ARCHAEOLOGICAL WATCHING BRIEF AT ALL SAINT'S BUILDING, WORCESTER COLLEGE OF TECHNOLOGY, WORCESTER

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INVESTOR IN PEOPLE

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Part 1 Project summary

An archaeological brief was undertaken at All Saint's Building, Worcester College of Technology (NGR SO 8485 5480). It was undertaken on behalf of Worcester College of Technology, who were constructing a new entrance and fire escape with associated services, for which a planning application has been submitted. The project aimed to determine if any significant archaeology was present and if so to indicate its location, date and nature.

The results of the watching brief concluded that although there has been considerable disturbance in the area, mainly from the construction of the present All Saint's Building in the early 1960s, though there were still a number of important archaeological features from the Roman through to the post-medieval periods, that were well preserved below the surface.

Possible prehistoric

Although no datable artefacts were recovered that indicated prehistoric activity, a single feature, possibly a ditch aligned north to south, could be of prehistoric date due to its stratigraphic relationships. This feature had been truncated to the west by the large 1st–2nd century ditch, implying either a prehistoric or very early Roman date.

Roman

A large ditch, aligned north to south, was recorded on the western edge of the excavation. The ditch contained pottery dated to the early Roman period. There were signs of the ditch having been re-cut or truncated in the 2nd century. The ditch did not appear to be part of the original main Roman defences, located towards the site of the cathedral, though its early date, and location suggests an ditch enclosing an area of land to the north of the first phase of activity in Roman Worcester.

Medieval

No features of medieval date were noted during the watching brief; however, a quantity of heavily abraded medieval pottery was recovered from later contexts. Though the presence of medieval material indicates occupation of this area during this period, though no medieval features were observed. Any existing medieval features would appear to have been heavily truncated and/or completely destroyed by the later use of this area as a graveyard for St. Andrew's Church.

Post-medieval

Post-medieval deposits observed during the watching brief related primarily to the use of the St. Andrew's graveyard. The remains of 24 articulated individuals were recovered along with large quantity of disarticulated remains; the associated datable artefacts indicated a 16th–19th century date range. Overall the condition of the articulated remains was generally fair to good. The human burials consisted of both male and female burials. The age ranges consisted of young and old, though with a slight bias to the older adult.

To the west of the site three brick walls were observed, relating to the graveyard wall. In addition, a circular brick culvert was recorded at the far eastern end of the site, running in an east to west direction. The brick walls are likely to have marked the northern extent of the graveyard.

Modern

Across the site evidence for modern activity was noted, these included modern walls, construction cuts and services, all associated with the present college building. None of these features are of archaeological significance.

In summary, evidence observed during the watching brief has concluded that an extensive, well-preserved early-Roman ditch is located to the west of the site, with the possibility of even earlier remains. The presence of this probable late 1st century AD ditch in an area where evidence of the early Roman town has been very heavily truncated is of considerable significance for the understanding of the development of the early Roman settlement. In addition the evidence for the human burials has helped with the understanding of post-medieval burial practices and augmented the contemporary documentary evidence.

Part 2 Detailed report

1. Background

1.1 Reasons for the project

An archaeological watching brief was undertaken at the All Saint's Building, Worcester College of Technology, (NGR SO 8485 5480), Worcester (Fig 1), on behalf of the College. The client was constructing a new entrance, fire escape and a new water pipe. The client has submitted a planning application to Worcester City Council (reference XP05D0194), who considered that a site of archaeological interest might be affected (WCM 96055).

1.2 Project parameters

The project conforms to the *Standard and guidance for an archaeological watching brief* (IFA 1999).

The project also conforms to a brief prepared by WCC (2005) and for which a project proposal (including detailed specification) was produced (HEAS 2005).

1.3 Aims

The aims of the archaeological watching brief were to locate any significant archaeological deposits and record them within the perameters set by the brief.

In particular, the brief suggested the following research questions:

- The nature of Roman activity
- The nature of Anglo-Saxon activity within Waerferth's *haga*
- Burial in medieval churchyards
- The post-medieval burial ground

2. Methods

2.1 Documentary search

Prior to fieldwork commencing a search was made of the Historic Environment Record (HER) Sites and Monuments Record (SMR). In addition the following sources were also consulted:

Cartographic sources

- 1888, 1st edition, Ordnance Survey, scale 1:500
- 1904, Ordnance Survey, scale 1:2500
- 1928, Ordnance Survey, scale 1:2500
- 1940, Ordnance Survey, scale 1:2500

Aerial photographs

- Areo Pictorial Ltd, Worcester 21st August 1961: ref A94875

Documentary sources

- County histories (VCH IV, 1924).
- Site archives (Dalwood 2004, Gelling 1958, Goad 2004, Vaughan 2004).

2.2 Fieldwork methodology

2.2.1 Fieldwork strategy

A detailed specification has been prepared by the Service (HEAS 2005). Fieldwork was undertaken between 14th June and 8th August 2005. The site reference number and site code is WCM 101369.

Observations were undertaken during, and after machine excavation of an area to the south of the Technical College, for the insertion of a new fire escape and associated services.

Two interlinking trenches (Trench 1 to the west and Trench 2 to the east) were observed and archaeologically recorded, amounting to just over 50m in length. The location of the trenches is indicated in Figure 2.

Deposits considered not to be significant were removed using a 360º tracked mini-excavator, employing both toothed and toothless bucket under archaeological supervision. Subsequent excavation was undertaken by hand. Clean surfaces were inspected and selected deposits were excavated to retrieve artefactual material and to determine their nature. Deposits were recorded according to standard Service practice (CAS 1995).

2.2.2 Structural analysis

All fieldwork records were checked and cross-referenced. Analysis was effected through a combination of structural, artefactual and ecofactual evidence, allied to the information derived from other sources.

2.3 Artefact methodology by Alan Jacobs

2.3.1 Artefact recovery policy

All artefacts from the area of salvage recording were retrieved by hand and retained in accordance with the service manual (CAS 1995 as amended).

2.3.2 Method of analysis

Finds from a selected sample of the material recovered were examined and a primary record was made on a Microsoft Access 2000 database. Artefacts were identified, quantified and dated and a *terminus post quem* date produced for each stratified context. The date was used for determining the broad date of phases defined for the site. All information was recorded on *pro forma* sheets.

Pottery was examined under x20 magnification and recorded by fabric type and form according to the fabric reference series maintained by the Service (Hurst 1994).

2.4 Environmental archaeology methodology, by Elizabeth Pearson

2.4.1 Sampling policy

The environmental sampling strategy conformed to standard Service practice (CAS 1995). Large animal bone was hand-collected during excavation. Samples of 6 to 8 litres were taken from three contexts (106, 108 and 110), a large ditch of early Roman date.

2.4.2 Method of analysis

The samples were processed by flotation followed by wet-sieving using a Siraf tank. The flot was collected on a 300µm sieve and the residue retained on a 1mm mesh. This allows for the recovery of items such as small animal bones, molluscs and seeds.

The residues were fully sorted by eye and the abundance of each category of environmental remains estimated. The flots were scanned for assessment purposes using a low power EMT stereo light microscope and the abundance of each category of environmental remains estimated. Two flots were subsequently selected for full analysis of charred plant remains (Contexts 106 and 110). As these flots were relatively rich in charred plant remains, a fraction of these flots were fully sorted, and plant remains identified using modern reference collections maintained by the Service, and seed identification manual (Beijerinck 1947). Nomenclature for the plant remains follows the Flora of the British Isles, 3rd edition (Stace 2001).

A magnet was also used to test for the presence of hammerscale.

2.5 The methods in retrospect

The methods adopted allow a high degree of confidence that the aims of the project have been achieved.

3. Topographical and archaeological context

The development area lies on level ground to the south of the Worcester College of Technology All Saints Building and to the north of St Andrew's Church (Fig 1). The level ground is located at the top of a steep escarpment leading down to the River Severn to the west. The site lies on well-drained river terrace gravels (Mackney *et al* 1983) overlying Mercian Mudstone (Dalwood 2004).

The site lies within the known extent of the area occupied by the Roman town and the area is also thought to have been within a late Anglo-Saxon enclosure or *haga*.

No archaeological fieldwork is known to have taken place within the development area. However, the site is 60m from the multi-period excavations at Deansway (Dalwood *et al* 2004). There have also been other smaller interventions in the vicinity (ie Vaughan 2004, Goad 2004, Gelling 1958). A watching brief undertaken during the construction of the All Saints Building in 1969 (phase III of the Technical College building programme) revealed evidence for early Roman, medieval and post-medieval activity (Sandon 1969).

Excavations were undertaken in the late 1950s between Little Fish Street and Warmstry Slip (Fig 8), prior to the construction of the Worcester College of Technology. The investigations involved two test pits within the footprint of the St Andrew's Building, and a trench aligned north to south. Modern disturbance was found to a depth of *c* 3.05m in the test pits. The north side of a ditch was identified in both test pits. In addition the second test pit revealed part of a 'rough causeway' of brushwood laid across the silted ditch infill. The full profile of the ditch was exposed within the trench. The primary silting was light grey silt with slips of gravely

material. The principal fill was dark grey silt sealed by a brown organic soil, in turn sealed by material containing a medieval green-glazed pottery sherd (Gelling 1958). A later trench exposed the complete profile of the ditch, some 20m wide and 2m deep. The ditch lacked the steep-sided V shaped profile of a military ditch, though an interpretation as a drainage channel may be discounted as the ditch appears to turn to the south instead of running straight down to the river (*ibid*).

To the north of the ditch the ground had been disturbed down to the level of the natural. To the south the ditch had been cut through a mixed layer of gravel and silt. Silt and a thick layer of discoloured clay and iron slag sealed the ditch. Overlying this lay a clay sand, terminating at a large lump of iron slag, in turn sealed by cobbles with a hearth above containing a probable 3rd century Roman coin. The substantial slag-bearing layer was considered to represent a bank or rampart contemporary with the ditch, of probable late Roman date (Gelling 1958), this late date was also substantiated by the discovery of a late, possibly 4th century, pottery sherd from the main silting of the central part of the ditch.

All that remains of St. Andrew's Church today is the mid 15th century tower crowned by a spire, built in 1751 (Baker 1980). The church is first recorded in the mid 11th century AD, though its origins are likely to pre-date this. The church occupied an imposing site right on the edge of the gravel terrace, overlooking Copenhagen Street and the quay at the bottom of the slope to the west (Barker and Holt 2004). A detailed history and description of the original church and the memorials can be found in Buchanan-Dunlop (1937 and 1950). The churchyard was not formally consecrated until 1635 (VCH IV 1924) but it is unlikely to have been newly created at this time. There is also medieval documentary evidence for a processional way around the church (*ibid*). The development area is on the northern edge of the churchyard, marked by a wall on the 1888 Ordnance Survey map, with what appears to be steps and a gateway leading down to Hare's Lane This is also visible in aerial photographs taken prior to the construction of the All Saint's Building (Areo Pictorial Ltd, Worcester 21st August 1961: ref A94875).

4. Results

4.1 Structural analysis

The trenches and features recorded are shown in Figs 2 – 7 and Plates 1 - 17. The results of the structural analysis are presented in Appendix 3.

4.1.1 Natural deposits

Natural deposits were only reached towards the base of the deep excavations for the fire escape at the south-western end of Trench 1. The underlying natural deposits consisted of loose light orangey brown sandy gravels.

4.1.2 Prehistoric/early Roman deposits

Although no deposits could be absolutely determined to be of prehistoric date, a single feature (142: Fig 5: Plate 4) within Trench 1, could be conjectured a probable pre-Roman date on stratigraphic grounds.

Feature 142 appeared to consist of a concave linear cut aligned north to south. This cut contained two fills (140 and 141), and these fills had been truncated to the west by another substantial linear cut (114), and overlain by a number of later soil layers.

4.1.3 **Roman deposits**

Towards the western end of Trench 1, a substantial ditch was observed. The ditch consisted of a large cut (114), running in a north to south direction, containing two fills (112, 113). Recovered material form these fills indicated a 1st–early 2nd century date. Overlying these two fills was a sequence of five distinct buried soil layers (126 – 129 and 139: Fig 5: Plate 4). These layers had in turn had been truncated by another large cut aligned north to south (111: Fig 5: Plate 3). Material recovered from the deposits within the later linear cut 111 also indicated an 1st–early 2nd century AD date. The five soil layers contained no datable finds, however their stratigraphical relationships with associated deposits would also suggests an early Roman date.

Residual Roman material was recovered from the soils associated with later post-medieval burial activity.

4.1.4 **Medieval deposits**

Residual material was recovered from later features that were of a post-medieval date, though no observed features could be securely dated to the medieval period.

4.1.5 **Post-medieval deposits**

Post-medieval deposits observed during the watching brief related solely to the use of the St Andrew's graveyard. The remains of 24 articulated individuals were recovered along with large quantity of disarticulated remains; the associated datable artefacts indicated a 16th–19th century date range. Overall the condition of the articulated remains was generally fair to good (see Appendix 4 for the detailed report). The human burials consisted of both male and female burials. The age ranges consisted of young and old, though with a slight bias to the older adult (*ibid*).

In Trench 1 three brick walls (120, 147, 158) were observed, walls 120 and 147 aligned in a roughly north to south direction and wall 158 aligned east to west. The bricks were bonded by a firm pinkish yellow mortar. Wall 120 was only partially exposed in the western section and wall 158 was only observed in plan. Wall 147 was clearly exposed and was 1.05m in height and contained 9 courses of bricks. In addition, a circular brick culvert, *c* 0.50m diameter was noted in the far eastern extent of the watching brief area, running in an east to west direction extending under Deansway. Also to the eastern end of the service trench a small east to west aligned post-medieval brick wall was observed (Fig 4).

4.1.6 **Modern deposits**

Throughout the extent of the watching brief a number of modern features were noted. These included services, modern walls, concrete footings, construction cuts and the make-up for the present surfaces.

4.2 Artefact analysis, by Alan Jacobs

The artefactual assemblage recovered is summarised in Appendix 1: Tables 1-6

All artefacts from the area of salvage recording were retrieved by hand and retained in accordance with the service manual (CAS 1995 as amended). Finds from a selected sample of the material recovered were examined and a primary record was made on a Microsoft Access 2000 database. Artefacts were sampled from all contexts of a potential Roman date and from selected grave fills, these artefacts were identified, quantified and dated and a *terminus post quem* date produced for each stratified context.

Pottery was examined under x20 magnification and recorded by fabric type and form according to the fabric reference series maintained by the Worcestershire Archaeological Service (Hurst and Rees 1992).

The sampled pottery assemblage retrieved from the excavated area consisted of 190 sherds of pottery weighing 2.827kg, and in addition fragments of tile, tobacco pipe, bone, glass, iron nails, kiln furniture, mortar and mollusc were recovered. The group came from 16 stratified contexts that were sampled and could be dated from the Roman period onwards (see Table 1). The level of preservation was generally fair with the majority of sherds displaying only moderate levels of abrasion.

4.2.1 **Discussion of the pottery**

All recovered sherds have been grouped and quantified according to fabric type (see Table 1). Seven diagnostic form sherds were present, and the other sherds were datable by fabric type to their general period or production span. The discussion below is a summary of the finds and associated location or contexts by period. Where possible, *terminus post quem* dates have been allocated and the importance of individual finds commented upon as necessary.

Roman

The Roman pottery consisted of 22% of the assemblage by count and 40% by weight, and is quantified in Table 2. A total of five Roman contexts contained pottery, and a limited range of forms and fabrics were represented. The Roman pottery fabrics are dominated by Severn Valley ware (fabrics 12, 12.1 and 12.2), which was recovered from all Roman contexts (105, 107, 108, 110 and 112), and where definable consisted of 1st century forms.

Examples recovered in Severn Valley ware (fabric 12) included a small butt beaker (Davies et al 1994; context 107) of Neronian-Flavian date, an unusual find in the context of Worcester (fig 9 no5), and a carinated beaker with a double beaded rim (Bryant and Evans 2004, 249, fig 155 no 4). These forms are a continuation of an Iron Age tradition, generally dated to the 1st-2nd centuries (fig 9 no 2). An early form of large narrow-mouthed jar was also present (fabric 12.2; Fig 9 No 1) with a parallel from Alcester (Cracknell and Evans 1994, 65, fig 24 no 0.84; context 107), this specific form is not clearly dated in Websters seminal work (1976). The form of a small grog tempered ware (fabric 16.2) jar was present (fig 9 no 3) in association with a Dressel 20 amphora rim (fabric 42.1; fig 9 No 4), both clearly of 1st century date. The only Malvernian form consisted of an unusual slab-built vessel (fabric 3; fig 9 no 6), from the lowest context within the ditch (112), which is unusual but has been recovered from Deansway (Bryant and Evans 2004), Droitwich (Hurst and Woodiwiss 1992) and at Manor Farm Powick (Jacobs 2005 forthcoming). This large vessel would have been rectangular in form with a thick rim, and is most likely of 1st century date as at Droitwich.

The only specifically later fabrics recovered were all residual. The Roman pottery recovered from previous excavations in the vicinity of the Worcester College of Technology (Jacobs forthcoming) are unusual in that they are of an early date, with a very distinct predominance of the organic Severn Valley ware (fabric 12.2), and range of 1st–early 2nd century forms, in both oxidised and reduced fabrics. Forms represented include both large storage jars and everted rim vessels decorated with barbotine and rusticated decoration, and unusual glass forms. This would indicate the early nature of activity along this area of the riverfront, the evidence for which has been almost entirely removed by the construction of the Worcester College of Technology buildings and its car parks.

Medieval

The medieval pottery consisted of 12% of the assemblage by count and 6% by weight, and is quantified in Table 3. No definably medieval contexts were excavated, all material being residual in later contexts. Only a limited range of forms and fabrics were represented, with only two forms, those of type 3 cooking pots (Bryant 2004, 282, fig 178 nos 3–13; contexts

172 and 176) being of 12th–14th century date. Most of the medieval material consisted of small, abraded fragments of later Malvernian ware. This assemblage is of relatively little significance beyond defining the lack of any surviving medieval contexts or Saxo-Norman activity.

Post-medieval

The post-medieval pottery consisted of 62% of the assemblage by count and 52% by weight, and is quantified in Table 4. A total of six post-medieval contexts contained pottery, a limited range of forms and fabrics being represented. The post-medieval pottery fabrics are dominated by red sandy ware (fabrics 78), which was recovered from all post-medieval contexts (192, 197, 218, 231, 232 and 244). A number of forms of large storage jars were recovered as well as smaller drinking vessels (192, 231 and 232) and a number of platters or dishes in post-medieval buff ware (fabric 91; context 192 and 294). Small amounts of other fabrics are represented in the assemblage including North Devon Gravel Tempered ware (fabric 75) consisting of an externally burnt sherd with a distinct internal glaze, Midlands Yellow ware drinking vessels (context 192) and examples of 18th century stonewares. The broad range of fabrics parallels other urban sites from Worcester with a number of flat and hollow ware forms. The nature of the mixing of late 16th–18th century material indicates the nature of re-deposition within the graveyard, which was in use throughout the post-medieval period.

