charcoal and coal present. A small amount of human bone and a few metal artefacts were also recorded.

The charcoal assemblage was of limited range, including oak (*Quercus*), birch (*Betula*) and possible lime/hornbeam (cf *Tilia/Carpinus*) with oak being the most abundant. None of the charcoal fragments were recorded as round wood, suggesting that all may have originated from larger trunk wood, possibly planks. Hornbeam (*Carpinus*) makes excellent charcoal as it

is extremely hard and in the past was known as 'lanthorn' because it burned with a bright flame and was hot enough to smelt iron (Mabey 1996). However, the extremely hard wood had various other historic associations including wheel spokes and cruck beams. The wood has also been recorded as posts for shoring pits in Medieval London (Gale & Cutler 2000), so in this sample the association of possible hornbeam within a stone lined cist tomb must be considered to be at least of note. Oak also has an ancient association as fuel wood for household and industrial purposes as well as a plethora of industrial and structural uses.

The carbonised seed assemblage included one grain of probable bread wheat (*Triticum cf aestivum*) and one carbonised seed each of dock (*Rumex* sp) and catchfly/corncockle (*Silene/Agrostemma*). Docks are general arable/ruderal indicators, but catchfly and especially corncockle are strongly associated with cereal cultivation. This assemblage could possibly indicate *in situ* cereal crop processing but is more likely to reflect re-deposition of earlier sediments including midden material, probably from the Anglian levelling deposits. The uncarbonised seed assemblage was less prolific than has been observed before and was primarily fragmented, suggesting poor preservation conditions. Nevertheless, robust taxa including elder (*Sambucus nigra/racemosa*) and one meadow buttercup (*Ranunculus acris*) seed were recorded. Both support the generic interpretation of grassy wasteland with enhanced soils.

The terrestrial mollusc assemblage including milky crystal snail (*Vitrea contracta*) indicates calcareous damp soils with vegetation cover. This further supports the suggestion of a damp grassland environment with enriched, basic soils as would be expected within a cemetery context.

DISCUSSION

The stratigraphic relationship of samples examined from this site is complex and the volume of environmental materials recovered was never extensive. Nevertheless, the environmental assemblages recovered support the archaeological interpretation of a period scanning late Roman to Anglo-Scandinavian occupation including various changes of use. There is evidence of the destruction of the Roman principia by the Anglian community who levelled the demolished building rubble with imported domestic and industrial midden material before subsequently reusing the area to bury their dead. Charnel pits dug subsequently by the later Anglo-Scandinavian occupants cut through those Anglian levels and further admixed those already disturbed deposits. Interpretation of the botanical assemblages has helped highlight periods of domestic middening and soil re-deposition over time, whilst emphasising the enriched nature of the soils that have resulted firstly from the introduction of domestic waste

and then subsequently from burial practices. Analysis and interpretation of the terrestrial and aquatic shell assemblages has assisted in the interpretation of each phase and has provided a deeper understanding of the environmental conditions prevailing as a result of the palimpsest of anthropogenic activities over time. Collectively, the environmental assemblages have helped identify periods of rapid or more extended sediment accumulation and explain associations between the stratigraphic sequences observed.

The most abundant charcoal taxon was oak (*Quercus*), although volumes were never extensive. Most of the charcoal fragments were recorded as trunk wood so originated from larger pieces of wood and not smaller round wood or twigs. The presence of trunk or round wood can in some circumstances support interpretation of function of a particular charcoal type or taxon assemblage, and at this site the abundance of oak in some contexts is considered likely to relate to burning of structural timbers during the destruction of the Roman principia. Other contexts also contained industrial waste and here the association with oak charcoal is likely to reflect to dumping of waste from metalworking and other industrial processes for the purposes of levelling. Tylecote (1962) notes the preferential selection of oak for industrial processes due to burning temperatures achieved and in the Anglian levelling deposits at least some of the oak recovered is likely to have had this provenance. However, in all cases the very high volume of CBM recovered suggest that at least some demolition debitage is also likely. Occasional fragments of other charcoal taxa were recovered, of which ash (*Fraxinus*) and lime/hornbeam (*Tilia/Carpinus*) are also likely to reflect structural and industrial uses. Others including birch (*Betula*), alder (*Alnus*) and willow (*Salix*) are indicative of scrub woodland collection and may also reflect domestic hearth waste, although small item structural uses such as fencing are also possible. Interpretations as hearth waste are given more credence when corroborated by the presence of other waste or refuse materials including cereals and nutshell, edible mollusc shells and animal bone.

York had undergone a succession of occupation from its Roman origins. York Minster occupied a site within the Roman forum, but during the Viking period the commercial focus of the town shifted to around the industrial workshop areas in Coppergate, Fossgate and Ousegate on the banks of the River Foss. Micklegate, the major road entering the city from the south, moved east and away from its earlier Roman alignment, shifting and fixing the crossing to the present site at the Ouse Bridge (Palliser 2000). The biological evidence from the samples reflects the change in importance of this site over time as highlighted within the ‘dark earth’ abandonment horizons and changes in the floral and malacological assemblages from the post Roman period onward.

The samples from the contexts thought to be late Roman contain very few carbonised and uncarbonised plant remains. Uncarbonised seeds of elder (*Sambucus nigra/racemosa*) seeds were present but in low numbers compared to the later contexts. This is possibly a reflection of the fact that the occupied Roman areas were maintained relatively free of discarded waste materials, meaning that soils were not particularly nitrogen rich. It also takes several years for elder shrubs to produce seeds, and it is likely that the area around the principia would have been kept fairly clear of scrub vegetation, at least during the occupation. During the Romano period the soils were probably more calcareous and better drained than later soils and deposits which were enriched by middening and then inhumation. This is evident from the high abundance of terrestrial molluscs and small amount of preserved organic material in the Romano and post-demolition period soils. From the post Roman period certain species became more prevalent and abundant, increasingly so at the beginning of the proposed Anglian period. Elder (*Sambucus nigra/racemosa)* was abundant in most of the samples and henbane (*Hyoscyamus niger*) seeds were frequent. The seeds recovered from the Anglo Scandinavian contexts showed a slight change of habitat, possibly moving towards a meadow/grassland environment with the presence of meadow buttercup (*Ranunculus acris*) and creeping/bulbous buttercup (*Ranunculus repens/bulbosus*).

Many of the uncarbonised seeds found within the samples are of species that are either medicinal or toxic and have been used in the past to treat many conditions. The possibility cannot be discounted that some were escapes from intentional physic cultivation, although at this site natural regeneration once the natural seed bank became established is considered very likely. However, Black horehound (*Ballota nigra*), henbane (*Hyoscyamus niger*) and hemlock (*Conium maculatum*) have been used as an effective sedative and analgesia in the past and fairy flax (*Linum catharticum*) has been used as a mild purgative (Mabey 1996). The old Roman name for hemlock is ‘cicuta’ and it was used in the treatment of neurological conditions such as epilepsy. This name can still be seen in tenth century Anglo Saxon texts (Stuart 1989). Nevertheless, since they are all weeds frequently associated with anthropogenically enriched soils in urban environments (Hall & Kenward 1990 289-434) it must be accepted that whilst some may have been medicinal escapes, they are equally likely to have grown there without direct human association. Elder also has medicinal uses, but thrives in the disturbed, enriched soils of waste ground, building sites and cemeteries.