Modern

The modern pottery consisted of 4% of the assemblage by count and 2% by weight, and is quantified in Table 5. A total of four modern contexts were excavated, and a limited range of forms and fabrics being represented. These were dominated by early Victorian pottery forms (172 and 176), which included examples of early-mid 19th century Mocha ware (contexts 172 and 189). The lack of material could well be an indication of depositional changes and the virtual abandonment of the graveyard by the mid 19th century.

Other finds

These consisted primarily of mammal bone, primarily cattle (contexts 107, 176, 189, 218 and 244), from Roman, post-medieval and modern contexts. These were primarily in the form of abraded and fragmentary cattle bone in Roman context (107). A number of un-diagnostic fragments of tobacco pipe were recovered (contexts 172, 176, 184, 192 and 244), dating to the 17th–19th century. A number of fragments of post-medieval and modern tile were also recovered (contexts 176, 184, 189 and 197); glass, iron nails, kiln furniture, mortar and mollusc were recovered from modern contexts.

4.3 Environmental analysis, by Liz Pearson

The environmental evidence recovered is summarised in Tables 7 to 10.

4.4 Hand-retrieved material

A total of 419g 937 fragments of animal bone were hand-collected during excavation (Table 10). As this was a small assemblage of bone, this was not considered to merit full analysis.

4.5 Macrofossil remains from bulk samples

An initial assessment of the material recovered from three fills of a large early Roman ditch (114) demonstrated the presence of a small quantity of large mammal, small mammal and fish bone, and in contexts 106 and 110 charred plant remains were abundant (Table 8). Contexts 106 and 110 were therefore selected for more detailed analysis of the charred plant remains (Table 9).

Charred plant remains from Context 110, the primary fill of ditch 114, predominantly consisted of small weed seeds and small grass grains, with occasional cereal grains. The grass grains were dominated by meadow-grass (*Poa* sp) and rye-grass/fescue (*Lolium/Festuca* sp) and were associated with similar sized weeds seeds. The latter included, for example, sedges (*Carex* spp), spike-rush (*Eleocharis* sp) which would have grown in wet or damp areas, common nettle (*Urtica dioica*), sheep's sorrel *(Rumex acetosella),* docks *(Rumex sp),* medick *(Medicago sp),* clover *(Trifolium* sp) and buttercup (*Ranunculus acris/repens/bulbosus*). Cereal grains were a small component of the assemblage and included wheat (*Triticum* sp), wheat/rye (*Triticum/Secale* sp) and a free-threshing wheat (*Triticu*m sp free-*threshing).* This type of assemblage may be the light chaff component which is the waste from winnowing during the processing of glume wheat crops, which is most likely to have been stored for fodder and fuel (Hillman 1981). However, other types of chaff which would be expected in this type of waste, such as awns or lemmas, were not present. An alternative explanation is that as many of the grasses and weeds are common in meadowland or rough grassland, that this is collected grassy material (possibly hay) which has been used as tinder for a fire, or even that it derives from a fire burnt on grassland *in situ*.

The assemblage of charred plant remains from context 106, a secondary fill of ditch 114, was different in composition. The assemblage was dominated by the chaff of spelt wheat (glume bases, spikelet forks and rachis nodes) while grass grains such as brome grass (*Bromus* sp) and other unidentified grasses were also common. A smaller number of cereal grains were present, which included spelt (*Triticum spelta*) and emmer/spelt wheat (*Triticum dicoccum/spelta*), which is consistent with the chaff waste recorded. Detached coleoptiles (embryo shoots) were also present, and were almost as numerous as the cereal grains. Occasional associated weed seeds included, for example, sheep's sorrel (*Rumex acetosella*), scentless mayweed (*Tripleurospermum inodorum*) nettle (*Urtica dioica*) and spike-rush (*Eleocharis* sp). This type of waste may derive from a corndrier or from a chaff store used for animal feed or for fuel for fires (Hillman 1981). The detached coleoptiles may indicate that the crop was used for malting, or that it had sprouted when damp.

4.6 Overview of environmental evidence

These remains demonstrate successive phases of disposal of charred cereal or grassy waste into a large ditch, which may have been a boundary of the northern part of the early Roman town.

In the case of the primary fill (110), the origin of the burnt waste is uncertain. It appears to be more similar to burnt grassy material than cereal crop waste. It is similar to an assemblage recorded by the author from a context associated with a late Iron Age pyre site at Walton in Warwickshire (Pearson 2005) and a cremation at Harbury, Warwickshire (Monckton, in Palmer forthcoming). The similarity is of interest as large rim fragments of early Roman (rusticated jars), which are commonly used for cremation beakers, have been recorded from excavations in the vicinity of the All Saints Building during the 1950s (Alan Jacobs pers comm.). Burnt bone was also mentioned from the 1950s excavations and a cremation in an urn has been recorded from Deansway nearby (Osborne 2004). None of the bone from context 110, however, looked like cremated human bone. It is possible that the above evidence is consistent with the area of All Saints Church having been used as a cremation ground during the early Roman period, and that the charred plant remains represent pyre debris.

The quantity and density of waste, in the secondary fill of ditch is most likely to derive from an agricultural, rather than domestic source. Crop waste in this context may have been accidentally charred during processing in a corndrier (perhaps during malting,) and disposed of in the ditch, or may derive from burnt chaff and fodder stores. This is comparable to that recovered from two pits of Roman date at Blackfriars in Worcester (Moffett 1987), whereas at Deansway, Worcester (Moffett 2004), the pattern of disposal of cereal crop waste was more consistent with domestic activity. This area of All Saints Church is on the margins of the Roman town and would have been essentially rural in character.

5. Synthesis

5.1 Possible prehistoric

Although no datable artefacts were recovered that indicated prehistoric activity, a single feature, possibly a ditch (142) aligned north to south, could be inferred a prehistoric date due to its stratigraphic relationships. This feature had been truncated to the west by the large 1st–2nd century AD ditch, implying a *terminus post quem* of either a prehistoric or very early Roman date.

5.2 Roman

The excavation of the ground for the new fire escape to the western end of Trench 1, on the south-eastern side of the Technical College, revealed a substantial ditch, running in an east to west direction. Though the ditch had been heavily truncated by the construction of the All Saints Building in the late 1960s there was still sufficient remains to establish form and dating. The ditch was fully exposed on the eastern side and base, though the limit of excavation did not allow for the complete exposure of the western edge. Though it was evident that here a considerable amount of truncation had also taken place with the insertion of a post-medieval brick wall and during the construction of the present college building.

The ditch appeared to be at least 2.10m and 1.45m deep. The top of the ditch at 21.40 AOD. The ditch was clearly cut into the underlying natural deposits. The earliest phase of this ditch was indicated by a V shaped cut (114), with a slightly stepped base. This ditch contained two fills (113, 112). The primary fill (113) likely to have derived from the almost immediate erosion of the ditch sides soon after establishment, the secondary fill (112) consisted of similar material and charcoal. Though the primary fill contained no datable artefacts, the secondary fill contained three pottery sherds all dated to the 1st century AD.

After the infilling of this ditch a series of soil horizons (126, 127, 128, 129, 139) formed over the in-filled ditch deposits. These were visible on the eastern side of the ditch. It is unclear whether these layers were the result of deliberate deposition of imported material, the levelling of the earlier up-cast from the ditch or that they formed through natural processes. It is also possible that these deposits are the remnants of an internal rampart associated with the later ditch re-cut (111). The deliberate layering of turfs between successive soil deposits to increase stability was noted during the Deansway excavations (Dalwood 2004, 55). The deposits here were interpreted as being part of the Saxon burg defences, though the only datable artefacts were of a Roman date. Unfortunately none of these layers contained any datable material.

After the accumulation of these layers the fill of the original ditch appears to have been truncated by a large feature (111), though the nature of the excavations did not unable the nature of this cut to be fully established. It may therefore be interpreted as either a re-cut of the original ditch or a large pit, cut into the earlier ditch fills. The top of the cut for this feature was at 21.80 AOD. It maybe conjectured that this feature is a re-cut of the earlier substantial ditch. Pottery recovered from the deposits within this later cut again indicated a 1st –early 2nd century date, though this material may be residual, having originated from the backfill of the earlier ditch cut. The lack of any later material in this secondary feature does not imply any considerable period of time between the infilling of the earlier ditch and this later feature. However, the steepness of the sides of this later feature, especially on the eastern side may suggest two possibilities. Firstly, this feature originally functioned as a large pit, backfilled almost immediately, or, secondly. The later cut is a re-cut of the earlier ditch, and was dug in a very defensive manner, an almost vertical side on the eastern edge, which would have been the internal edge of a defensive ditch around the Roman town on the top of the natural escarpment overlooking the river. The preservation of the steep sides suggests that

the feature was either in-filled quickly, or that the layers of turf to the east stabilised the bank and the side of the ditch for enough time for it to be in filled naturally.

Though this ditch is not likely to be part of the original main Roman defences of Worcester, located around the site of the cathedral, this ditch is clearly dated to the early phase of Roman Worcester and probably represents an enclosure of land to the north of the primary occupation area.

The significant assemblage of well-stratified 1st –early 2nd century AD Roman pottery recovered from the ditch is of considerable significance, especially where evidence of the early Roman town has been very heavily truncated. The dating of the Roman pottery is indicative of other evidence found in the locality. The pottery found during the construction of the Technical College building in 1969 produced only first and second century wares (Sandon 1969). 1st and 2nd century pottery was found during a watching brief undertaken in Fish Street (Naptham 2001). The areas around the present site of the Technical College suggest a higher level of activity in the first two centuries AD, together with activity at the same period in the area around The Shambles (Jacobs pers comm).

The pattern of expansion of the Roman settlement northwards in the 3rd and 4th centuries is indicated by discoveries of later artefacts in the area of Castle Street, Farrier Street and the Tything. The lack of a considerable amount of later finds from the area around the present Worcester College of Technology implies a change from domestic occupation to iron production, evident from numerous intensively burnt area, spreads of fired clay and tap slag (Dalwood 2004, 212). A number of later Roman burials indicate that this area had been converted into a later burial ground with a date range *c* 300 – 400 AD (Dalwood 2004, 215). By this time iron working had shifted northwards to Newport Street and The Butts .

It would appear from the pottery assemblage that this ditch and its later probable re-cut belong to the early phase of activity in this area, though it should be considered that there is a possibility that the ditch cut is later and all the pottery is residual. Though this is unlikely, an east-west ditch uncovered in the Deansway excavations that was interpreted as forming part of the later Anglo-Saxon *burh* defences only contained residual Roman pottery. Yet the likelihood that the ditch at the Technical College represents part of the western Anglo-Saxon defences is low considering that most Anglo-Saxon defences tended to use water boundaries. Here the likelihood is that the later defences would have extended down to the edge of the River Severn (Jacobs pers comm).

5.3 Medieval

No features of medieval date were noted during the watching brief, though a quantity of heavily abraded medieval pottery was recovered from later contexts. The presence of medieval material indicates occupation of this area during this period, yet the absence of any observed medieval features suggests that any existing medieval archaeology may have been heavily truncated and/or completely destroyed by the insertion of the later burials. This would account for the medieval pottery being recovered from the backfill of these graves. Though the preservation of buried medieval levels may still lie below the level of this watching brief.

5.4 Post-medieval

The post-medieval evidence centres solely on the graveyard associated with St Andrew's church. A significant number of articulated and disarticulated human burials were recovered, along with the observations of the probable northern graveyard wall, on the boundary with Hare's Lane.

A number of human burials were recovered from the area of the watching brief. The burials relate to the usage of the St Andrews graveyard. The burials all appeared to be aligned in an east/west orientation, in accordance with Christian burial practices. The burials were

generally in a fair to good condition. There appeared to be considerable truncation of many of the burials by the insertion of later interments. The mixed burial soil layer contained a high percentage of disarticulated human bone, coffin furniture and pottery indicating considerable disturbance of the burial ground due to the insertion of later interments.

The skeletal remains dated primarily from the late Georgian to early Victorian periods and were buried within the grounds of the St Andrews churchyard (closed c 1850). Twenty-four articulated human burials, along with a large quantity of disarticulated remains were uncovered.

A number of the burials appeared to have been disturbed whilst soft tissue was still present (see Appendix 4 for the detailed specialist report), which appears to confirm the contemporary records that the parish burial grounds were so full that recent burials were frequently disturbed during the insertion of new interments (Clark 1849).

In addition a number of burials displayed skeletal evidence of both chronic disease and trauma, indicative of the changing conditions throughout the Georgian and Victorian periods. The harsh conditions of the new industries associated with the Industrial Revolution, allied with a change in the climate, seeing increasingly cold winters and warm summers led to a increase of disease, especially in urban environments. Though the number of well healed trauma injuries and the old age of some of the individuals buried at St. Andrew's attest to the increase in medical care even for the poor.

Phasing of human remains, disarticulated earlier, articulated later, though the contemporary reports of the extensive use may indicated that the disarticulated remains do not pre-date the articulated remains by a significant period of time (Appendix 4).

A number of the burials were no more than 0.5m below the existing ground surface; corroborated by the contemporary records for St Andrew's churchyard, indicating that many coffins were placed in the ground with not more than 17 inches (0.45m) of earth over them (Clark 1849).

The lack of later Victorian Willow and Oriental Pheasant transfer pattern sherds would support the closing of this graveyard around the late 1850's. The 1852 Burial Act led to the foundation of purpose built out-of-town cemeteries, such as the Astwood Cemetery, run by local authorities and institutions, with strict regulations. The formation of these led to rapid closure of the exhausted inner city burial grounds.

The skeletal remains recovered during the watching brief were generally in good condition and have yielded interesting information about the age and health of the individuals, a complete analysis of the recovered human burials, along with a history of the St Andrew's area is appended (Appendix 4).

The three brick walls observed in the western end of Trench 1 appeared to be contemporary, the bricks were of a size that suggested a post 1784 date (A Crawford pers comm). The appeared to be contemporary and may have marked part of the graveyard boundary. Wall 158 was aligned east/west and is likely to have marked the northern boundary with Hare Lane. The other two walls (120 and 147) were of identical make-up and may have been part of the walls that appeared to lead to steps leading down to Hare's Lane. These may be the foundations for two walls that can be seen in the aerial photograph taken in 1961. Wall 147 was clearly built whilst the graveyard was still in use as burial 130 overlay the backfill of the construction cut for the wall. This in turn indicates that this burial post dates the late 18th century.

The culvert observed in the eastern end of Trench 2 is of probable late 18th–early 19th century date and is probably part of the early Victorian drainage system, this culvert possibly part of a third class sewer, built of brick and 2 foot, 6 inches diameter (Clark 1849). The culvert would have originally run downhill, below Hare's Lane.

6. Research frameworks

Roman

The presence of the probable late 1st century AD ditch in an area where evidence of the early Roman town has been very heavily truncated is of considerable significance for the understanding of the development of the settlement.

Post-medieval burials

Until recently most research concerning the post-medieval period, and particularly the impact of urbanisation and industrialisation on human health has been undertaken using primary historical documentary sources. Very few osteological studies have been made of post-medieval/modern burial assemblages, particularly outside London. Yet it can be argued that that direct funereal and skeletal analysis is a more objective and reliable source of evidence while in addition it can provide far wider scope for research (Molleson and Cox 1993; Reeve and Adams 1993; Dinn 2004).

7. Publication summary

The Service has a professional obligation to publish the results of archaeological projects within a reasonable period of time. To this end, the Service intends to use this summary as the basis for publication through local or regional journals. The client is requested to consider the content of this section as being acceptable for such publication.

An archaeological watching brief was undertaken on behalf of Worcester College of Technology at All Saint's building, Worcester College of Technology, Worcester (NGR ref SO 8485 5480; SMR ref WCM 101369). The client was constructing a new entrance and fire escape with associated services, for which a planning application had been obtained.

The results of the watching brief concluded that although there has been considerable disturbance in the area, mainly from the construction of the present All Saint's Building in the early 1960s, though there were still a number of important archaeological features from the Roman through to the post-medieval periods, that were well preserved below the surface.

Prehistoric

Although no datable artefacts were recovered that indicated prehistoric activity, a single feature, possibly a ditch aligned north to south, could be inferred a prehistoric date due to its stratigraphic relationships. This feature had been truncated to the west by the large 1st–2nd century ditch, implying either a prehistoric or very early Roman date.

Roman

A large ditch again aligned north to south, was recorded on the western edge of the excavation. The ditch contained pottery dated to the early Roman period. There were signs of the ditch having been re-cut or truncated in the 2nd century. The ditch did not appear to be part of the original main Roman defences, located towards the site of the cathedral, though its early date, and location suggests an ditch enclosing an area of land to the north of the first phase of activity in Roman Worcester.

Medieval

No features of medieval date were noted during the watching brief; however, a quantity of heavily abraded medieval pottery was recovered from later contexts. Though the presence of medieval material indicates occupation of this area during this period. Any existing medieval features would appear to have been heavily truncated and/or completely destroyed by the

later use of this area as a graveyard for St Andrew's Church. This accounts for the medieval pottery being recovered from the backfill of these graves.

Post-medieval

Post medieval deposits observed during the watching brief related primarily to the use of the St Andrew's graveyard. The remains of 24 articulated individuals were recovered along with large quantity of disarticulated remains; the associated datable artefacts indicated a 16th–19th century date range. Overall the condition of the articulated remains was generally fair to good. The human burials consisted of both male and female burials. The age ranges consisted of young and old, though with a slight bias to the older adult.

In addition to the human burials, a number of other features were observed that relate to the post-medieval period.

To the west of the site three brick walls were observed, relating to the exterior walls of the graveyard. In addition, a circular brick culvert was recorded in the far eastern extent of the site, running in an east/west direction.

Modern

Across the site evidence for modern activity was noted, these included modern walls, construction cuts and services, all associated with the present college. None of these features are of archaeological significance.

In summary, evidence observed during the watching brief has concluded that an extensive, well-preserved Roman ditch is located to the west of the site, with the possibility of even earlier remains. The presence of this probable late 1st century AD ditch in an area where evidence of the early Roman town has been very heavily truncated is of considerable significance for the understanding of the development of the settlement. In addition the evidence for the human burials has helped with the understanding of post-medieval burial practices and augmented the contemporary documentary evidence.

8. The archive

The archive consists of:

20	Fieldwork progress records AS2
5	Photographic records AS3
393	Digital photographs
1	Sample records AS17
254	Abbreviated context records AS40
40	Scale drawings

The project archive is intended to be placed at:

Worcester City Museum

9. Acknowledgements

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10. Personnel

The fieldwork and report preparation was led by Simon Sworn. The project manager responsible for the quality of the project was Simon Woodiwiss. Fieldwork was undertaken by Simon Sworn, Angus Crawford, Robin Jackson, Andy Mann, Alvaro Mora-Ottomano, Jon Millward and Tom Vaughan, finds analysis by Alan Jacobs, environmental analysis by Liz Pearson and illustration by Carolyn Hunt. Gaynor Weston of Ossafreelance (in association with Mercian Archaeology) contributed the osteological analysis of the human remains (Appendix 4).

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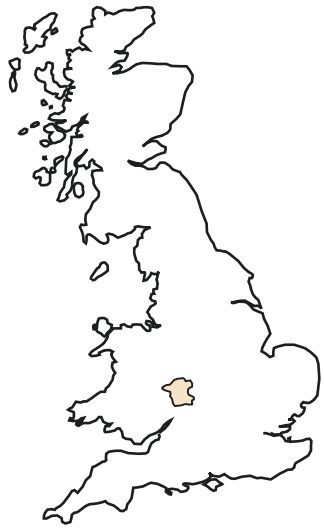
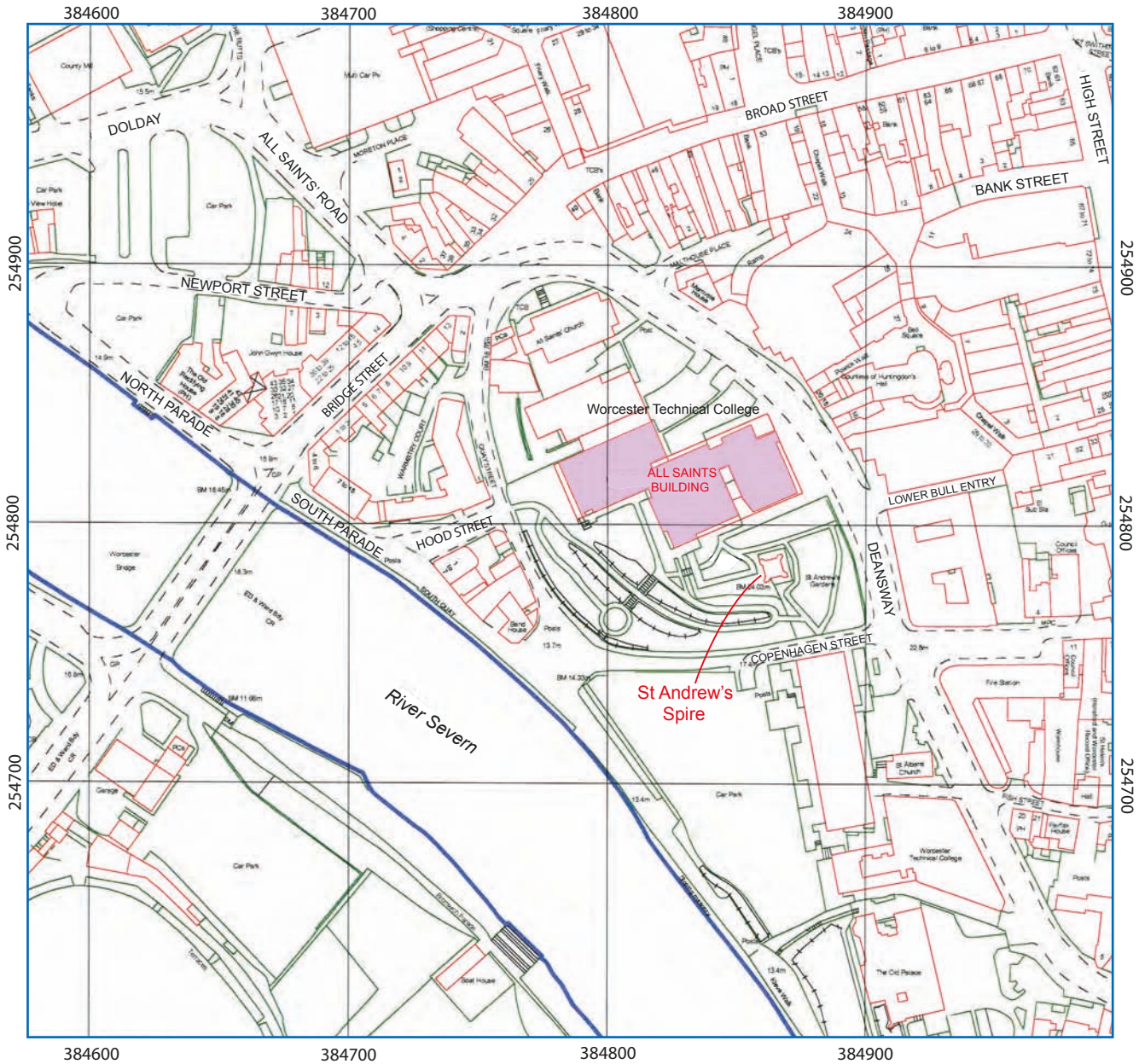
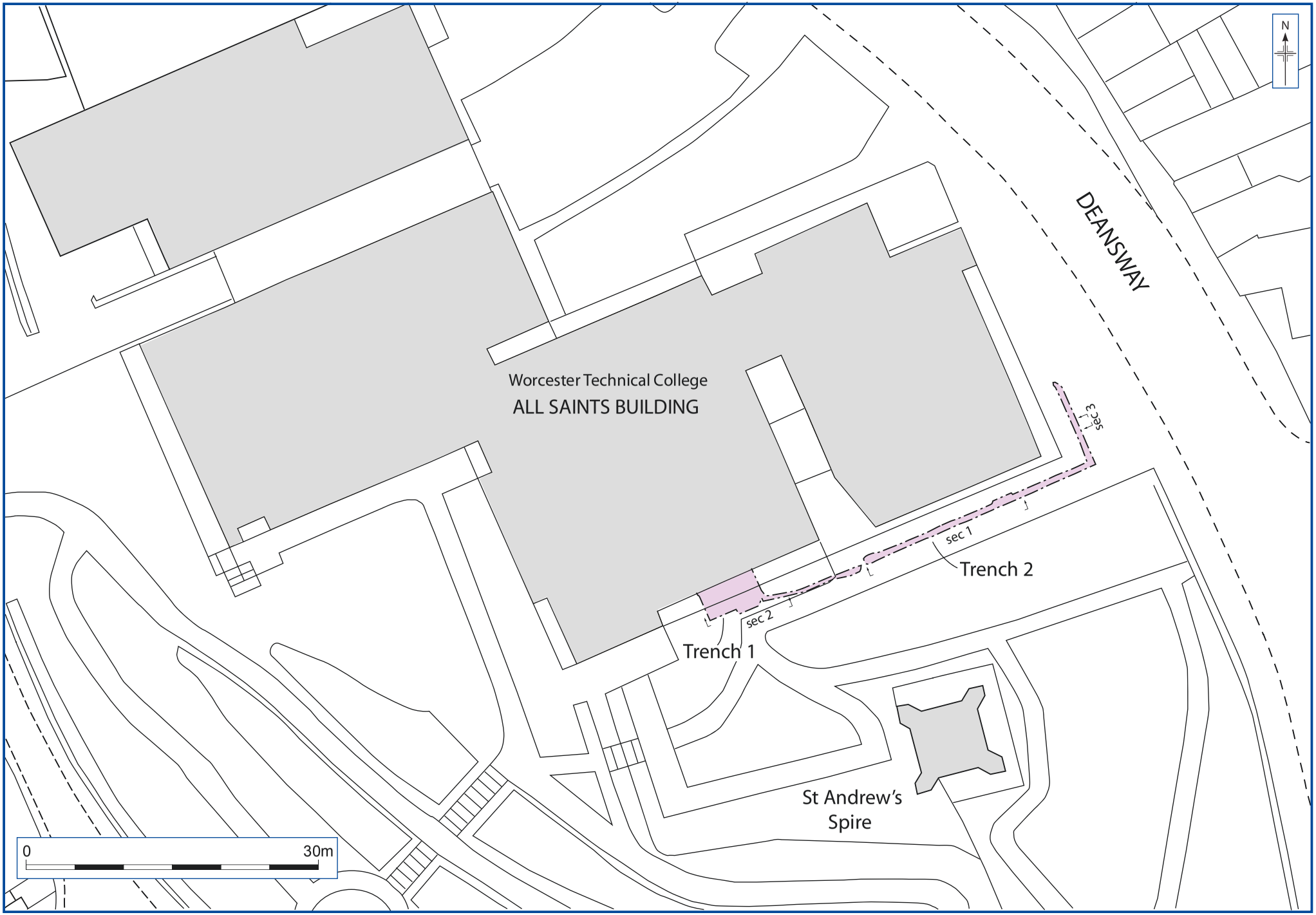
Figures





Location of the site. *Figure 1*



Trench location plan

Figure 2

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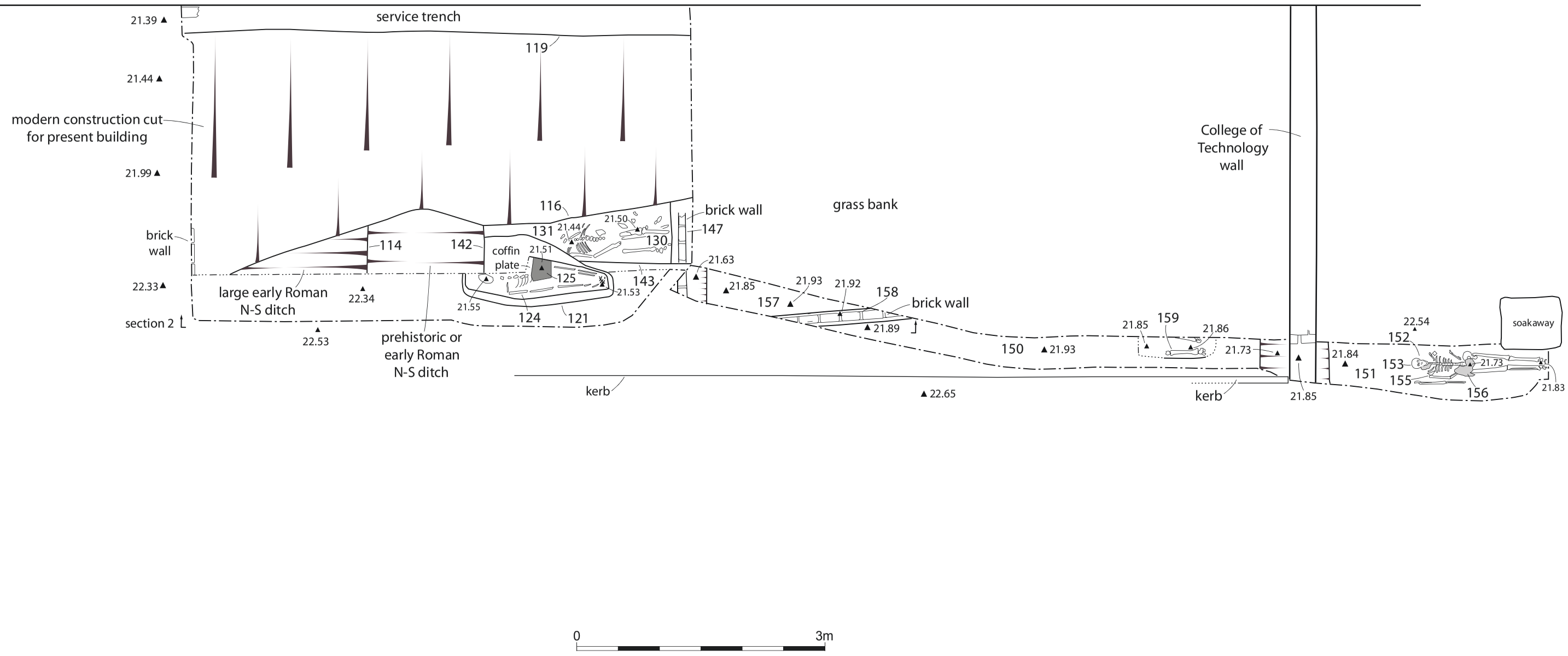
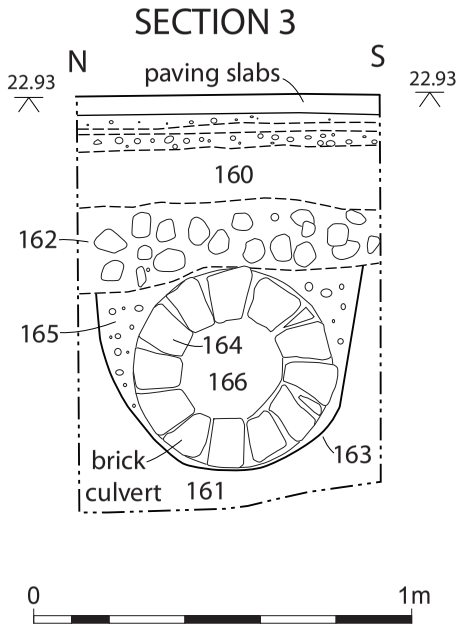


Plan of Trench 1 (western end of excavation)

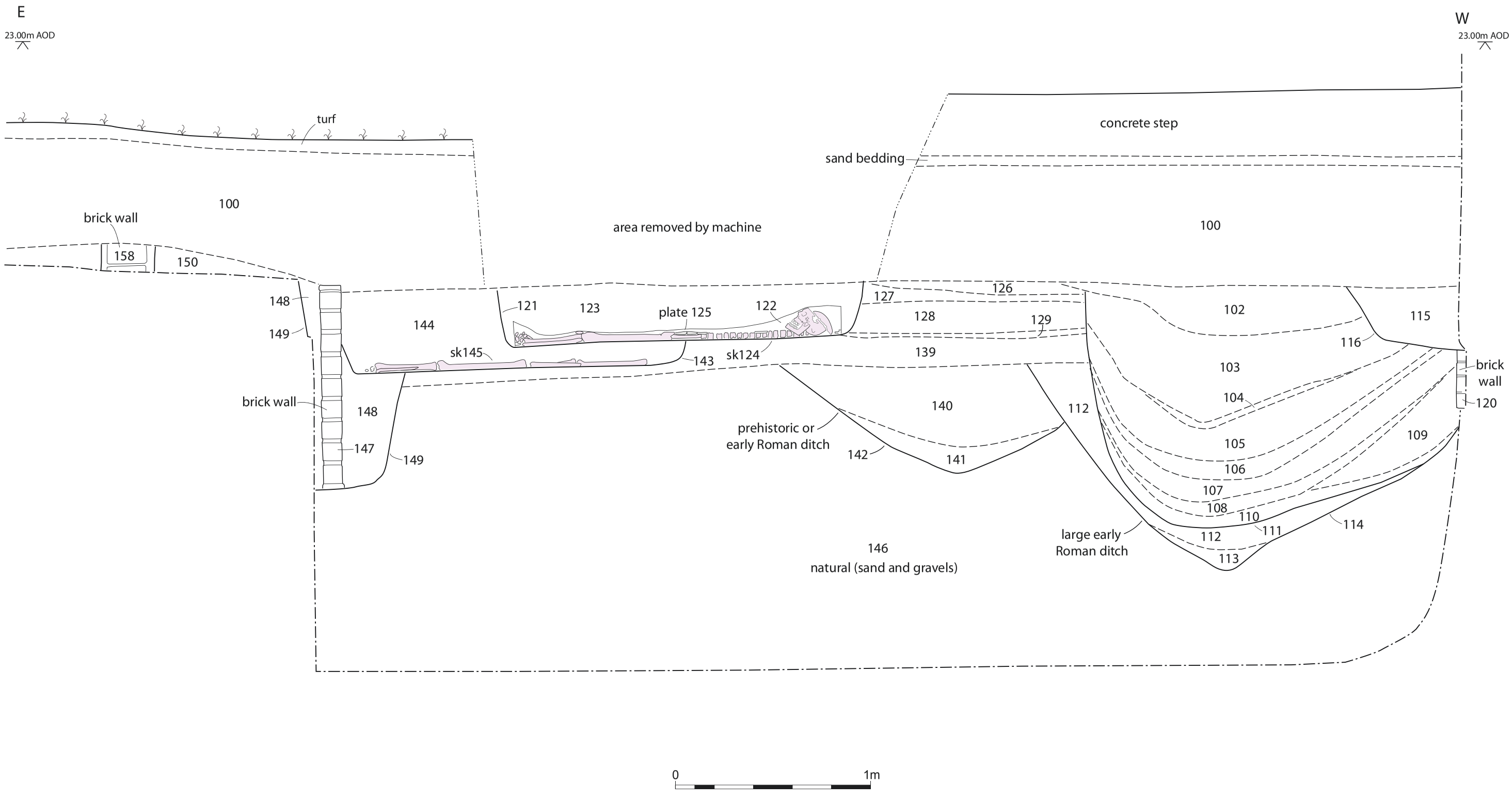
Figure 3



WORCESTER COLLEGE OF TECHNOLOGY

Plan of Trench 2

Figure 4



Section 2, southern extent of Trench 1

Figure 5

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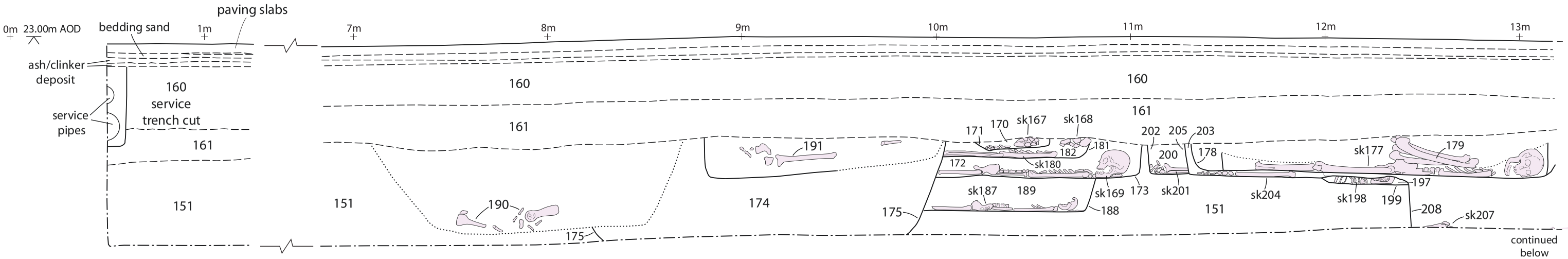