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	Sample information (Vol. in L)				Sorting %		Sample weights (g)																		
Context	Num	Type	Vol	Res. Vol	Enviro	Other	C.V.	Seed	Nut shell	Bone		Shell	Ceram	CBM	Metal	Glass	Industrial		Stone				other	Wd	Comments
										Hum	An						Slag	Other	Lithic	Wked	Qtz?	Slate?			
1023	**002**	**GBA**	10.00	2.00	100.00	60.00				1.22				260.00	39.00			2.00							
1036	**009**	**GBA**	10.00	2.00	100.00	60.00							13.00	440.00											
1037	**013**	**GBA**	10.00	1.80	100.00	100.00				23.174			2.00	247.00				1.00							
1039	**014**	**GBA**	10.00	1.50	100.00	100.00							2.00	7.00	2.00										
1044	**015**	**GBA**	10.00	1.50	100.00	60.00								456.00	17.00			3.00							
1049	**022**	**GBA**	10.00	1.50	100.00	50.00								260.00	3.00								0.10		amber
1050	**024**	**GBA**	10.00	1.50	100.00	100.00								94.00											
1051	**026**	**GBA**	10.00	1.50	100.00	60.00				1.32				269.00	12.00			1.50							
1053	**028**	**GBA**	10.00	1.50	100.00	60.00								189.00	15.00			3.00							Lead?
1054	**030**	**GBA**	10.00	2.00	100.00	50.00								166.00	7.00		2.00								
1055	**032**	**GBA**	10.00	1.50	100.00	60.00								465.00	3.00			1.20							
1058	**036**	**GBA**	10.00	1.50	100.00	60.00								649.00											
1061	**038**	**GBA**	10.00	1.50	100.00	100.00									2.00			0.80							
1060	**040**	**GBA**	10.00	2.00	100.00	80.00								489.00				0.50							coal?
1060	**044**	**GBA**	10.00	1.50	100.00	100.00												1.00							
1069	**048**	**GBA**	10.00	1.00	100.00	60.00							12.00							713.00					1 lrg frg
1031	**006**	**BS**	30.00	10.00	100.00	60.00						12.10	0.70	559.00				3.30							
1036	**010**	**BS**	30.00	2.50	100.00	60.00						48.58	26.85	568.00		2.24		3.16							
1037	**012**	**BS**	30.00	2.50	100.00	60.00				104.56		4.60		407.00	9.86		16.10	1.90							
1044	**016**	**BS**	30.00	4.60	100.00	60.00						23.66		623.00	2.20			0.80							
1049	**023**	**BS**	30.00	4.00	100.00	60.00					52.00	1.70		699.00	9.78			3.40							
1050	**025**	**BS**	30.00	3.50	100.00	60.00						55.20	1.78	418.00	102.35			2.76							
1051	**027**	**BS**	30.00	3.00	100.00	60.00						51.50	19.80	8.32	25.82			2.50					3.50		unknown
1053	**029**	**BS**	30.00	3.50	100.00	60.00						7.00	472.71	92.71	25.01			2.80							
1054	**031**	**BS**	30.00	3.80	100.00	60.00						17.61	11.94	646.00	3.27		7.90	4.00					1.60		
1055	**033**	**BS**	30.00	1.50	100.00	60.00						2.10	39.00	344.00				0.70							
1058	**037**	**BS**	60.00	8.20	100.00	60.00						11.50	5.60	1437	40.84	0.10		1.10					1.04		coin?
1061	**039**	**BS**	30.00	2.50	100.00	60.00						12.80		675.00			6.50	6.90					11.00		daub like substance
1060	**041**	**BS**	30.00	4.50	100.00	60.00						10.20	15.00	874.00	6.46	0.89		4.40							
1065	**045**	**BS**	30.00	4.80	100.00	60.00						30.00		313.00	1.70			9.50							
1069	**049**	**BS**	60.00	5.70	100.00	60.00						7.80	16.10	2326	7.24			6.30							