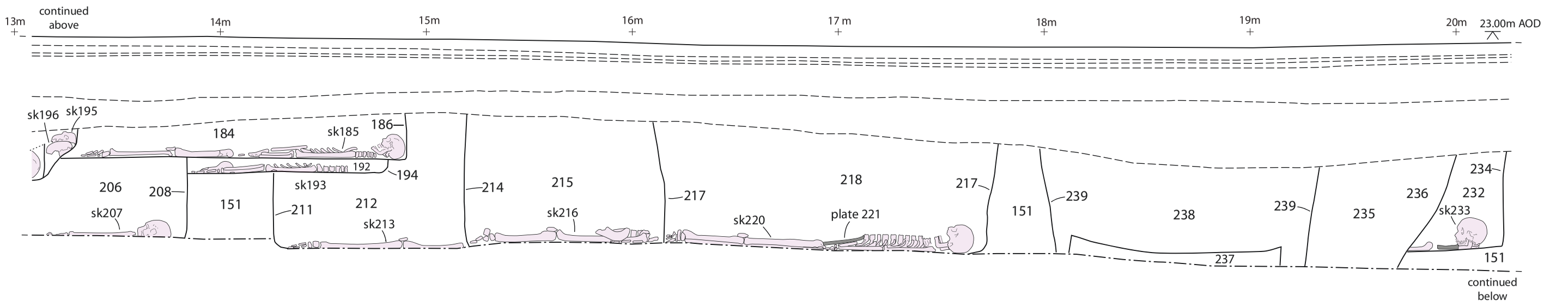

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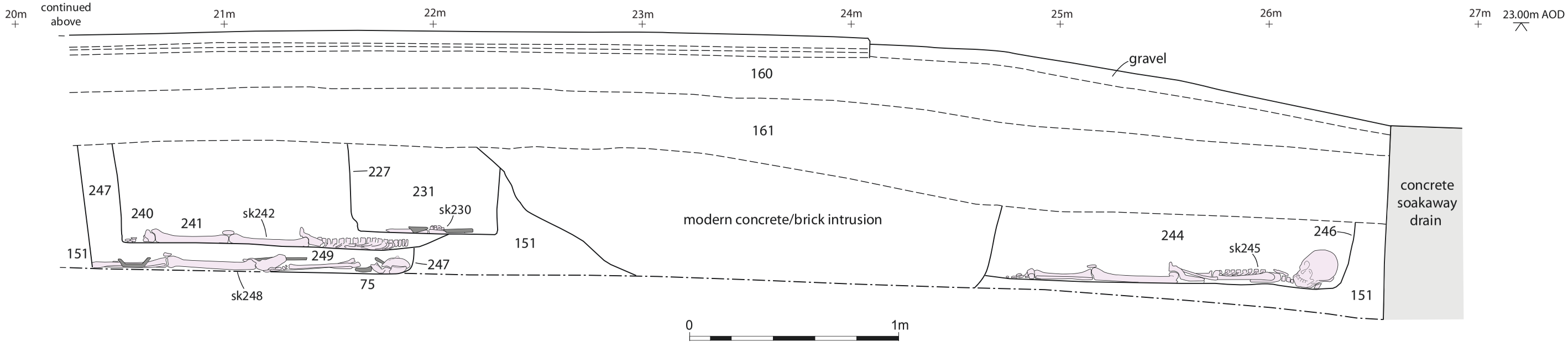
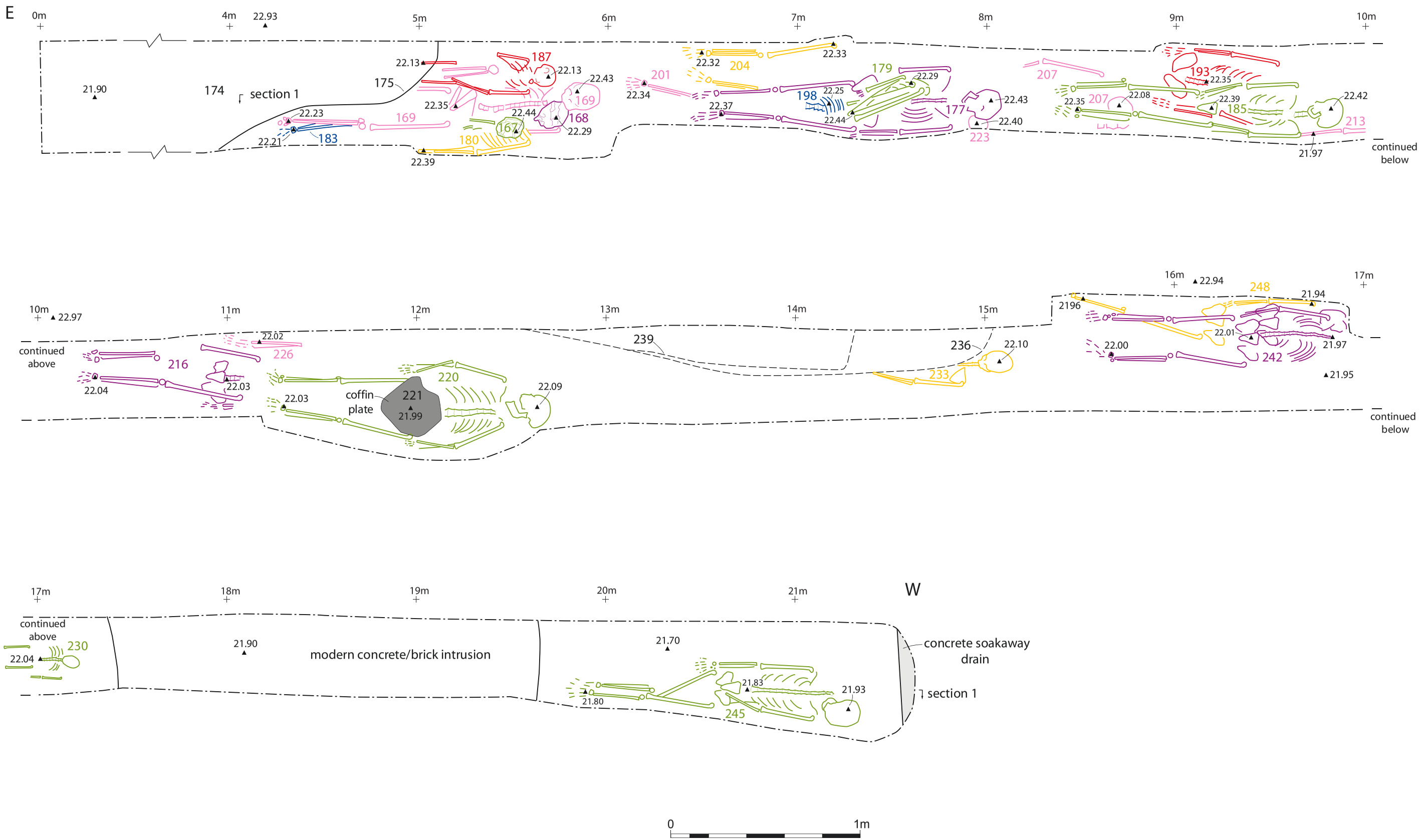


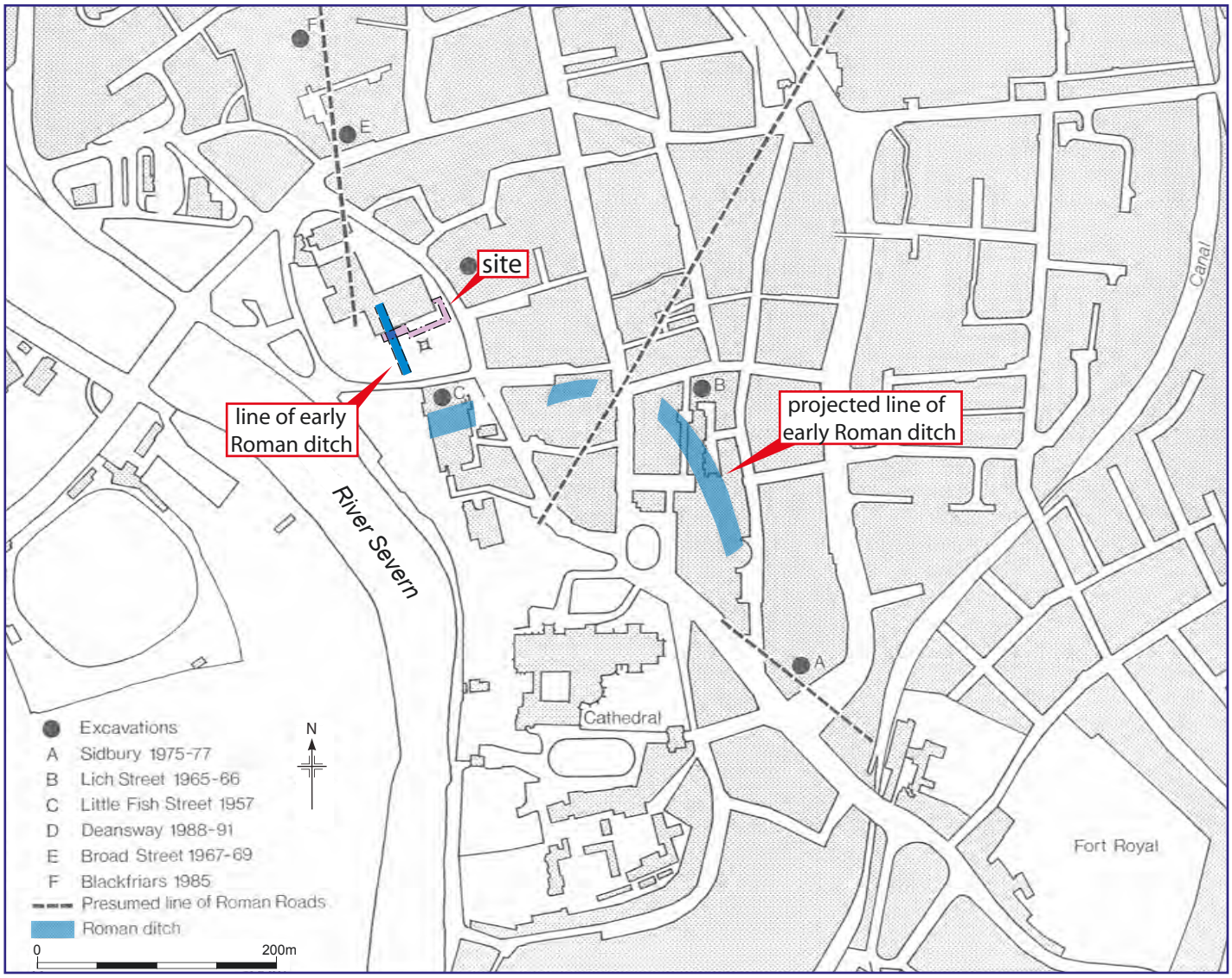
Section 1, schematic section through human burials within Trench 2

Figure 6



Plan of Western end of Trench 2 showing multi-phasing of human burials

Figure 7



Projected line of early Roman ditch (after Darlington and Evans, 1992)

Figure 8

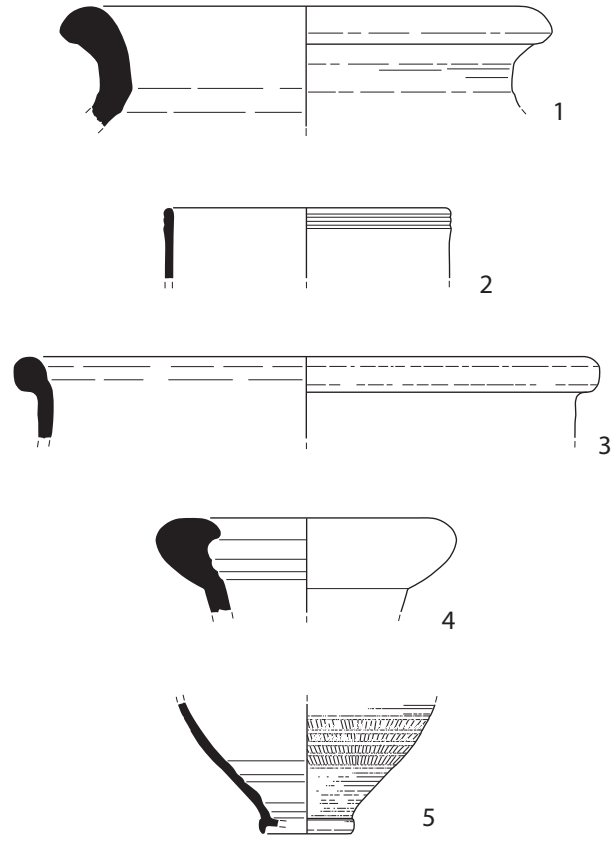


Figure 9

Early Roman pottery fragments: 1, narrow mouthed jar (107); 2, carinated jar (105); 3, 1st century grog tempered ware jar (110); 1st century Dressel 20 amphora (110); bott beaker (107); Malvernian slab built vessel (110)

Plates

Plate 1: General view of western end of service trench during the start of excavation (facing east).

Plate 2: General view of eastern end of service trench, scale at 2m (facing west).

Plate 3: Section through early Roman ditch 114,the later re-cut can be seen as a vertical cut to the left of the section, scale at 1m (facing south).

Plate 4: Section through prehistoric or early Roman ditch 142, overlain by later buried soil horizons, scale at 1m (facing south-east).

Plate 5: Section through buried Roman soil horizons 126 – 129 and 139, scale at 1m (facing south).

Plate 6: Northern brick wall 158 of post-medieval graveyard, scale at 1m (facing north).

Plate 7: Remains of post-medieval brick culvert 164, scale at 1m (facing east).

Plate 8: Burial 122, heavily degraded coffin plate on pelvic area, scale at 1m (facing south).

Plate 9: Burial 153, scale at 1m (facing south).

Plate 10: Adult burial 169 (right leg truncated), with juvenile 168 and infant 167 above, scale at 0.3m (facing north).

Plate 11: Burial 177, with collection of re-deposited long bones 179, scale at 0.5m (facing north).

Plate 12: Burials 177 (foreground) and 185, scale at 0.5m (facing west).

Plate 13: Burial 177, scale at 0.5m (facing north).

Plate 14:Heavily truncated burial 193, scale at 0.5m (facing north).

Plate 15: Heavily truncated burial 198, only right scapular and ribs remaining, detail of circular copper alloy pins from coffin decoration still visible, scale at 0.3m (facing north).

Plate 16: Burial 245, note how body has slumped to the left, possibly moved in coffin during internment, scale at 1m (facing north).

Appendix 1 Artefactual tables

Material	Total	Weight (g)
Roman pottery	42	1132
Medieval pottery	23	157
Post-medieval pottery	118	1484
Modern pottery	7	54
Tobacco pipe	26	65
Tile	10	781
Bone	61	2735
Glass	13	255
Iron nails	4	50
Kiln furniture	1	26
Mortar	1	27
Mollusc	1	4
Total	307	6770

Table 1: Quantification of the sampled assemblage

Fabric	Name	Total	Weight
3	Malvernian	3	185
12	Severn Valley ware	16	134
12.1	Severn Valley ware reduced	4	18
12.2	Severn Valley ware organic	2	18
16.2	Grog tempered ware handmade	2	18
21	Micaceous ware	1	2
22	Black-burnished ware	1	9
42.1	Dressel 20 Amphora	1	188
43.1	Samian, South Gaulish	1	25
43.2	Samian, Central Gaulish	1	1
Total		32	598

Table 2: Quantification of the Roman pottery by fabric

Fabric number	Fabric name	Total sherds	Weight (g)
55	Worcester-type unglazed ware	7	81
64.1	Worcester-type sandy glazed ware	1	4
69	Malvernian oxidised glazed ware	15	72
Total		23	157

Table 3: Quantification of the medieval pottery by fabric

Fabric		Total	Weight (g)
75	North Devon Gravel tempered ware	11	175
77	Midlands Yellow ware	4	13
78	Post-medieval red sandy ware	52	823
81.2	Westerwald stoneware	4	51
81.3	Notingham stoneware	1	1
82	Tin Glazed ware	4	15
84	Creamware	8	33
90	Post-medieval Orange ware	7	104
91	Post-medieval Buff ware	22	162
108	Midlands Purple ware	4	106
		118	1484

Table 4: Quantification of the post- medieval pottery by fabric

Fabric	Name	Total	Weight
83	Porcelain	1	1
85	Modern stone china	7	54
Total		8	55

Table 5: Quantification of the modern pottery by fabric

Table 6: Artefactual assemblage by context

Context	Material	Type	Fabric	Total	Weight(g)
105	Pottery	Roman	12	2	18
105	Pottery	Roman	12.1	1	1
105	Pottery	Roman	12.2	1	12
105	Pottery	Roman	43.1	1	25
107	Bone	Mammal		1	14
107	Pottery	Roman	12	4	46
107	Pottery	Roman	12.2	6	475
108	Pottery	Roman	12	3	12
108	Pottery	Roman	16.2	1	5
108	Pottery	Roman	3	1	94
110	Pottery	Roman	12	1	10
110	Pottery	Roman	12.2	2	39
110	Pottery	Roman	16.2	1	13
110	Pottery	Roman	42.1	1	188
112	Pottery	Roman	12.2	1	15
112	Pottery	Roman	3	2	91
115	Mortar	Cement		1	27
172	Glass	Bottle		4	96
172	Pottery	Medieval	64.1	1	4
172	Pottery	Medieval	55	2	13
172	Pottery	Post-medieval	108	2	25
172	Pottery	Post-medieval	75	1	7
172	Pottery	Post-medieval	78	14	286
172	Pottery	Post-medieval	81.2	1	6
172	Pottery	Post-medieval	82	1	6
172	Pottery	Post-medieval	85	2	5
172	Pottery	Post-medieval	91	5	64
172	Tobacco pipe	Stems		7	25
176	Bone	Mammal		20	278
176	Ceramic building material	Tile	2a	7	597
176	Glass	Bottle		9	159
176	Iron	Nails		2	5
176	Mollusc shell			1	4
176	Pottery	Medieval	55	3	30
176	Pottery	Medieval-post-medieval	69	8	40
176	Pottery	Modern	83	1	1
176	Pottery	Post-medieval	75	7	55
176	Pottery	Post-medieval	77	3	11
176	Pottery	Post-medieval	78	30	378
176	Pottery	Post-medieval	81.2	2	12
176	Pottery	Post-medieval	81.3	1	1
176	Pottery	Post-medieval	82	3	9
176	Pottery	Post-medieval	84	5	18
176	Pottery	Post-medieval	85	3	39
176	Pottery	Post-medieval	90	7	104
176	Pottery	Post-medieval	91	6	48
176	Pottery	Roman	12	3	14
176	Pottery	Roman	12.1	2	10
176	Tobacco pipe	Stems		11	20
184	Ceramic building material	Modern	1	1	25
184	Iron	Nails		2	45

Context	Material	Type	Fabric	Total	Weight(g)
184	Pottery	Post-medieval	84	1	3
184	Pottery	Post-medieval	91	2	7
184	Pottery	Roman	12.2	1	8
184	Pottery	Roman	21	1	2
184	Tobacco pipe	Post-medieval		2	2
189	Bone	Mammal		3	20
189	Ceramic building material	Tile	2a	1	148
189	Pottery	Modern	85	1	2
192	Pottery	Medieval-post-medieval	69	6	22
192	Pottery	Post-medieval	75	2	58
192	Pottery	Post-medieval	77	1	2
192	Pottery	Post-medieval	78	3	8
192	Pottery	Post-medieval	91	6	19
192	Tobacco pipe	Stems and bowl		2	9
197	Ceramic building material	Medieval-post-medieval	3	1	11
197	Pottery	Post-medieval	108	1	21
197	Pottery	Post-medieval	75	1	55
197	Pottery	Post-medieval	81.2	1	33
197	Pottery	Roman	12	1	9
218	Bone	Mammal		11	81
218	Pottery	Post-medieval	78	1	25
231	Pottery	Post-medieval	78	1	4
232	Pottery	Medieval-post-medieval	69	1	10
232	Pottery	Post-medieval	108	1	60
232	Pottery	Post-medieval	78	2	108
232	Pottery	Post-medieval	91	1	3
232	Pottery	Roman	2a	1	3
244	Bone	Mammal		2	26
244	Kiln waste	Modern		1	26
244	Pottery	Medieval	55	2	38
244	Pottery	Post-medieval	78	1	14
244	Pottery	Post-medieval	84	2	12
244	Pottery	Post-medieval	85	1	8
244	Pottery	Post-medieval	91	2	21
244	Pottery	Roman	12	2	25
244	Pottery	Roman	12.1	1	7
244	Pottery	Roman	22	1	9
244	Pottery	Roman	43.2	1	1
244	Tobacco pipe	Stem		4	9

Table 6: Artefactual assemblage by context

Appendix 2 Environmental tables

Context	Sample	Context description	Period	Sample volume	Volume processed	Residue assessed	Flot assessed	Full analysis
110	3	ditch 114	RBR	10	10	Y	Y	Y
108	2	ditch 114	RBR	10	10	Y	Y	N
106	1	ditch 114	RBR	6	6	Y	Y	Y

RBR = Romano-British

Table 7: List of environmental samples

Context	Sample	large mammal	small mammal	fish	charred plant
106	1	occ			abt
108	2	occ-mod		occ	occ-mod
110	3	mod	occ	occ	abt

Key:
Occ = occasional; mod = moderate, abt = abundant

Table 8: Summary of environmental remains from bulk samples

Latin name	Family	Common name	Habitat	106	110
Triticum spelta grain	Poaceae	spelt wheat	F	4	
Triticum spelta glume base	Poaceae	spelt wheat	F	515	
Triticum spelta rachis	Poaceae	spelt wheat	F	170	
Triticum spelta spikelet fork	Poaceae	spelt wheat	F	7	
Triticum dicoccum/spelta grain	Poaceae	emmer/spelt wheat	F	9	
Triticum dicoccum/spelta glume base	Poaceae	emmer/spelt wheat	F	173	
Triticum dicoccum/spelta spikelet fork	Poaceae	emmer/spelt wheat	F	18	
Triticum sp (free-threshing) grain	Poaceae	free-threshing wheat	F	2	1
Triticum sp grain	Poaceae	wheat	F	20	1
Triticum/Secale sp grain	Poaceae	wheat/rye	F		2
Hordeum vulgare rachis	Poaceae	barley	F	2	
Cereal sp indet grain	Poaceae	cereal	F	26	1
Cereal sp indet culm node	Poaceae	cereal	F		1
Cereal sp indet embryo shoot	Poaceae	cereal	F	28	
cf *Festuca* sp	Poaceae	fescue	ABD	97	
Lolium/Festuca sp	Poaceae	fescue/ryegrass	A		17
Poa sp grain	Poaceae	Meadow-grass	ABCD	6	32
Bromus sp grain	Poaceae	brome grass	AF	132	1
cf *Avena* sp grain	Poaceae	oat	AF	2	
Poaceae sp indet grain	Poaceae	grass	AF	127	4
Poaceae sp indet grain (3mm size)	Poaceae	grass	ABD		11
Poaceae sp indet grain (2mm size)	Poaceae	grass	ABD		7
Ranunculus acris/repens/bulbosus	Ranunculaceae	buttercup	CD		2
Urtica dioica	Urticaeae	common nettle	ABD	1	5
Rumex acetosella	Polygonaceae	sheep's sorrel	ABD	3	1
Rumex sp	Polygonaceae	dock	ABCD		6
Fabaceae sp indet	Fabaceae	legume	ABCDE		2
Medicago sp	Fabaceae	medick	ABD	1	2
Trifolium sp	Fabaceae	clover	ABD		3
Galeopsis sp	Lamiaceae	hemp-nettle	ABCD		1
cf *Galeopsis* sp	Lamiaceae	hemp-nettle	ABCD		4
Tripleurospermum inodorum	Asteraceae	scentless mayweed	AB	4	
Eleocharis sp	Cyperaceae	spike-rush	E	3	22
Carex sp	Cyperaceae	sedge	CDE	1	
Carex spp	Cyperaceae	sedge	CDE		8
Sample size (L)				6	8
Fraction of flot sorted				1/8th	1/2
No of items per litre				1835	34

Key:

Habitat
A= cultivated ground
B= disturbed ground
C= woodlands, hedgerows, scrub etc
D = grasslands, meadows and heathland
E = aquatic/wet habitats
F = cultivar

Table 9: Charred plant remains from selected contexts

Context	No of fragments	Weight (g)
107	1	14
176	20	278
189	3	20
218	11	81
244	2	26
Total	**37**	**419**

Table 10: hand-collected animal bone

Appendix 3 Trench descriptions

Trench 1

Maximum dimensions: Length: 16.75m Width: 0.65m Depth: 1.00 – 2.90m

Orientation: East/west

Context	Classification	Description	Depth below ground surface – top and bottom of deposits
100	Modern made-ground	Dark brown/black friable silty sand. Frequent brick, tile and rubble, occasional disarticulated human bone fragments.	0.06 – 0.68m
101	Topsoil	Friable dark brown silty loam. Frequent small sub-rounded pebbles. Heavy root disturbance.	0 – 0.08m
102	Secondary ditch fill	Compact mid brown silty sand. Frequent small sub-rounded pebbles and occasional charcoal flecks. Fill of cut 111. Possible slumped internal bank.	1.28 – 1.54m
103	Secondary ditch fill	Compact light brown silty sand. Frequent small sub-rounded pebbles and occasional charcoal flecks. Fill of cut 111.	1.22 – 1.96m
104	Secondary ditch fill	Firm light brown sandy clay. Fill of cut 111.	1.72 – 2.01m
105	Secondary ditch fill	Loose light brown silty sand. Occasional small sub-rounded pebbles. Fill of cut 111.	1.43 – 2.17m
106	Secondary ditch fill	Loose charcoal rich layer Occasional silty sand. Fill of cut 111.	1.65 – 2.27m
107	Secondary ditch fill	Loose mid-light brown silty sand. Occasional small sub-rounded pebbles and charcoal flecks Fill of cut 111.	1.70 – 2.38m
108	Secondary ditch fill	Compact dark olive grey silty sand. Frequent charcoal flecks and occasional small sub-angular gravels. Fill of cut 111.	1.80 – 2.44m
109	Secondary ditch fill	Loose light brown silty sand. Occasional small sub-rounded pebbles and charcoal flecks. Fill of cut 111.	1.65 – 2.28m
110	Primary ditch fill	Compact dark grey silty sand. Frequent charcoal flecks. Fill of cut 111.	1.97 – 2.53m
111	Ditch re-cut/Pit cut	Cut of re-cut ditch/pit. Steep vertical eastern edge, shallow western edge. Concave base. Filled by 102–110.	1.26 – 2.53m
112	Secondary ditch fill	Loose light brown silty sand. Occasional charcoal and sub-rounded pebbles. Fill of north/south ditch 114.	1.59 – 2.56m
113	Primary ditch fill	Light brown loose silty sand. Occasional charcoal and sub-rounded pebbles. Fill of north/south ditch 114.	2.35 – 2.63m
114	Ditch cut	North-south linear ditch cut. Partially exposed, moderate gentle slope to east. Stepped base. Filled by 112 and 113.	1.68 – 2.73m
115	Primary construction cut fill	Friable dark brown silty sand. High percentage of modern rubble, brick, tile, charcoal and concrete fragments. Fill construction cut for Technical College.	1.18 – 1.48m
116	Construction cut (1950's)	Linear cut following edge of building c.3m out. Steep slope to base of building. Filled by 115 and 117.	1.18 – 2.94m+
117	Construction cut fill	Loose mid brown silty sand. High percentage of sub-rounded pebbles, gravels, brick, tile and concrete fragments. Fill of 1950's construction cut 116.	1.21 – 2.94m+

Context	Classification	Description	Depth below ground surface – top and bottom of deposits
118	Service trench fill	Modern gravel and rubbish fill of service trench 119 that runs alongside the southern edge of the Technical College.	1.76 – 2.80m
119	Service trench	Vertical sides with a flat base. Cut made for a concrete service pipe. Runs along southern edge of College.	1.76 – 2.80m
120	Brick wall	Partially exposed brick foundation. Five courses exposed, aligned north/south. Pink firm concrete mortar. 19th/20th century wall.	1.52 – 1.87m
121	Grave cut	East/west aligned. Vertical sides, flat base. Filled by 122-125.	1.28 – 1.55m
122	Coffin fill	Loose dark brown-black sandy silt. Frequent disarticulated human bone, tile and limestone rubble. Fill of grave cut 121.	1.28 – 1.55m
123	Grave fill	Loose dark brown-black sandy silt. Frequent disarticulated human bone, tile and limestone rubble. Fill of grave cut 121.	1.28 – 1.55m
124	Human burial	Supine, extended, east facing adult male skeleton. Cranium surgically removed, a single 1-inch trephination hole visible on right side of cranium, and craniotomy. Associated with series of coffin nails marking extent of rotted timber coffin. Fill of grave cut 121. Burial heavily truncated to upper left by machine.	1.32 – 1.55m
125	Coffin plate	Iron coffin plate with gold plating associated with burial 124. Resting over lower torso.	1.31 – 1.36m
126	Up-cast/buried soil horizon	Mid-brown silty sand. Very high percentage small sub-rounded pebbles. Occasional charcoal. Up-cast/bank from re-cut 111. Similar to 102.	1.19 – 1.25m
127	Up-cast/buried soil horizon	Loose, fine red-brown silty sand. Probable original up-cast/bank from ditch re-cut 111.	1.25 – 1.28
128	Buried soil horizon	Friable, mid olive-brown sandy silt. Occasional small sub-angular gravel and sand. Most likely a buried Roman soil horizon.	1.28 – 1.42m
129	Soil layer	A thin layer of burnt red clay. Roman occupation layer.	1.42 – 1.45m
130	Human burial	Supine, extended adult male skeleton, facing east, arms extended by sides. Heavily truncated by 138. Skull missing. Within grave cut 250.	1.09 – 1.13m
131	Grave fill	Loose dark brown-black sandy silt. Frequent disarticulated human bone, tile and limestone rubble. Fill of grave cut 250.	0.89 – 1.13m
132	Human burial	Heavily truncated extended supine lower right leg. Only tibia and fibular present. Cut by 138, 250 and 252. Fill of grave cut 251.	1.05 – 1.10m
133	Human burial	Heavily truncated remains. Extended supine juvenile. Left and right tibia, fibular and feet present. Cut by 250. Fill of grave cut 252.	1.00 – 1.05m
134	Grave fill	Loose dark brown-black sandy silt. Frequent disarticulated human bone and tile. Fill of grave cut 252.	0.80 – 1.05m
135	Human burial	Articulated left foot, heavily truncated by grave cut 138. Located solely within grave cut 138.	1.40 – 1.45m
136	Human burial	Heavily truncated east/west adult male(?). Extended supine, only upper right side remaining. Within grave 138. Cut by construction cut 116.	1.03 – 1.13m

Context	Classification	Description	Depth below ground surface – top and bottom of deposits
137	Grave fill	Loose dark brown sandy silt. Frequent disarticulated human bone. Fill of 138	1.00 –1.13m
138	Grave cut	Truncated east/west cut. Filled by 136 and 137	1.00 –1.13m
139	Buried soil horizon	Friable, olive-brown silty sand. Occasional charcoal flecks. Possibly Roman.	1.46 – 1.60m
140	Secondary ditch fill	Friable, mid-brown silty sand. Occasional charcoal flecks. Fill of pre-Roman (?) ditch 142.	1.60 – 1.99m
141	Primary ditch fill	Friable, light brown silty sand. Frequent small sub-rounded pebbles. Occasional charcoal flecks. Fill of ditch 142.	1.99 – 2.16m
142	Linear ditch cut	North/south linear ditch cut. Slightly concave, regular sides. Gentle, concave at base. Filled by 140 and 141.	1.60 – 2.16m
143	Grave cut	East/west cut. Not excavated. Filled by 145 and 144.	0.64 – 0.84m
144	Grave fill	Loose, dark brown-black sandy silt. Frequent limestone fragments. Fill of grave cut 143.	0.64 – 0.84m
145	Human burial	Supine, east facing adult skeleton. Only partially exposed. Post-medieval burial. Fill of grave cut 143.	0.45 – 0.48m
146	Natural soil horizon	Loose, light beige-orange sandy gravel. Frequent small, sub-rounded pebbles. Exposed in southern end of excavation only.	1.60 – 2.94m+
147	Brick wall	North/south aligned post-medieval brick wall. Nine courses visible. Only partially exposed in southeast corner of main trench.	1.20 – 2.10m
148	Construction cut fill	Friable, dark brown-black sandy silt. Fill of cut 149.	1.50 – 2.10m
149	Construction cut	North/south aligned linear cut. Steep, regular sides and flat base. Filled by 147 and 148.	1.50 – 2.10m
150	Burial layer	Dark brown/black sandy silt. Frequent disarticulated human bone, pebbles, tile, brick fragments and charcoal flecks.	0.50 – 0.90 m+
157	Deposit	Compact, light brown silty clay. Frequent limestone rubbles, brick fragments, and charcoal. Partially exposed.	0.60m+
158	Brick wall	East/west aligned brick wall, brick dimensions 220 x 105 x 75mm, bonded by a hard yellow lime mortar.	0.61m+
159	Human burial	Lower legs of east facing human burial. Partially visible, not removed, below impact level.	0.80m+
250	Grave cut	Partially exposed east/west grave cut, vertical sides, flat base. Filled by 130 and 131.	0.89 – 1.13m
251	Grave cut	Partially exposed east/west grave cut, vertical sides, flat base. Filled by 132 and 253.	1.05 – 1.10m
252	Grave cut	Partially exposed east/west grave cut, vertical sides, flat base. Filled by 133 and 134.	0.80 – 1.05m
253	Grave fill	Loose, dark brown silty loam. Occasional small sub-rounded pebbles, and charcoal flecks. Fill of grave cut 251.	1.05 – 1.10m

Trench 2

Maximum dimensions: Length: 26.50m Width: 0.65m Depth: 1.00m – 1.15m

Orientation: East/west and north/south at Eastern end

Context	Classification	Description	Depth below ground surface – top and bottom of deposits
151	Burial layer	Dark brown/black sandy silt. Frequent disarticulated human bone, pebbles, tile, brick fragments and charcoal flecks.	0.55 – 1m+
152	Grave fill	Firm, dark brownish-grey silty clay. Occasional CBM fragments and small sub-rounded pebbles. Backfill of grave.	0.70 – 0.98m
153	Human burial	Supine, east facing old adult female (?) burial. Coffin plate 156 covers right hand.	0.81 – 0.98m
154	Coffin	Partially exposed timber coffin. Very degraded. Associated with burial 155.	0.81m+
155	Human burial	Left arm of adult skeleton visible only. Associated with coffin 154 an iron coffin handle.	0.67m
156	Coffin plate	Thin metal coffin plate and iron nails. Associated with burial 153.	0.81 – 0.83m
160	Make-up layer	Friable, mid dark-brown sandy silt. Frequent medium sub-rounded pebbles, rubble, brick ends, and occasional charcoal.	0.15 – 0.42m
161	Made-ground	Friable, dark brown sandy silt. Occasional brick-ends, rubble, small sub-rounded pebbles and charcoal.	0.42 – 1.10m+
162	Surface	Compact, mid brown silty sand. Frequent medium sized sub-rounded pebbles. Path or road surface.	0.30 – 0.52m
163	Construction cut	Linear, east/west aligned cut. Steep sides with concave base. Filled by 164-166.	0.52 – 1.0m
164	Brick culvert	East/west aligned circular brick culvert.	0.52 – 1.0m
165	Construction cut fill	Friable, olive-green silty sand. Occasional sub-rounded pebbles and gravel. Fill of cut 163.	0.52 – 1.0m
166	Culvert fill	Friable, mid brown silty sand. Fill of brick culvert 164.	0.60 – 0.86m
167	Human burial	Supine, east facing neonate burial. Skull, upper right arm and right ribs survive. Slight traces of coffin timber below ribs.	0.60 – 0.65m
168	Human skull	Disarticulated skull within backfill 173. Possibly skull of truncated skeleton 180 that was truncated by 173.	0.63 – 0.67m
169	Human burial	Supine, east facing young adult male skeleton. A coffin plate and handle cover central and left area of the pelvis. Fill of grave cut 173.	0.68– 0.61m
170	Grave fill	Loose, dark brown silty loam. Occasional small sub-rounded pebbles, limestone fragments, and charcoal flecks. Fill of 171.	0.59 – 0.69m
171	Grave cut	Linear east/west aligned grave cut. Vertical sides, flat base. Heavily truncated by 116. Filled by 167 and 171.	0.59 – 0.69m
172	Grave fill	Friable, dark brown sandy silt. Occasional small rounded stones, charcoal, and brick fragments. Fill of grave cut 173.	0.72 – 0.99m

Context	Classification	Description	Depth below ground surface – top and bottom of deposits
173	Grave cut	Linear east/west aligned grave cut. Vertical sides and concave base. Truncated to southeast corner by 175. Filled by 169 and 172.	0.72 – 0.99m
174	Grave fill	Friable, mid dark-brown sandy loam. High percentage of brick rubble, mortar, and crushed tile, as well as glass, pottery and disarticulated bones. Fill of grave cut 175.	0.72 – 1.57m
175	Grave cut	Linear east/west aligned cut. Filled by 174.	0.72 – 1.57m
176	Grave fill	Moderately compact, dark greyish-brown sandy loam. Occasional post-medieval pottery, tile, and tobacco pipe fragments. Very occasional charcoal flecks. Fill of grave cut 178.	0.63 – 1.32m
177	Human burial	Supine, east facing old adult female skeleton. Skull turned to the north. Frequent coffin nails indicating outline of coffin. Fill of grave cut 178.	0.60 – 0.67m
178	Grave cut	Linear, east/west grave cut. Filled by 176 and 177.	0.63 – 1.32m
179	Human bone assemblage	Five adult long bones placed lengthways above right arm and pelvis of burial 177. Disturbed by cut 178.	0.57 – 0.60m
180	Human burial	Skeleton heavily truncated by 173. The ribs and left arm bone remain, facing east. Disarticulated skull 168 likely belongs to this skeleton. Fill of grave cut 181.	0.58 – 0.64m
181	Grave cut	Unclear edge of cut due to truncation by 173. Filled by 180.	0.51 – 0.64m
182	Grave fill	Moderately compact, dark brown sandy silt. Occasional small rounded stones. Fill of grave cut 181.	0.51 – 0.64m
183	Human burial	Articulated adult left-leg bones and hand bones. Heavily truncated skeleton with the leg bones and hand bones surviving only.	0.70 – 0.74m
184	Grave fill	Loose, dark brown sandy silt. Occasional tile and brick rubble, limestone fragments and sub-rounded pebbles, pot, and tobacco pipe fragments, and disarticulated bone. Fill of grave cut 186.	0.36 – 0.58m
185	Human burial	Supine, east facing old adult female skeleton. Coffin burial as iron nails and handles recovered, though coffin wood decayed. Pelvis truncated by 160. Fill of grave cut 186.	0.45 – 0.58m
186	Grave cut	Linear, east/west grave cut. Vertical sides, rounded corners and flat base. Filled by 184 and 185.	0.36 – 0.58m
187	Human burial	Supine, east facing juvenile skeleton. Skull truncated by 173 and legs truncated by 175. Fill of grave cut 188.	0.80 – 0.85m
188	Grave cut	Linear, east/west grave cut. Vertical sides, rounded corners and flat base. Filled by 187 and 189.	0.72 – 0.90m
189	Grave fill	Moderately compact, dark brown sandy silt. Occasional small rounded stones and very occasional pot fragments. Fill of grave cut 188.	0.72 – 0.90m
190	Human burial	Partial remains of an east facing adult skeleton. Lower part of femur, patella, finger bones, pelvis and occasional rib fragments. Within burial layer 151.	0.89 – 0.96m
191	Human burial	Partial remains of an east facing adult skeleton. Lower leg bone and anklebones survive. No coffin remains. Within burial layer 151.	0.61 – 0.67m
192	Grave fill	Loose, dark brown sandy silt. Occasional small sub-rounded pebbles and charcoal, pottery fragments and disarticulated bone. Fill of grave cut 194.	0.65 – 0.75m