Table 10:1 GBA and BS sorting results

York Minster GBA Enviro Results	Phase	1	1	1	1	2	3	3	3	3	3	3	3	4	4	4	5	PHASES
Ymm DC 2012-001 5104 /NL 4274161	**Set**	**1**	**3**	**4**	**5**	**6**	**7**	**7**	**7**	**9**	**10**	**10**	**13**	**14**	**15**	**15**	**19**	
	Context	**1069**	**1065**	**1060**	**1061**	**1058**	**1055**	**1054**	**1053**	**1051**	**1050**	**1049**	**1044**	**1039**	**1037**	**1036**	**1023**	1 = late Roman
	Sample	**048**	**044**	**040**	**038**	**036**	**032**	**030**	**028**	**026**	**024**	**022**	**015**	**014**	**013**	**009**	**002**	
Flot Composition (1-5 abundance scale)	**Description**	GBA	GBA	GBA	GBA	GBA	GBA	GBA	GBA	GBA	GBA	GBA	GBA	GBA	GBA	GBA	GBA	2 = post Roman
Total flot volume		3ml	20ml	3ml	7ml	4ml	5ml	10ml	12ml	8ml	12ml	<5ml	5ml	4ml	6ml	5ml	10ml	
Roots		-	-	-	-	-	-		-	+	+	-	+	-	+	+	-	3 = possibly Anglian
Charcoal		++	++	++++	++	++	++++	++++	+++	++++	++++	++	+++	+++	++++	++++	++	
Coal		-	+	+	+	-	-	-	-	-	+	-	-	+	-		+	4 = Anglo Scandinavian
Bone		-	+	+	-	+	+	++	+	+	++	+	+	+	++	+	+	
Molluscs /shell		++++	+++	+++	++++	++++	+++	++	++	+++	+++	++	+	++	++	++	+	5 = Anglo Scandinavian
Insect/Invertebrates		+	+	+	-	+	-	-	+	-	-	-	-	-	-		-	
Seed		+	+	+	+	++	++	++	++	+++	+++	++	++	++	+++	++	++	
CBM		-	-	+	-	-	+	+	-	-	-	-	-	-	-		-	
Mortar		+	+++	+	-	-	++	+	++	+	+	++	++	+++	+	+	+++	
Limestone		++	+++	+	+	++	+	-	+	-	+	++	-	-	-	+	++	
Total Charcoal (F+R)		3ml	6ml	14ml	5ml	8ml	20ml	40ml	35ml	33ml	23ml	11ml	12ml	5ml	33ml	12ml	13ml	
Charcoal >4mm		2ml	1ml	9ml	-	3ml	5ml	10ml	10ml	18ml	8ml	3ml	5ml	-	18ml	5ml	8ml	
% ID >4mm		100%	100%	100%	-	100%	100%	100%	100%	50%	100%	100%	100%	-	50%	100%	100%	
Charcoal <4mm		1ml	5ml	5ml	5ml	5ml	15ml	30ml	25ml	15ml	15ml	8ml	7ml	5ml	15ml	7ml	5ml	
AMS option Y / N		N	N	nutshell 0.07g		N	Prunoideae 0.17g	Salix 0.05g	Salix 0.04g	?Prunoideae	? Cereal	nutshell (0.1g)	?Prunoideae	N	Salix (0.15g)	N	? Betula 0.02g	
Charcoal (* means includes roundwood)	**Common Name**																	
Alnus	alder	-	-	1 (0.06g)	-	-	1 (0.03g)	-	-	-	-	-	-	-	1 (0.13g)	-	-	
Betula	birch	-	-	-	-	-	-	-	1 (0.03g)	-	-	-	-	-	-	-	1 (0.02g)	
Corylus	hazel	-	-	-	-	-	-	-	2 (0.05g)	-	-	-	1 (0.02g)	-	-	-	-	
Fraxinus	ash	-	-	-	-	-	-	-	-	1 (0.10g)	-	-	-	-	1 (0.04g)	-	-	
Populus/Salix	poplar/willow	-	-	2 (0.08g)	-	-	1 (0.01g)	1 (0.05g)	1 (0.04g)	-	-	-	-	-	1 0.15g)	-	-	
Prunoideae	plum/cherry	-	-	-	-	-	2 (0.24g)	-	-	1 (0.03g)	-	-	1 (0.03g)	-	-	-	-	
Quercus	oak	9 (0.34g)	1 (0.02g)	7 (0.30g)	-	2 (0.06g)	17 (0.70g)	27 (1.69g)*	22 (1.24g)	19 (1.48g)	26 (0.81g)	2 (0.13g)	11 (0.33g)	-	16 (1.50g)	5 (0.28g)*	6 (1.03g)	
cf Tilia/Carpinus	cf lime/hornbeam		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1 (0.03g)	
Indet charcoal VPC			-	-	-	-	-	-	-	-	-	-	-	-	1 (0.10g)	1 (0.05g)	-	
Cereals (c)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Avena sativa/strigosa	cultivated /black oat	1	-	-	-	-	-	-	2	-	-	-	2	1	-	-	-	
Avena/ Secale fgmt	oat/rye	-	-	-	-	-	-	2	-	-	2	-	2	1	-	-	-	
cf Hordeum vulgare sl	cf 6-row barley	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	
Triticum sp	wheat	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	
Triticum aestivum	bread wheat	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	
Triticum cf aestivum	cf bread wheat															1	1	
Cereal indet	cereal grain fgmt	-	-	-	-	-	-	-	-	1	-	1	-	1	-	1	1	
Other macros (c)																		
Corylus nutshell fgmt	hazel	-	-	1 (0.07g)	-	-	-	1 (0.01g)	1 (0.01g)	-	-	2 (0.17g)	-	-	-	-	-	
Fabaceae fgmt NFI	bean/ pea family	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	