Context	Classification	Description	Depth below ground surface – top and bottom of deposits
193	Human burial	Supine, WNW-ESE facing young adult male skeleton. Truncation has removed the skull and leg bones. A few teeth remain. The remaining skeletal elements have been damaged by grave cut 186. Fill of grave cut 194.	0.65 – 0.70m
194	Grave cut	WNW-ESE aligned grave cut. Vertical sides, flat base. Filled by 192 and 193.	0.65 – 0.75m
195	Human skull	Disarticulated adult skull. Poor condition. Within burial layer 151 and associated with burial 177.	0.53 – 0.59m
196	Human skull	Disarticulated adult skull. Poor condition. Within burial layer 151 and associated with burial 177.	0.53 – 0.59m
197	Grave fill	Loose, dark brown silty loam. Occasional small sub-rounded pebbles and charcoal flecks, pot fragments and disarticulated bone. Heavily truncated. Fill of grave cut 199.	0.70 – 0.75m
198	Human burial	Partial remains of a supine, east facing adult skeleton. Ribs, right scapular and two vertebrae left in situ. Left chest overlain by a circle of copper pins and coffin fragments. Fill of grave cut 208.	0.70 – 0.75m
199	Grave cut	Vertical sides, flat base. Truncated by 208 and 209. Filled by 197 and 198.	0.70 – 0.75m
200	Grave fill	Loose, dark brown silty loam. Occasional sandstone fragments, small sub-rounded pebbles and charcoal flecks. Fill of grave cut 202.	0.55 – 0.71m
201	Human burial	Partial remains of an east/west oriented adult male (?) burial. Tibia, fibular, patella, and disturbed left foot bones present. Fill of grave cut 202.	0.64 – 0.71m
202	Grave cut	Partially visible linear, east/west grave cut. Vertical sides, flat base. Filled by 200 and 201.	0.55 – 0.71m
203	Grave fill	Loose, dark brown silty loam. Occasional disarticulated bone, small sub-rounded pebbles, limestone fragments and charcoal flecks. Fill of grave cut 205.	0.55 – 0.71m
204	Human burial	Partial remains of a supine, east facing adolescent male skeleton. Right leg, pelvis and lower left leg remaining. Fill of grave cut 205.	0.68 – 0.71.
205	Grave cut	Linear, east/west grave cut. Vertical sides, flat base. Filled by 203 and 204.	0.55 – 0.71m
206	Grave fill	Loose, dark brown silty loam. Frequent small sub-rounded pebbles, limestone fragments and charcoal flecks. Fill of grave cut 208.	0.59 – 0.99m+
207	Human burial	Partially exposed east facing adult skeleton. Skull, right humerus, patella and proximal tibia exposed. Fill of grave cut 208.	0.89 – 0.99m+
208	Grave cut	Partially exposed linear east/west grave cut. Vertical sides. Filled by 207 and 206.	0.59 – 0.99m+
209	Grave fill	Partially exposed loose, mid brown silty loam. Frequent small sub-rounded pebbles, occasional charcoal and limestone fragments. Fill of grave cut 210.	0.73 – 0.95m+
210	Grave cut	Partially exposed east/west grave cut. Vertical sides. Filled by 209.	0.73 – 0.95m+
211	Grave cut	Partially exposed east/west grave cut. Not excavated.	0.35 – 1.02m+
212	Grave fill	Unexcavated grave fill.	0.35 – 1.02m+
213	Human burial	Partially exposed skeleton. Leg bones and some foot bones present. Not excavated.	0.96 – 1.02m+

Context	Classification	Description	Depth below ground surface – top and bottom of deposits
214	Grave cut	Linear east - west grave cut. Vertical sides, flat base, rounded corners. Filled by 215 and 216. (Remains of a possible foetal burial recovered from this context, referred to as 2441 in Appendix 4).	0.35 – 1m+
215	Grave fill	Friable, dark brown sandy silt. Occasional pot fragments and disarticulated bone. Fill of grave cut 214.	0.35 – 1m+
216	Human burial	Partial remains of a supine, east facing adult skeleton. Heavily truncated and lower body remains only. Some post-depositional disturbance. Fill of grave cut 214. (Referred to as 2162 in the human remains Appendix 4).	0.91 – 1m+
217	Grave cut	Linear, east/west aligned cut. Vertical sides, flat base, rounded corners. Filled by 218 and 221.	0.37 – 1.01m
218	Grave fill	Moderately compact, dark brown sandy silt. Occasional fragments of post-medieval pottery and disarticulated bone. Fill of grave cut 217.	0.37 – 1.01m
219	Coffin	Friable, very light brown wood. Remains of coffin for burial 220. Survives on the right side of the cut only, coffin handles present. Fill of grave cut 217.	0.90 – 1m
220	Human burial	Supine, east facing old adult female skeleton. Good condition. Overlain by coffin plate 221. Fill of grave cut 217.	0.86 – 1.01m
221	Coffin plate	Remains of a thin iron plate lying on pelvis of 220. Yellow painted description partially legible, reads: 'Mary Rod?n, aged 87 yrs, died ?4th June 1844'. Text located within a shield with a twisted rope insigne around the edge of the coffin plate. Fill of grave cut 217.	0.94 – 0.95m
222	Burial soil horizon	Same as 151.	0.59 –1.05m+
223	Human skull	Disarticulated infant skull. Right side of skull only partially visible. No other related bones. Left in situ.	0.54 – 0.66m
224	Grave cut	Partial remains of an east/west grave cut. Vertical sides. Extends beyond edge if excavation. Filled by 225 and 226.	0.91 – 1.05m+
225	Grave fill	Friable, dark brown sandy silt. Partially excavated. Fill of grave cut 224.	0.91 – 1.05m+
226	Human burial	Partial remains of an east facing adult skeleton. Left articulated arm (radius, ulna and hand bones) present. Truncated by 217. Fill of grave cut 224.	0.91 – 0.94
227	Grave cut	Linear, east/west oblong grave cut. Vertical sides, right angled corners. Filled by 228-231.	0.80 – 0.85m
228	Coffin	Friable, light brown-yellow wood. Remains of coffin for skeleton 230. Survives at base of cut and sides of the skeleton only. Fill of grave cut 227.	0.83 – 0.85m
229	Coffin plate	Remains of a thin iron plate lying over the pelvis and lower ribs of skeleton 230. Corroded and illegible. Similar to 221. Fill of grave cut 227.	0.75 – 0.76m
230	Infant burial	Partial remains of a supine, east facing infant (0.6–2 years) skeleton. Damaged remains, with right leg missing and a crushed skull. Fill of grave cut 227.	0.79 – 0.84
231	Grave fill	Moderately compact, dark brown sandy silt. Fill of grave cut 227.	0.80 – 0.85m
232	Grave fill	Loose, dark brown silty loam. Occasional sub-rounded pebbles, brick fragments, disarticulated bones, and charcoal flecks.	0.90 – 1.50m

Context	Classification	Description	Depth below ground surface – top and bottom of deposits
233	Human burial	Partial remains of a supine, east facing adult skeleton. Heavily truncated by 236, with skull, left arm and scapula remaining only. Associated finds were an iron coffin handle and nails (SF68-71).	0.77 – 0.90m
234	Grave cut	Linear, east - west grave cut. Vertical sides, flat base. Heavily truncated to south be 236. Filled by 232 and 233.	0.90 – 1.50m
235	Grave fill	Loose, dark brown silty loam. Occasional small sub-rounded pebbles, and charcoal flecks. Partially excavated. Fill of grave cut 236.	0.90 – 0.98m
236	Grave cut	Partially exposed east - west grave cut. Vertical sides, flat base. Filled by 235.	0.90 – 0.98m
237	Coffin fill	Partially exposed, very loose, dark brown-black silty loam. Occasional sub-rounded pebbles, pot fragments and charcoal flecks. Fill of coffin with grave 239.	0.97 – 1.07m+
238	Grave fill	Loose, dark brown silty loam. Occasional sub-rounded pebbles, pot fragments and charcoal flecks. Fill of grave cut 239.	0.48 – 1.07m+
239	Grave cut	Linear, east/west grave cut. Not excavated. Filled by 238.	0.48 – 1.07m+
240	Grave cut	Linear, east/west grave cut. Vertical sides, right angle corners. Filled by 241 and 242.	0.51 – 1.02m
241	Grave fill	Moderately compact, dark brown sandy silt. Occasional rounded stone, pot and bone fragments. Fill of grave cut 240.	0.51 – 1.02m
242	Human burial	Supine, east facing young adult female skeleton. Largely intact although truncation by 243 has removed the skull and thoracic vertebrate, and cut 227 has removed humerus, scapula and clavicle. Fill of grave cut 240.	0.92 – 1.03m
243	Grave cut	Partial east/west grave cut, vertical sides. Not excavated.	0.85m+
244	Grave fill	Loose, dark brown silty loam. Occasional small sub-rounded pebbles, and charcoal flecks. Fill of grave cut 246.	0.74 – 1.10m
245	Human burial	Supine, east facing young adult female skeleton. Skeleton slightly hunched to left side. Good condition. Fill of grave cut 244.	1 – 1.10m
246	Grave cut	Linear, east/west grave cut. Vertical sides, flat base. Filled by 244 and 245.	0.74 – 1.10m
247	Grave cut	East/east grave cut, vertical sides, flat base. Poorly defined. Filled by 284 and 249.	1 – 1.15m
248	Human burial	East/west aligned adult female burial. Poor preservation, fragmented iron coffin plate resting over pelvic area.	1.07 – 1.15m
249	Grave fill	Loose, dark brown silty loam. Occasional small sub-rounded pebbles, and charcoal flecks. Fill of grave cut 247.	1 – 1.15m

Appendix 4 Analysis of the human remains

1. Introduction

The aim of this report is present the data collated from the osteological analysis of human skeletal remains recovered from the site of the former burial ground of St. Andrew's Church, Worcester city. The excavation was carried out by Worcestershire Historic Environment and Archaeology Service between June and August 2005. The data presented here will be set in its historic context concerning the social history of the parish of St. Andrew's obtained from contemporary records. This covers a wide range of aspects of life in Worcester city in the late Georgian and early Victorian period: population demographics, lifestyles and occupation, adaptation of individuals to the environment of the Industrial period in terms of health and disease, economic structure, availability of medical care in Worcester and finally funerary practices of the time. It is hoped that by combining all the evidence available from this period and taking a multidisciplinary, biosocial approach to its analysis, a detailed, albeit brief, insight into the lives of people in St. Andrew's, Worcester during this period will be gained.

2. St Andrew's: The population from historical records

2.1 Demographic Structure and Economic Profile

Analysis of the 1831 census returns provides some useful information regarding the social and economic background of the population from St. Andrew's burial ground. Many of the individuals represented by the skeletal remains recovered are likely to have been living around the time this census was taken (see Burial Practices; St Andrew's Churchyard, below) and this data was used as it was thought to be the most representative of the population under examination.

Though abolished in 1898, in 1831 St. Andrew's was a small but heavily populated parish of the city of Worcester. As illustrated in Figure 1, St Andrew's can be seen to occupy a small area containing only a few streets. However, this area contained 350 occupied houses and 49 unoccupied dwellings at this time, a peak number of houses that dwindled in number after 1830 (Great Britain Historical GIS Project 2004). The occupied houses were inhabited by 481 families comprising in total of 1,945 people. Therefore, it appears that over a third of the occupied houses were shared by two families with an overall average of 5-6 people living in one house. Living conditions here appear to have been poor during this period; housing in St Andrew's consisted of old medieval buildings "here and along Newport Street and Dolday, becoming the core of the urban slum which characterised the area in the late 18th, 19th and early 20th century". (Worcester City Council 2006).

Figure 1: *St. Andrew's Parish Boundaries in the 19th Century (1st series map)*

Plate 1: *Area off Newport Street c.1930*
(After Lovell, Archenfield Archaeology, 2004).

A photograph of the Newport Street area (see Plate 1) illustrates the crowded narrow medieval streets and courts that would have provided housing for a large number of the population. In 1849, the Health in Towns Society reported that "only one mile of new sewers has been laid [after a cholera outbreak in 1832] and that the poor were living in courts of 5 to 20 houses, served by one or two privies, emptying into a central cess pit which itself was emptied perhaps once every six months – the worst areas lying between the High Street and the River" (Worcester City Council 2006. Conditions only appear to have improved following The Artisans and Labourer's Dwellings Act in 1868.

The economic structure of the population also reflects the lower social status of the majority of the population. The 1831 census returns reveal that of the 1,945 people living in St. Andrews, 907 were male and 1038 were female. Few details are given of the occupations of the females. Of the 458 males that were 20 years old or over (several males younger than 20 years of age would have been employed as apprentices), 220 were employed in the retail trade or handicrafts as masters or workmen whilst 108 were employed in manufacture or in making manufacturing machinery. A further 77 were labourers in separate fields. Figure 2, below, indicates the small percentage of males in educated, professional careers ($n = 5$, 1%).

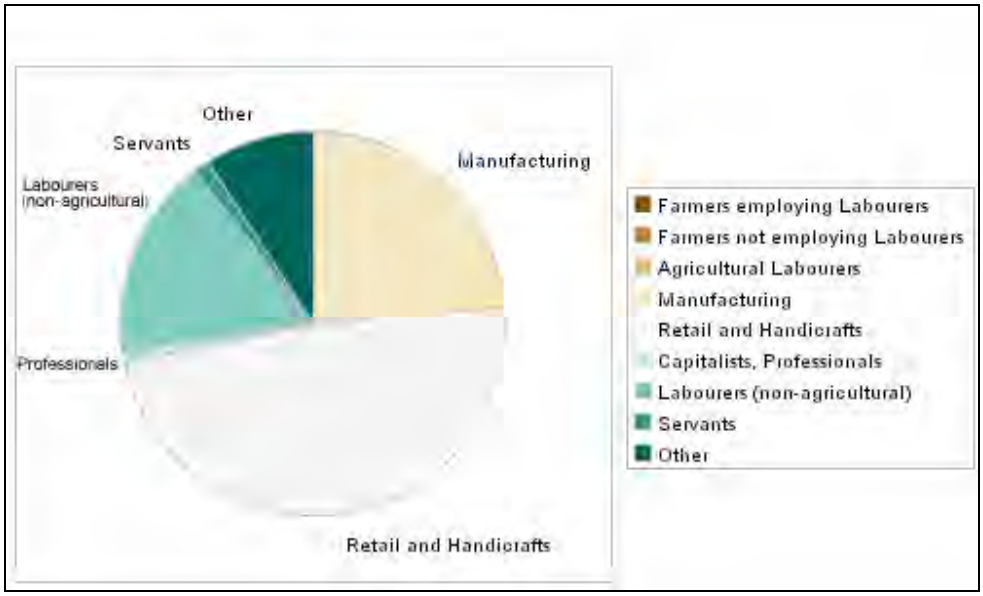


Figure 2: *Occupational statistics of males aged 20 years or over from St. Andrew's parish* (Great Britain Historical GIS Project 2004).

The census returns are a good indicator of the general occupations held by the inhabitants of St Andrew's, consisting mainly of labourers and workers involved in the handicrafts and retail trade, more likely than not employed in the dominant glove manufacturing industry, seated at this time between Deansway and the waterfront of St Andrew's. (Worcester City Council 2006). It is also likely that several members of St Andrew's population were involved in Worcester porcelain production, the main factories having been located along the waterfront in nearby areas. The comparison in Figure 3, below, shows that a much higher percentage of males living in St Andrew's parish were involved in manufacturing than the national average. However, individuals involved in these trades were not necessarily perceived by contemporaries as being of low social status. Definitions of social status at the time of the census would roughly have been as follows:

Employers and "Educated Men" (1831 definition): *described either as "Agriculture: Occupiers employing Labourers" or as "Capitalists, Bankers, Professional and other Educated Men".*

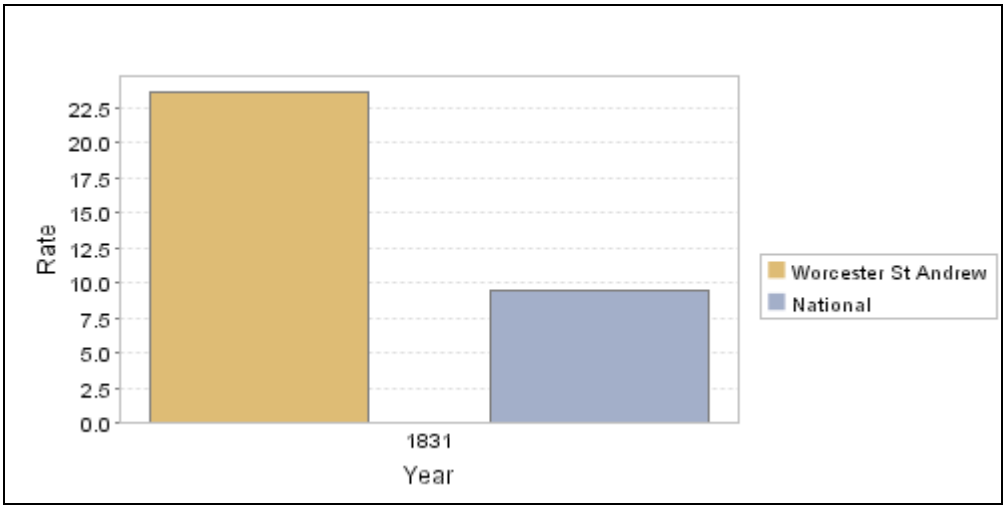


Figure 3: *Comparison of the percentage of male individuals from St Andrew's involved in manufacturing to the national average.* (Great Britain Historical GIS Project 2004)**.**

"Middling Sorts" (1831 definition): *described as farmers "not employing Labourers", as "Employed in Manufacture, or in making Manufacturing Machinery", and as "Employed in Retail Trade, or in Handicrafts as Masters or Workmen". This is certainly not a modern notion of "the middle class" as it includes many skilled manual workers, but it is very roughly what people at the time would have called "middling sorts".*

Labourers and Servants (1831 definition): *described either as "Labourers", both agricultural and non-agricultural, or as "Servants".* (Southall 2004).