Rumex sp	dock	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Silene/Agrostemma fgmt	catchfly/corncockle fgmt																1	
Macros (nc)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ballota nigra	black horehound	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	
Brassicaceae NFI	cabbage family	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	
Chenopodium album	fat hen	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	
Conium maculatum	hemlock	-	-	-	-	3	3	-	-	-	-	-	-	-	-	-	-	
Hyoscyamus niger	henbane	-	-	-	-	1	5	3	12	1	10	1	8	2	3	29	-	
Linum catharticum	fairy flax	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	
Papaver sp	poppy	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	
Pinus sylvestris bud scale	Scots pine bud scale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
Ranunculus acris	meadow buttercup	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Ranunculus repens/bulbosus	creeping /bulbous buttercup	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	
Rubus fruticosus ss	blackberry	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	
Sambucus nigra/racemosa	elder/red-berried elder	2	6	3	12	35	>80	>80	>80	>70	>70	17	36	8	34	19	4	
*Sambucus nigra/racemosa*fgmt	elder/red-berried elder	2	5	3	8	23	>40	>50	>100	>80	>50	15	27	10	>50	21	12	
Stachys sylvatica	hedge woundwort	-	-	-	-	1	3	1	2	1	1	-	-	-	1	-	-	
Urtica dioica	common nettle	-	-	-	-	-	2	1	1	2	-	-	-	-	1	-	-	
Bud scale	bud	3	-	-	-	-	-	-	-	1	-	-	1	1	-	-	1	
Terrestrial Molluscs																		
Carychium sp	thorn snails	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	
Carychium tridentatum	slender herald snail	6	-	20	16	11	11	-	6	1	-	-	-	-	2	-	-	
Cochlicopa sp	pillar snails	12	-	4	13	12	8	5	4	4	5	-	-	-	1	-	-	
Discus rotundatus	rounded snail	24	-	9	11	27	11	22	9	15	13	-	-	4	3	11	5	
Helix aspersa	garden snail	2	5	-	-	-	-	-	-	-	-	-	1	-	-	-	-	
Oxychilus sp	glass snails	-	-	-	-	-	-	4	1	3	5	-	-	-	-	-	-	
Oxychilus cellarius	garlic glass snail	4	-	-	9	-	3	-	-	-	-	-	-	-	4	-	-	
Oxychilus draparnaudi	dark bodied glass snail	4	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	
Pupilla muscorum	moss chrysalis snail	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	
Trichia sp	hairy snails	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	
Trichia hispida /plebia	hairy / bell snail	18	-	3	11	11	6	4	-	-	1	-	-	-	1	-	-	
Trichia striolata	strawberry snail	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	
*Truncatellina*sp	whorl snails	-	-	-	-	6	-	-	-	-	-	-	-	-	-	-	-	
Vallonia costata	costate vallonia	-	-	-	-	4	2	-	-	-	-	-	-	-	-	-	-	
Vallonia excentrica	excentric vallonia	6	-	5	14	18	6	2	1	3	2	-	1	1	7	8	-	
Vertigo angustior	narrow-mouthed whorl snail	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	
cf *Vertigo pusilla*	cf wall whorl snail	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	
Vitrea contracta	milky crystal snail	17	-	3	4	4	2	2	-	-	-	-	-	-	-	-	1	
Vitrea crystallina	crystal snail	-	-	-	-	-	2	-	-	-	1	-	-	-	-	-	-	
Vitrea sp	crystal snails	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	
Indet / juvenile fgmts	indeterminate	+++	+++	+++	+++	+++	++	++	++	++	++	+	-	+	+	++	+	
Freshwater Molluscs		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Anisus sp	ramshorn snails	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	

Valvata piscinalis	european stream valvata	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	
Marine Bivalves		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Mytilus edulis	blue/edible mussel	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	
*Ostrea edulis*fgmt	native/European flat oyster	-	-	+	-	-	++	+	++	+	++	++	+	+	-	+	-	
Marine Molluscs																		
Littorina littorea	common periwinkle	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	

Table 10:2 General Biological Analysis samples

Ymm DC 2012-001 5104 BS flot composn															
Context	**1031**	**1036**	**1037**	**1044**	**1049**	**1050**	**1051**	**1053**	**1054**	1055	1058	1061	1060	1065	1069
Sample	**006**	**010**	**012**	**016**	**023**	**025**	**027**	**029**	**031**	033	037	039	041	045	049
Description	**BS**	**BS**	**BS**	**BS**	**BS**	**BS**	**BS**	**BS**	**BS**	**BS**	**BS**	**BS**	**BS**	**BS**	**BS**
Flot Assessment (1-5 abundance)															
Volume of flot	10ml	11ml	50ml	8ml	10ml	45ml	12ml	3ml	30ml	10ml	21ml	10ml	10ml	50ml	10ml
Roots	+	+	+	+	+	+	+	+	-	+	+	+	-	-	+
Charcoal	+++	++	+++++	+++	++	++++	++++	++	++++	+++++	++++	+++	+++	+	+++
Bone	+	+	+	+	+	+	++	+	+	+	+	+	-	+	+
Molluscs /shell	++++	++++	++++	+++++	+++++	+++++	++++	+++	+++++	+++++	+++++	++++	+++++	+++++	++++
Seed	++	++	+++	+++	++	+++	++	++	+	++	++	++	++	-	+
Total Charcoal (F+R)	19ml	9ml	45ml	20ml	17ml	47ml	62ml	30ml	60ml	37ml	32ml	8ml	12ml	4ml	15ml
Charcoal >4mm	15ml	2ml	30ml	8ml	12ml	22ml	50ml	20ml	30ml	25ml	10ml	5ml	7ml	2ml	5ml
Charcoal <4mm	4ml	7ml	15ml	12ml	5ml	25ml	12ml	10ml	30ml	12ml	22ml	3ml	5ml	2ml	10ml

Table 10:3 Bulk Sieved samples composition

APPENDIX 11: SOIL MICROMORPHOLOGY REPORT BY S CARSON

SUMMARY OF CONCLUSIONS

Excavations at York Minster revealed a series of sloping deposits thought to relate to the destruction of the Roman principia and subsequent land use. One block soils sample was selected to be processed for micromorphological analysis to determine the nature of the deposits in relation to the decline of the Roman occupation and abandonment. Four discrete strata of events were identified within the sample examined, of which the upper two contexts are considered to relate to 'Dark Earth' soil formation processes accumulating over time from Romano period demolition rubble and associated debris. Within these events there has been related pedogenic (soil formation) processes including vegetation overgrowth and biological admixing. The lower two deposits more closely reflect rapidly dumped demolition material quickly sealed by successive deposition or dumping.