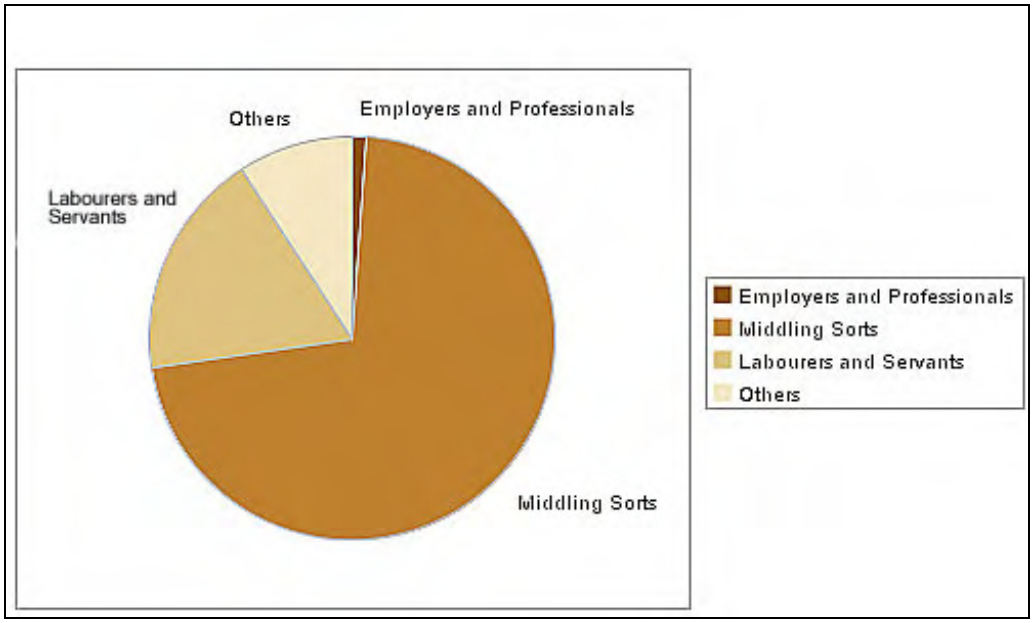


Figure 4: *Social Status of the St. Andrews population using definitions of 1831*(Great Britain Historical GIS Project 2004)**.**

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The social status of this population at the time would, therefore, have been described as mainly being of the "middling sort" (see Figure 4) despite the labour-intensive nature of the occupations of the majority of the population and the seemingly harsh living conditions.

The demographic data from the 1831 census would suggest that the population consisted of approximately half males (46.6%) and half females (53.4%); of the males, almost half were under the age of 20 years (49.5%). Specific fertility and infant mortality rates for the population of St Andrew's were not available but it can be seen from Figures 5 and 6 that later, in 1851, fertility rates were considerably lower and infant mortality rates considerably higher for Worcester city than the national average. These rates are generally found to be a good indicator of the general health of a population; if this data compiled from the Worcester population as a whole reflects at least in part the health of the population of St. Andrews, it would appear to have been comparatively poor, despite the majority of people living there being classed as of "middling" social status.

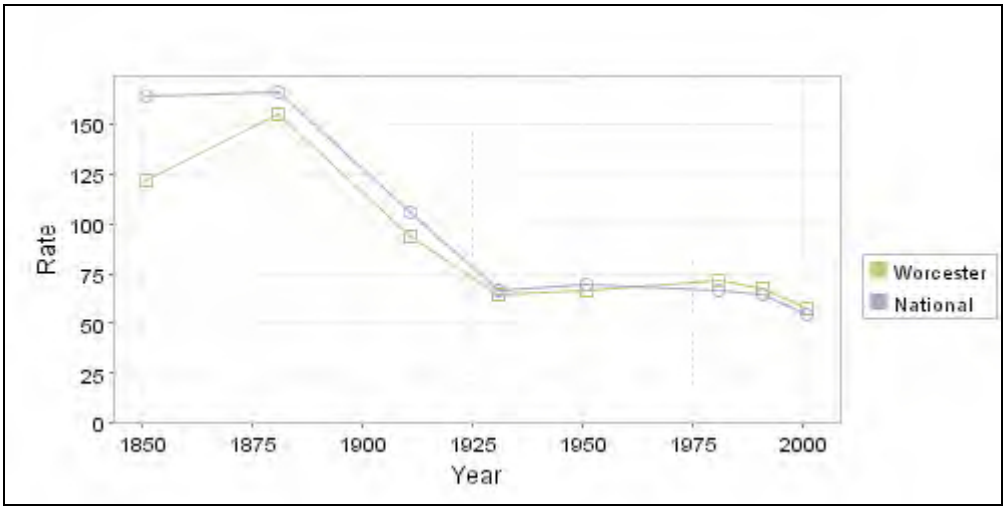


Figure 5: Fertility rates in Worcester 1851-2000 (live births per 1000 women aged between 20-49) (Great Britain Historical GIS Project 2004).

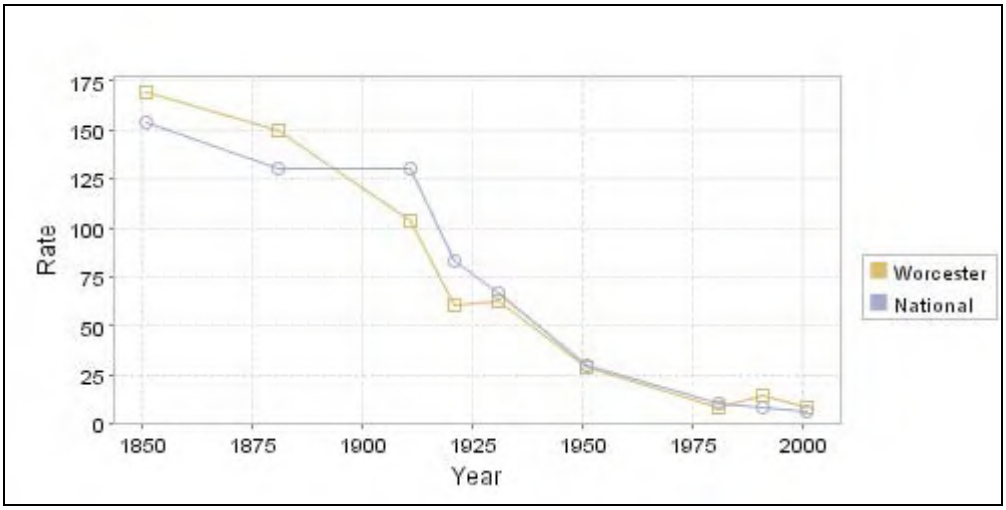


Figure 6: Infant mortality rates in Worcester 1851-2000 (deaths per 1000 live births) (Great Britain Historical GIS Project 2004).

2.2 Health, Disease and Occupational hazards

Health and prevalence rates of disease are inextricably linked with social status and contemporary medical knowledge. Whilst an individual's health status will vary according to their particular nutritional intake and exposure to disease, these factors are largely determined by accessibility to adequate food, water and health care as well as living and working conditions; financial means would have been critical in determining the nature of the environment to which an individual was exposed. The general housing and sanitary conditions of St. Andrew's parish, as described above, can be seen to be poor at least in parts of the area. Many houses were crowded and this would have contributed to the spread of diseases, particularly those of an infectious nature transmitted through human-to-human contact.

Throughout the late Georgian and Victorian period, a number of conditions were endemic in Britain and the spread of some was so rife that there resulted epidemic outbreaks. Diseases such as smallpox, typhus, cholera, typhoid, tuberculosis and influenza all took a major toll on populations living in overcrowded, run-down housing with little provision for sanitation or drainage. Many of these diseases were only eradicated, or at least their prevalence rates dramatically reduced, during the late Victorian period; smallpox vaccinations became compulsory (despite having been available to those who could afford such an expensive, albeit at this time much less efficient, treatment from the early 18th century) and the provision of better housing and sanitary conditions, coupled with new medical discoveries, eradicated diseases such as typhoid, cholera and typhus. Many of these diseases were clearly linked with overcrowding and typhus was referred to as "an unerring index of destitution" (Lane 2001). Tuberculosis was endemic in England between 1780 and 1830 and in 1839 was calculated as being the cause of death of 17.6% of the population. Of course, diagnoses at the time may not have been as accurate as in modern day clinical practice but nonetheless, tuberculosis continued to be the most common cause of death amongst young adults until the 1940's (Lane 2001). Life expectancy was 41 years for males and 43 years for females in 1841 (Roberts and Cox 2003), though this is in part exacerbated by the high infant mortality rates demonstrated in Figure 6. The burial registers from St Martins-in-the-Fields, Birmingham, show that of the adult population, 24% would be classified as young adults (20-34 years old), 24% as middle adults (35-49 years old) and 52% as old adults (50+ years) (Brickley *et al* 2006). It should be remembered that most of the epidemic diseases would have had the greatest impact on the youngest individuals. Mortality tables for London show, for example, that in the 1830's and 1840's, 35% of individuals died before the age of 5 years old (Roberts and Cox 2003). It is generally considered that once over the age of 5 years, that average life expectancy of an individual would be greatly increased, a fact that is bourn out by both demographic and archaeological data (Kausmally 2004, Roberts and Cox, 2003).

In addition to the endemic diseases and epidemic outbreaks that hit many urban populations throughout England, occupational diseases were also especially commonplace amongst those who worked in the many trades of the Industrial period. Prior to the later Victorian period, the recognition of the need for improvements in the workplace for lower class labourers was largely ignored and conditions in factories and workplaces exposed individuals to further hazards to

their health. A large number of the population of Worcester and in particular of St Andrew's would have been involved in the manual labour required for the production of pottery and gloves, factories for both being located along the water front due to the need for large quantities of water (Buteux 2003, Clarkson, 1966). The specific risks of workers in the employment of these trades in the city was documented in contemporary accounts written by the physician at Worcester Infirmary and the President of the Worcester Medical and Surgical Society, Sir Charles Hastings (1794-1866) (Cohen, 1960). His main focus was on the chest and other diseases among the leather dressers, glovers, needlepointers, china workers and stone cutters in Worcester (Bartrip, 2003). Subsequently, Thomas Arlidge, another physician investigating the effects of the environment of potteries on health, concluded that the most prevalent conditions amongst male workers were bronchitis, phthisis (tuberculosis), rheumatic afflictions, stomach disorders and lead poisoning; for women, the most common complaints were stomach disorders, uterine maldies, phthisis (tuberculosis), anaemia, bronchitis and lead poisioning (Bartrip, 2003). The main cause of this apparent high prevalence of pulmonary diseases was the inhalation of dust containing silica (Hicks, 2006):

"In the process of baking china, around flint used to imbed each piece of ware in as it goes into the oven, in order that it may not undergo any change of shape when at intense heat. After the ware has been baked this fine powder has be to brushed off. Females are employed in this process, sometimes children. The irritating dust they inhale in this occupation frequently gives rise to rough and other pulmonary ailments, which sometimes terminate in phthisis." (J. B. Davis, Surgeon 1840, for the Scriven Report on Child Labour).

Silicosis, known amongst other things as 'Potter's Rot' at the time, is usually a chronic disease deteriorating over time, leaving the lungs scarred or fibrotic due to a strong inflammatory reaction to the inhaled silica. The disease in incurable, rendering sufferers more susceptible to lung infections and tuberculosis. Smoking also leads to the accelerated deterioration of the condition (Hicks 2006).

Lead poisoning was also known to cause a number of health problems amongst pottery workers, particularly those involved in the dipping and painting processes. Lead poisoning can lead to blindness, miscarriage, paralysis and death; yet as late as 1897, despite repeated reports to Parliament regarding the subject, 42% of cases of lead poisoning still occurred in pottery and earthenware manufacture (Bartrip 2003).

Those involved in the glove manufacturing trade were more fortunate as this on the whole involved contact with less hazardous materials. Nonetheless, it could still prove to be a dangerous occupation as the primary processing of hides involved suspending the skins in pits containing solutions of lime in order to loosen hair and outer tissues (Buteux 2003). Tanning pits containing lime used for this purpose have been found as a result of archaeological excavations in Birmingham (Buteux 20030). Lime and lime water can cause serious corrosive burns to the skin and eyes and if ingested, to the gastrointestinal tract; furthermore, prolonged and repeated inhalations may damage the respiratory tract (Castle Cement 2006). It may also aggravate pre-existing inflammatory or fibrotic pulmonary conditions (International Industrial Gases, 2006). Another threat was 'Woolsorter's Disease' or pulmonary anthrax, known to have affected those in the tanning trade. This was a fatal disease culminating in the death of its victim after only 2 or 3 days after contraction (Exotic Diseases Resources Associates 2006).

Fortunately, this disease is rarely spread through human contact but nonetheless was a particularly perilous threat.

The full impact of occupational diseases was not formally recognised until the late Victorian period, though attempts to highlight the plight of children and general safety in the workplace began with the introduction of the *Factory Act* in 1844 (Bartrip 2003). Many of these diseases were seen as being inflicted upon the deserving at God's will by the moral codes of the day and employers, keen to improve their competitive trades, were extremely reluctant to take any responsibility for the welfare of their employees that resulted in increased manufacturing costs, claiming that the unsanitary conditions and the lack of cleanliness of their workers were the cause of many of the maladies (Bartrip 2003). Not until the discoveries of specific causative agents by the medical practitioners through its increasing knowledge of disease aetiology and human anatomy, as well as its growing weight as a recognised professional body, was legislation improving work, home and sanitary conditions finally introduced.

2.3 Medical and Community Support

The late Georgian and early Victorian period saw a number of dramatic changes in the development of the medical profession and the manner in which medical and social aid was administered. The medical profession in the late Georgian period predominantly consisted of practitioners who had undertaken an apprenticeship with a recognised surgeon-apothecary and who worked on the whole under terms of contract to small hospitals and Guardians of the Poor. Medical practice was well established in Worcester at this time to the extent that in 1755, a surgeon's instrument shop was opened in Worcester by Edward Cropper (Lane 2001). There was a variety of practitioners whom the parish council could call upon for medical treatment besides the surgeon-apothecary, such as midwives and bonesetters, but all were costly; fees were charged according to the severity of the ailment and the complexity of its remedy. Fractured and displaced bones were amongst the most expensive treatments and these were charged for on a scale of the difficult of setting the bone or joint. For example, £3, 3s was charged in Epsom as a set fee by the surgeon-apothecary for the setting of a broken leg or thigh, £2, 2s for a main arm bone and £1, 1s for a fractured clavicle, rib or small bone (Lane 2001). Those who sought Poor Relief would not only have benefited from free medical treatment, generally administered at home, but any food, drink, fuel, bedding and sometimes even clothes required during any period of confinement, if deemed appropriate, all to the cost of the parish. Poor Relief was also administered by small, local Poorhouses to those classified as paupers. In 1777, three workhouses are recorded in Worcester as housing 90 inmates Higginbotham (2006).

During this period a growing number of hospitals emerged that were specifically designed and constructed for the function of treating patients; these were run as charitable organisations for the poor championed by wealthy patrons. Worcester was fortunate to benefit from the opening of The Worcester General Infirmary in 1771, which was supported by the patronage of Lord Coventry. The admission of poor patients to the hospital, however, was strictly limited to those who had been referred by the local surgeon-apothecary with a letter of support. Treatment was also restricted by the available facilities during the late 18th century as well as administrative practices; only 60 beds were available in the hospital during this

period and patients were only admitted to the Worcester General Infirmary on Saturdays at 11am (Lane 2001). Those with mental illnesses, such as epilepsy, whose behaviour may have upset other patients, along with those suffering from incurable diseases or who were otherwise 'unacceptable' were not admitted (Lane 2001). It would appear that only a small proportion of those who required professional medical attention would have received it through hospital care.

During the late 18th and early 19th centuries, the pressures of a growing population and its increasing need for the ever expanding medical treatments led to a complete revision of the provision of aid to the Poor. The medical profession became more widely recognised as a unified and cohesive organisation with the foundation of the Provincial Medical and Surgical Society (later to become the British Medical Association) in 1832 in Worcester by Charles Hastings (Cohen of Birkenhead 1960), transforming it from its previous empirical and somewhat informal state. Knowledge of human anatomy (particularly after the Anatomy Act of 1832) and medicinal aid was expanding almost exponentially during this period. Subsequently surgeon-apothecaries were in increasing demand by many societies and institutions. This demand for medical attention was concomitant, however, with the rise of a series of socio-economic factors, such as pressure on local communities from population growth and the growing numbers and decreasing tolerance of paupers, whose financial burden upon the community was recognised as becoming increasingly problematic (Lane 2001). In 1792, a local Act *For the better Relief and Employment of the Poor of the several Parishes within the City of Worcester…and for providing a Burial Ground for the Use of such Parishes* resulted in the construction of a new, centralised workhouse and burial ground at Tallow Hill in 1794, housing 221 inmates (Higginbotham 2006). Subsequently, in 1836, following the New Poor Laws of 1834, The Worcester Poor Law Union was formed, after which neither financial nor medical support was administered in the parish community. The Union workhouse in Worcester itself had infirmary facilities so that treatment was administered on site whilst residing in the workhouse. The workhouse infirmary became the main provision of medical treatment for the poorest individuals.

Outside of the Workhouse in the early to mid 19th century, alternatives for those being able to provide for themselves did exist. Apart from the General Infirmary, dispensaries could provide for patients "who were improper objects for the Infirmary" and these proved increasingly popular after the 1800's. Usually founded by charitable organisations, medical non-residential treatment was available to the poor for free or for small sums of money. In-patient facilities were often restricted but generally the dispensary could treat large numbers of patients who otherwise may have received no attention at all (Lane 2001).

Many of the population of St Andrew's, however, are likely to have been a member of a 'friendly society', subscription to which would provide a medical insurance should a member become incapacitated and unable to work. Friendly societies were in existence from the mid 18th century to the late 19th century. Worcester had 1,189 friendly societies in operation at this time (Lane 2001). Rather than being 'pauperised', members whose subscriptions were up to date could apply for financial provision to be made through their friendly society until they were able to work and provide for themselves again. Societies would employ a surgeon-apothecary on a contract basis to assess the illness and certify the needs of the individual as well as to provide any necessary medical attention. Some societies also paid a subscription to the local Infirmary so that medical treatment

could also be provided there if required. Societies were single sex and often associated with specific trades. To join, men were required to be in employment and aged between 20-40 years old. An annual contribution of 13s on average was paid (Lane, 2001). The joining age of Women's societies, founded slightly later, essentially reflected their child-bearing ability, and was from around 15-45. This was mainly due to the fact that although widows of male friendly society members would receive a small sum of compensation upon the death of the husband, unemployed single women, widows as well as pregnant woman either single or married (midwifery and child-birth treatment being exempt from male friendly society conditions), would not receive any support. The foundation of Women's Friendly Societies was vital for a large number of females to avoid pauperisation. Friendly societies provided not only medical treatment whilst members were "on the box" but also paid for the burial and funeral costs of its members. Through the medium of the Friendly Society, it was possible for those who may otherwise have been forced into the Workhouse through poverty and sickness to avoid the stigma of pauperism and that of the pauper burial (Lane 2001).

2.4 Burial Practices – The 'Dearly' Departed

The burials at St Andrew's reflected the predominant Christian beliefs of the period and were aligned in an East-West orientation, with the head at the west end of the grave so that the individual would be facing the east looking towards Jerusalem at the time of the Resurrection. Several of the burials are truncated by later disturbance and it is clear that during this period the churchyard of St Andrew's was being heavily used. This is not only testified to be the intercutting nature of the burials, with some disarticulated material of a previous occupant being placed in the new grave (see Plate 2) but also by the physical evidence presented by the skeletal material itself from peri- and post-mortem damage inflicted (See The Physical Evidence – the People of St. Andrew's). The growing population concomitant with the high mortality rates experienced meant that the facility provided by the parish burial ground was being stretched to its absolute limits.