INTRODUCTION

A series of rubble deposits was revealed in the south facing section of the trench. Two groups of which (contexts 1055, 1071 and 1073) exhibited a marked downward slope from NE-SW. These may represent the in situ demolition of the remains of the principia and the reworking of stonework that has created a banked 'ramp' of debris against the principia wall. Context 1058 was described in the field as a thick layer of undifferentiated organic soil with some demolition rubble within it. It was thought to represent the abandonment of the principia area, and although no dating evidence was available it was attributed to the 5th-6th century. Consequently, soil micromorphology was utilised in order to gain a more comprehensive understanding of the nature of the deposits and to ascertain a basic chronology of events.

METHODOLOGY

A total of 6 block samples were recovered from the South facing section of the trench. The location of the samples was selected in accordance with specific research questions associated with the complex stratigraphy of sloping deposits. Due to the friable nature of the deposits and volume of large inclusions of rocks and bone, it was not possible to use kubiena tins as this would disturb the microstratigraphy. The blocks were cut out by hand and tightly wrapped in paper once extracted. They were then stored and air dried under suitable conditions before processing.

Once dried, one block sample was selected for processing and analysis. Sample number 052 was chosen for processing to potentially answer the most salient questions regarding the sequence of rubble deposits. The sample was sent to Earthslides, Cambridge where it

was manufactured following the standard methods of Murphy (1986). The sample was dried again to remove any further traces of moisture and was resin impregnated under a vacuum and then cured. After this the block was sliced, bonded to glass slides and then lapped to a thickness of 30µm. The slides were then cleaned, polished and coverslipped. Slides were analysed using a petrological microscope at magnifications of x20 and x400 in plane polarised light (PPL) and cross polarised light. Descriptions follow Bullock et al. (1985), Courty et al (1989) and Stoops (1999). Identification of rock and mineral constituents was achieved with reference to MacKenzie & Adams (1994). Descriptions of the individual units are presented in Table 1. and thin section units shown in Figure 1.

RESULTS

CONTEXT 1055

The deposit is described as a silty clay loam composed of mineragenic coarse material in an organo-mineral fine material matrix and is unsorted. It has a complex packing microstructure and the coarse/fine material distribution is close porphyric, ie with the coarse material embedded in a matrix of finer material. The lower boundary was noted as being diffuse irregular, consistent with being a pedological (soil) boundary that has undergone mixing through soil formation processes, whether by roots, earthworms or other biological means.

The inclusions are unoriented (non-directional) with a random unreferred distribution and homogenous in appearance. They do not appear to be arranged in any particular alignment related to any features. The organic inclusions include frequent fragments of bone and shell, with particularly abundant small charcoal fragments. Some small fragments of oolitic limestone and micaceous sandstone of a sub angular form were observed and frequent fragments of a crushed mortar type material were distributed throughout the deposit.

The context was similar in appearance to the underlying horizon but has a more compacted microstructure, the mineral inclusions are smaller with fewer rock fragments and more charcoal fragments, although these are fairly small. Some root channels were present with remains of degraded plant material still visible, and the context also contains a large amount of amorphous organic material that is indeterminate. Although some evidence of post depositional alteration was noted by root activity, the deposit did not display any other evidence of bioturbation or earthworm activity. The diffuse boundary is probably due to mixing of the two deposits caused by roots.

CONTEXT 1071

The context is described as sandy clay composed of mineragenic coarse material in an organo-mineral fine material matrix and has bimodal sorting which is poorly sorted sand in a

well sorted silt matrix. It has a complex packing microstructure with some channels and the coarse/fine material distribution is close porphyric, with the coarse material embedded in a matrix of finer material. The lower boundary was noted as being clear wavy consistent with being an anthropic (anthropogenic) boundary.

The inclusions are unoriented with a random unreferred distribution and are homogenous in appearance. They do not appear to be arranged in any particular alignment in relation to any features. The deposit contains similar components as the deposit directly above, but has fewer small charcoal fragments and with one large rounded fragment observed. The rock and mineral content is also similar but has a higher abundance of quartz and is of a larger size, with some fragments of mica within the matrix. The sample contained more roots and further evidence of this can be seen with the presence of channels, some containing remnants of organic material.

No evidence of clay or silt infilling of the root channels was observed, suggesting that the deposit was fairly rapidly sealed by another deposit, although it was exposed long enough for vegetation overgrowth to occur. The rock fragments and the mineral do not appear weathered or degraded and so had not been exposed to the elements for any significant length of time.

CONTEXT 1073

The context is described as a silty clay loam composed of mineragenic coarse material in an organo-mineral fine material matrix and is unsorted. It has a complex packing microstructure and the coarse/fine material distribution is close porphyric, with the coarse material embedded in a matrix of finer material. The lower boundary was noted as being diffuse irregular consistent with being a pedological (soil) boundary.

The inclusions were orientated parallel to the gradient of slope, with a random distribution of components giving a mixed appearance. The organic inclusions include frequent fragments of bone, with some small fragments of charcoal and one large angular oak (Quercus) fragment , the latter identified by the wide rays associated with oak internal anatomy. Some small fragments of oolitic limestone and micaceous sandstone of a sub angular form were observed and frequent fragments of a crushed mortar type material were distributed throughout the deposit.

The deposit was very yellow in colour compared to the other contexts present. This may be due to a higher abundance of the mortar type material within this sloping context. Some of the oolitic limestone fragments noted were degraded and/or weathered, with fine material or

clay infillings and coatings within the cracks. Other fragments were fractured. This may suggest that the material was exposed to weathering by the elements before deposition or is re-deposited rather than a gradual accumulation of materials. Most of the larger voids were not filled with any translocated clays or silts so may possibly indicate a rapid sealing of the deposit, and no evidence of roots or root channels were noted or any other forms of bioturbation. An abundance of bone with some fragments of calcined bone may corroborate the suggestion that the bulk of the material may have been accumulated elsewhere and mixed with other biological components prior to be being re deposited.

CONTEXT 1058

The context is described as loamy sand composed of mineragenic coarse material in an organo-mineral fine material matrix and is unsorted. It has a complex packing microstructure with voids and the coarse/fine material distribution is close porphyric, with the coarse material embedded in a matrix of finer material. The deposit does not have a lower boundary description as this exceeds the limit of the thin section.

Some of the inclusions were in parallel orientation to a large stone inclusion embedded within the rubble deposit, with a random distribution of materials that were mixed in appearance. The organic inclusions included frequent fragments of charcoal, bone and amorphous organic material. The deposit appeared to contain an abundance of oolitic limestone and large fragments of a crushed mortar type material. The mortar in this deposit differs from the others because some of the fragments contained ceramic building material (CBM) which could have been re used as an aggregate.

The overall appearance of the unit suggests a rapid deposition of materials, evident from the presence of many large voids with no infilling of finer materials, and then rapidly sealed by the overlying deposit. There were no post depositional alterations noted and no evidence for biological activity or pedogenesis (soil formation).

DISCUSSION

The sample was originally thought to contain three different deposits consisting of contexts 1055, 1071 and 1058 as seen on the section drawing. However, analysis of the thin section has revealed that the deposit labelled as 1071 was composed of two different deposits and was not one unit. This new lower unit has been labelled as context 1073, and is different in terms of the overall composition and inclusions from the context above it. It contains more mortar and bone but has no roots or biological channels.

Mortar and bone were present in all of the deposits, mainly within the lower levels. The bone could be residual from mortar, highlighting previous incorporation as an aggregate. This technique seems to have been relatively common since at least the medieval period , with the bone added during lime production to improve the quality of the mortar (C. Francoz pers. comm.). Deposit 1058 also contained mortar with incorporated CBM fragments suggesting structural demolition. Contexts 1073 and 1058 are thought to reflect the dumping of structural materials and debris and the large stone and charcoal inclusions support this. The large fragment of oak (Quercus) charcoal could have derived from the destruction of a building and the burning of structural timbers. Oak has commonly been used as a building material for large or high status buildings due to the strength of the trunks that are easily cleaved into timbers (Gale & Cutler 2000).

One notable aspect of these deposits is that they did not contain significant traces of earthworm channels or other evidence of post depositional biological activity. Evidence of plant remains only occurred in the top two deposits of the micromorphology sample, and only a few root channels were present that could possibly have formed under the influence of vegetation growth. The sloping deposits suggest a rapid sequence of deposition or accumulation of deposits that have been sealed very quickly. There were few indicators of alteration or weathering, and those that did were only slightly weathered. The lack or scarcity of voids or channels caused by biological processes and the undifferentiated fabric of inclusions suggest that the material had undergone only slight weathering and/or pedogenesis (turning to soil) since the time of deposition. These attributes are a close parallel to other findings from thin section analysis of similar contexts in York described as ‘dark earth’ deposits. Samples analysed from Fetter Lane, York displayed similar evidence for the lack of pedogenic processes to have occurred and the contexts were described as being deposited, re deposited or possibly dumped on top of the Roman contexts and quickly sealed with subsequent deposits (Usai 1999).

The term ‘dark earth’ could be used to describe the upper two deposits of the thin section. ‘Dark Earth’ is the sequence of poorly stratified archaeological deposits that occurs between Roman levels and overlying medieval and post-medieval archaeology. Various recent studies have established that dark earth is formed pedologically from derelict Roman buildings, their debris, and the deposits derived from their most recent land use (MacPhail 2003). This could apply to contexts 1055 and 1071 within the thin section as they both appear to contain some form of rubble and debris, and some evidence of pedogenic processes. The lower two deposits more closely reflect dumped material quickly sealed by successive deposition or dumping.

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York Minster MM Sample 52				
Context	**1055**	**1071**	**1073**	**1058**
Description				
Lower boundary	diffuse irregular	clear-wavy	clear wavy	limit of thin section
Thickness (mm)	10mm	5mm	<5mm	-
Particle size	silty clay loam	sandy clay	sandy clay loam	loamy sand
Coarse/fine ratio (%)	40/60	30/70	40/60	70/30
Sorting	unsorted	bimodal	unsorted	unsorted
Fine material	organo-mineral	organo-mineral	organo-mineral	organo-mineral
Birefringence fabric	undifferentiated b-fabric	undifferentiated b-fabric	undifferentiated b-fabric	undifferentiated b-fabric
Related distribution	close porphyric	close porphyric	close porphyric	close porphyric
Microstructure	complex packing	complex packing + channels	complex packing + vughs	complex packing + vughs
Inclusions orientation	random	random	parallel	parallel
Inclusions distribution	unreferred	unreferred	random	random
Organic inclusions	**%, size, form**	**%, size, form**	**%, size, form**	**%, size, form**
Charcoal	10%, 0-2mm, sub angular,	2%, 0-2mm, sub angular	2%, 0-2mm, sub angular	5%, <5mm, sub angular
Charcoal large fgmt.	-	1 fgmt., 10mm, rounded	1fgmt., 30mm, angular	-
Bone	<5%, 0-3mm, rounded-sub rounded	1%, 0-1mm, angular	10%, 0-2mm, angular	5%, 0-3mm, angular
Calcined bone	-	-	1%, 0-3mm, angular	1%, 0-3mm, angular
Shell	<5%, 0-2mm, sub rounded	-	-	-
Amorphous organic material	15%, 0-5mm, amorphous	10%, 0-2mm, amorphous	1%, 0-2mm, amorphous	5%, 0-10mm, amorphous
Roots	1%, 0-2mm,	5%, 0-2mm,	-	-
Mineral inclusions	**%, size, form**	**%, size, form**	**%, size, form**	**%, size, form**
Microline	1%, 0-1mm, sub angular	-	-	1%, 0-1mm, sub angular
Plagioclase	2%, 0-1mm, angular	2%, 0-1mm, angular	1%, 0-1mm, angular	-
Quartz	20%, 0-0.5mm, rounded-angular	30%, 0-2mm, rounded-angular	20%, 0-2mm, sub angular	50%, 0-3mm, rounded-angular
Calcite	<1%, 0-1mm, angular	<1%, 0-1mm, angular	-	<5%, 0-1mm, angular
Mica	-	1%,0-1mm, angular	-	-
Rock inclusions	**%, size, form**	**%, size, form**	**%, size, form**	**%, size, form**
Oolitic limestone	2%, 0-3mm, sub angular	2%, 0-3mm, sub angular	10%, 0-5mm, sub angular	20%, 0-50mm, sub angular
Limestone	-	<5%, 0-3mm, sub angular	-	<5%, 0-5mm, sub angular
Micaceous sandstone	<1%, 0-2mm, sub angular	<1%, 0-2mm, sub angular	<5%, 0-5mm, sub angular	<5%, 0-5mm, sub rounded
Other inclusions	**%, size, form**	**%, size, form**	**%, size, form**	**%, size, form**
Mortar	5%, 0-5mm, angular	<5%, 0-2mm, sub angular	10%, 0-10mm, sub angular	20%, 0-10mm, sub angular
CBM	2%, 0-2mm, angular	1%, 0-4mm, sub rounded	2%, 0-10mm, angular	2%, 0-2mm, angular

Table 11:1 Micromorphological analysis results

Plate 38 Prepared slide of MM sample 052