Plate 2 :*Collection of long bones (context 179) deposited with a later interment (SK177) (after WHEAS 2005).*

In 1849, a report was submitted to the recently founded Worcester General Board of Health to present the situation regarding the burial grounds of all the parishes in Worcester and their impact on the health of residents (Curtis, unpublished). St Andrew's churchyard was found to be in a similar condition to many of the others, although was still in use at the time, unlike St Nicholas's and St Helen's, which were already too full to use. The stench arising from the churchyards due to putrefaction of bodies was complained about by local residents and by this time sextons at St Andrew's were said to be unable to dig any grave without disturbing other coffins, coffins often being smashed in to make room for further burials on top. Sextons managing a churchyard generally rotated the use of designated areas of the burial ground and were also known to use boring rods, testing the ground to avoid disturbing previous interments (Buteux 2003). However, it is clear by 1849 there simply was no room left to prevent this occurring and the use of these methods was fruitless. This was a problem experienced nationally and was also evident at the churchyard of St-Martins-in-the-Bullring, Birmingham (Brickley et al 2006), where a substantial and disproportionately high wall surrounded the Churchyard during the period of its heaviest use; towering above the street; contemporaries feared that the Church itself may be buried by the dead (Buteux 2003).

In addition to the lack of space, funerary practices at the time further presented dangers to public health. Generally, the Victorian funeral was one of as much pomp and circumstance as could be afforded – in many cases, exceeding what could be afforded in order to provide what was perceived at the time to be a 'decent funeral'. Individual coffins were now in common use with a range of soft-furnishings, trims and coffin furniture available, as well as paraphernalia customary for the funeral march and mourning attire for the relatives (May 1996). The increased social mobility of the era created the *nouveau riche* class, keen to assert their status and respectability in death just as in life. The newly founded trade of Undertakers were eager to provide all manner of trappings considered 'proper' for a funeral, notorious for playing on the perceived social obligations of the mourners. This, especially for the poorer classes, could mean spending a whole weeks wages on the simplest possible 'decent' burial (May 1996). The most feared burial was the pauper burial; a public disgrace to be seen not to be able to provide one's own means in this society of a rather Malthusian persuasion, in many cases quite a brutal disposal followed the death of paupers and these bodies were not laid to rest for long; Engels gives a contemporary account of inner-city pauper burials:

"In death as in life the poor in England are treated in an utterly shameless manner. Their corpses have no better fate than the carcasses of animals. The pauper burial ground at St. Bride's in London is an open piece of marshland which has been used since Charles II's day and there are heaps of bones all over the place. Every Wednesday the remains of dead paupers are thrown into a hole which is fourteen feet deep. A clergyman gabbles through the burial service and then the grave is filled with loose soil. On the following Wednesday the ground is opened again and this goes on until it is completely full. The whole neighbourhood is infected by the dreadful stench from this burial ground."

"In Manchester there is a pauper burial ground in the Old Town on the other side of the Irk. This too is a desolate piece of waste ground. Two years ago a new railway line was built which ran through the burial ground. Had it been a

churchyard in which 'respectable' people were interred the middle classes and the clergy would have protested loudly against the desecration of the burial ground. But since it was only a pauper burial ground - the last resting place of 'superfluous' paupers - they did not show the slightest concern. No one bothered to give a decent burial on the other side of the churchyard to the half-decayed corpses which were dug up to let the railway go through. The navvies dug holes where they pleased and great stakes were knocked into fresh graves. Since the men were working in marshy land, water containing putrefying matter from these graves was forced up to the surface and the whole district suffered from the nauseating and dangerous gases, which filled the air. I cannot give the more revolting details about the consequences of this callous and disgusting act."

The Condition of the Working-Class in England in 1844

Even after stripping away the political veneer of these comments, it can be seen that those who suffered a pauper burial really did meet an undignified end. Many feared not only the stigma of burial in an unmarked and undignified mass grave, often disturbed by later work but also the high risk of the bodies left to the charge of the Poor House being snatched and sold for dissection. Unclaimed bodies or bodies claimed by 'friends' were at this time the prime source of cadavers for anatomy demonstration in teaching hospitals (Richardson 2001). Being able to provide financial means for a funeral allowed some peace of mind that the body should be preserved intact for the Resurrection, not only from disturbance of subsequent construction but also from the 'Resurrectionists'. Of course, the more financial means available, the more suitable the burial could be to meet this purpose and that of providing a 'proper' send off.

Recent excavations at the New City Burial Ground, located at Tallow Hill show differences between the burial practices of the upper class and lower class families; the family of a Wine Merchant, for example, were buried in a vault of brick construction, one individual with an inscribed lead alloy coffin plate. Other vault burials revealed the presence of a decorative studded coffin, whilst some individuals in vaults were accompanied with modest personal decorative items (Vaughan 2006). Importantly, none of these burials were disturbed through later phases of burial due to their containment and protection by the brick vault. The brick vault acted as a residence for the deceased and kin, demarcating a physical as well as socio-economic boundary for the family unit.

All the individuals from St. Andrew's, in contrast, were interred in earth cut graves and several were disturbed by later burials. Despite the lower social status of many individuals, however, evidence of the importance of providing a proper burial is testified to by the presence of coffin plates accompanying several burials. Whilst there was little evidence recovered of elaborate funerary coffin furniture (although this may in part be dictated by preservation conditions) it is clear from the coffin furniture present that even those who were labourers (see The Physical Evidence: The people of St Andrew's, below) at the time, belonging to the perceived lower end of the social spectrum, ensured that loved ones received at least the more modest commodities of a proper burial, possibly with the help of subscription to friendly societies discussed above or to the growing number of burial clubs (May 1996).

Providing a decent funeral affected the poorer classes most of all, for not only would they have to spend a large proportion of their income on the funeral itself;

often, not being able to afford the cost immediately, people were accustomed to keeping the corpse in their living space until they could afford to do so. This clearly had consequences for the health of the living relatives and was an extremely unpleasant experience in already cramped, unsanitary living conditions. Indeed, being recognised as a national problem, a report was commissioned and carried out by Edwin Chadwick in 1843, the shocking findings of which were to have far-reaching ramifications for the approach to burial by society.

Chadwick (1843) found that corpses often occupied the bed of the house until money had been raised to pay for a coffin. Funerals were generally held on the Sunday following death, weather permitting, providing that funds were raised to pay for them within this amount of time. Sometimes, it could be as long as 12 days until the body was interred. The body would be retained for as long as it took to raise the finances for the funeral with no regard for any diseases that the body may be carrying and irrespective of what the individual had died of. In one case, an undertaker stored a corpse until the family could afford black clothing so that they could attend the funeral respectably.

It was clear that these practices and the growing lack of burial space required swift new regulations to deal with this impending public health crisis. In 1852, a Burial Act was passed allowing large out-of-town cemeteries to be created, run by local authorities and institutions, with strict regulations regarding burial practice imposed. In 1855, land was purchased for such a purpose and the Astwood Cemetery was opened shortly after. From 1858, the inner city parish churchyards including St Andrews, by this point completely exhausted of space, were closed for burial (Curtis, unpublished).

3. The Physical Evidence: The people of St Andrew's

3.1 Introduction

Excavations at the site of the burial ground of St. Andrew's by Worcester County Council Historic and Environmental Services in 2005 resulted in the retrieval of both articulated and disarticulated remains. These two skeletal assemblages have been analysed as separate populations here, on the basis that the disarticulated remains are thought to originate from burials that pre-date those that were articulated. Since the burial ground was used so intensely towards the latter stages of its existence, it is likely, however, that in reality at least some of these disarticulated remains do not pre-date the articulated material by a significant period of time. Nonetheless, the date of the material incorporated into the disarticulated assemblage cannot be firmly given nor can it be assumed that all the material is from the same phase of re-interment; it is possible that some much older skeletal elements have been incorporated into this assemblage. On the other hand, the articulated material can be said the represent the last phase of burial on site and furthermore, the interment of one individual was securely dated to 1844 due to the presence of a well-preserved coffin plate. Thus, the two assemblages have been analysed separately, though comparisons and overall conclusions will be drawn from both.

A coffin plate was present with one set of remains that was excavated that displayed the name, age and date of death of the individual. Subsequently, a death certificate was obtained for this individual from the General Registry Office, confirming the age, sex and cause of death. This individual will be discussed in detail later.

3.2.1 The Articulated Assemblage: Methods and Process

The skeletal material was analysed according to the standards laid out in the guidelines recommended by the British Association of Biological Anthropologists and Osteologists in conjunction with the IFA (Guidelines to the Standards for Recording Human Remains, Brickley and McKinley (eds) 2004) as well as by English Heritage (Human Bones from Archaeological Sites: Guidelines for producing assessment documents and analytical reports, Centre for Archaeology Guidelines, 2002).

- Recording of the material was carried out using the recognised descriptions contained in Standards for Data Collection from Human Skeletal Remains by Buikstra and Ubelaker (1994). A summary of the data recorded for each skeleton are contained in Appendix A of the report. Full recording forms are supplied separately to be archived with any other archaeological recording forms.

- The material was analysed macroscopically and where necessary with the aid of a magnifying glass for identification purposes. Where relevant, digital photographs have been used for illustration and a full digital image archive of all pathologies and any other features of interest has been provided on the CD-Rom enclosed with this report.

- The material was analysed without prior knowledge of associated artefacts so that the assessment remained as objective as possible.

3.2.2 Reasons for the Analysis

Osteological analysis was carried out to ascertain:

- Condition of bone present
- Completeness of the skeleton
- Inventory of the skeletal material
- Sex Determination
- Age Assessment
- Non-metric Traits
- Stature

- Skeletal Pathology
- Dental Pathology

3.3.1. The Physical Evidence in Summary

The excavations at the burial ground of St. Andrew's recovered the remains of 23 articulated individuals. In addition, some of skeletal elements from context [244] are also considered here to have a strong possibility of representing the same individual, a foetal or premature baby with distinguising pathological changes, referred to as SK [2441]. The elements were recovered in close proximity to each other from this context. Working conditions on site were very difficult due to the limitations of space, intercutting burials with post-depositional disturbance as well as difficulty in distinguishing specific grace cuts and fills due to the intensity of the use of the burial ground during the later phases of activity, so it is certainly a possibility that disturbed foetal remains from this context, in the vicinity of a soakaway, could have easily been recovered as disarticulated elements. Whilst it is possible that this individual was interred at a slightly earlier date and these remains have been re-interred, no other comparative articulated foetal remains were excavated and, therefore, it is anticipated that any prevalance rates or other statistics derived from the dataset will not be effected by the inclusion of this individual here. The articulated skeletal assemblage from St. Andrew's is, therefore, considered to represent a total of 24 individuals.

3.3.2 Condition of the skeletal material

The condition of the skeletal material was analysed macroscopically assessed and graded according to those guidelines set out by Brickley and McKinley (eds) (2004). Since most of the skeletons exhibited more than one grade of state of preservation, these categories were simplified into 4 main groups of preservation: Good (grades 0-2), Fair (grades 2-4), Poor (grades 4-5+) and Varied (more than 3 grades of condition). The comparative results are illustrated in Figure 7. Out of the 24 individuals, 29.2% were categorised as being in a 'good' state of preservation, 25% in 'fair' condition, 12.5% in 'poor' condition whilst 33.3% of individuals from this sample were of a varied condition. Factors extrinsic (such as soil acidity or hydrolic action) and intrinsic (shape and density) to the bone can contribute to its preservation; it has been reported that age of the individual can also be an underlying contributory factor to state of preservation of skeletal material, with older and younger individuals more likely to have less robust and more susceptible bones (Henderson 1987). However, the preservation of the remains from St. Andrew's appeared to exhibit no correlation on initial assessment with the age or sex, where attributable, of these individuals. Although it may be possible to infer that there should not, therefore, be any bias in the age and sex of the individuals contained in this assemblage as a result of preservation conditions, the sample under examination is a very small proportion of the St Andrew's population as a whole and caution should be taken with this observation. Overall, preservation of the material was fair or good but several individuals demonstrated variation in the state of their preservation of the outer bone cortices. This appeared to be mainly due to erosion of the surfaces from localised root action.

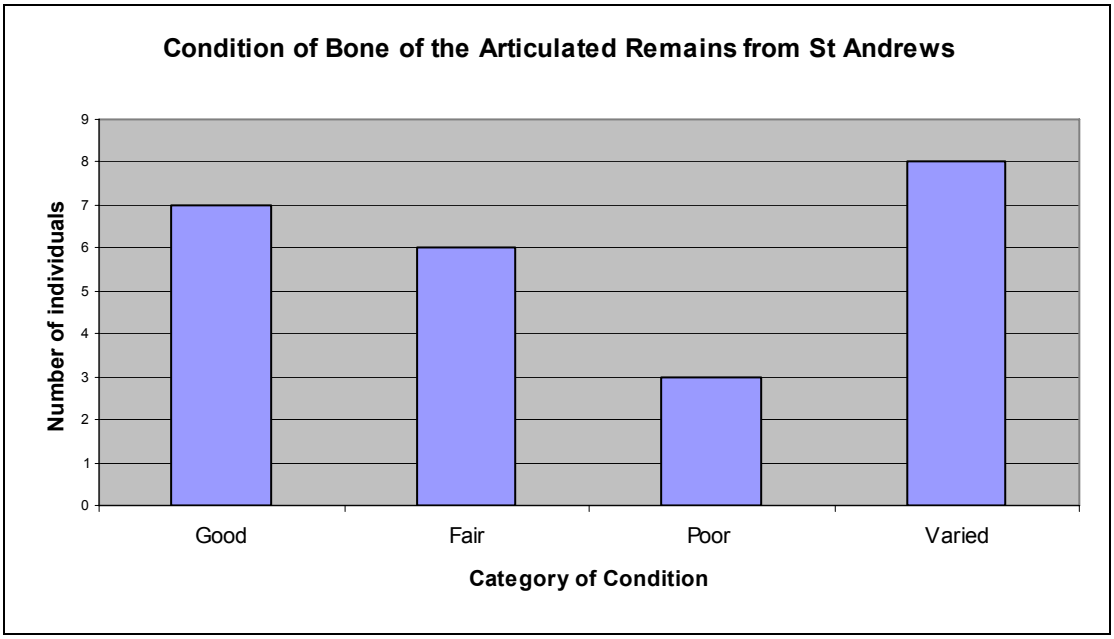


Figure 7: *Condition of Bone of the Articulated Remains*

3.3.3 Completeness of the Individuals

This is a guide to the overall completeness of the individual's skeletal remains and is calculated according to the percentage of the bones present in relation the total number of bones in a complete human skeleton. This is gauged through an assessment of the amount of material representing different areas of the body. A complete skeleton comprises of:

Skull = 20%
Torso = 40%
Arms = 20%
Legs = 20%

Each area of the skeleton was assessed and then placed into the following four categories of completeness: 75%>, 50-75%, 25-50%, <25% (Buikstra and Ubelaker 1994).

Recording the completeness of the individual can allow an insight to be gained into how much post-depositional activity has occurred as well as to assess how much information can potentially be gained from the remains. Figure 8, below, indicates that the majority of the individuals are less than 50% complete. This is likely at least in part to be a consequence of the intensive usage of the burial ground at the time as discussed above (see Burial Practices). Of those adult individuals that were 75% complete (n = 7), all were ascribed both a sex and age category, despite 50% being in a 'varied' state of preservation. Of those adults less than 25% complete (n = 8), sex could be assigned for only 3 individuals and only 1 individual assigned to an age category. This highlights the limitations placed upon the analysis of incomplete individuals.

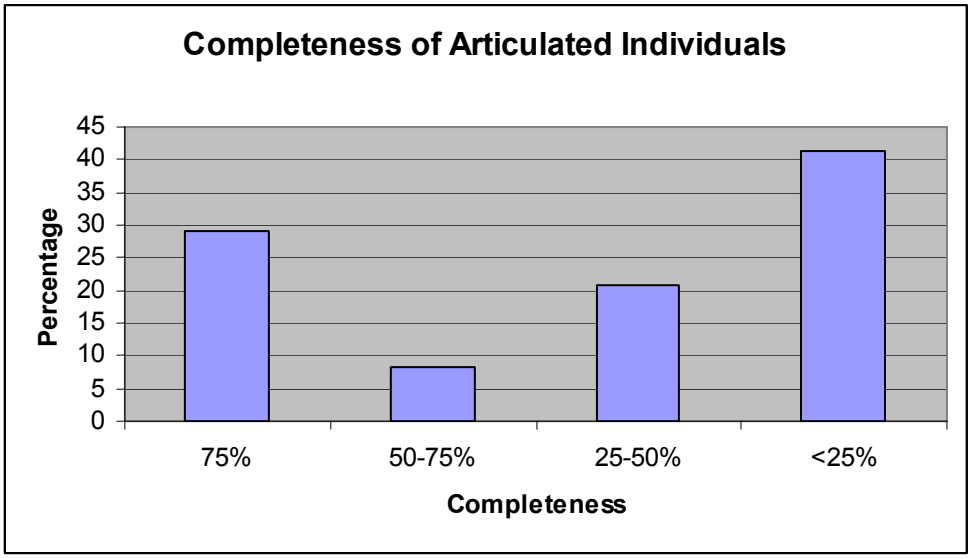


Figure 8: *Comparative percentage of completeness of articulated remains*

Of all those adult individuals whose grade of completeness was 25-50% or above (all of whom could be assessed for sex), no correlation was observed upon an initial assessment between sex of the individual and the level of completeness, nor between age assigned and completeness. All the sub-adults recovered were less than 50% complete, though 80% were in fair or good condition; unfortunately the sample of sub-adults is small and it is not clear how representative this sample is of the whole population. Overall, however it would appear that sub-adult remains were less likely to be complete than those of adults (52% of the adult sample, being less than 50% complete compared to the 100% of sub-adult sample).

3.3.4 Age and Sex Assessment

Due to the small size of the assemblage, it is difficult to draw any firm conclusions from the analysis of the demographic data. Sex was assessed using the criteria laid out by Buikstra and Ubelaker (1984) in the analysis of morphological features of the skull and pelvis. In addition, metric data was also used where possible, taking measurements of sexually dimorphic elements such as the femoral and humeral head (Bass 1995). Categories ascribed to individuals on the basis of this data were 'Male', Possible Male', 'Indeterminate', 'Possible Female', 'Female' and 'Unobservable'. No sexing of sub-adult material was attempted due to the lack of reliable criteria available. Age of sub-adults was assessed, however, using both dental development (Smith 1991) and eruption (Ubelaker 1989) as well as long bone lengths (Hoppa 1992) and epiphyseal fusion (Scheuer & Black 2004). These methods can usually provide a reasonably accurate age estimation due to a relatively narrow range of variation in normal sub-adult development. Thus sub-adults can be placed into the following age categories: Foetal (<36 weeks), Neonate (37weeks to 6 months), Infant (6 months-2 years), Child (2-5 years), Juvenile (5-12 years) and Adolescent (12-19 years). Although these groups can be seen to overlap, usually the different methods used to assess the age of a sub-adult provide a slight variation in estimated age at death Thus, for example, any individuals displaying a range from 4-5 years of age would be placed in the Child category, whilst an individual estimated to have an age at death of 5-6 years would be placed in the Juvenile category.

Assessment of adult age at death, unfortunately, results in much less specific age estimates due to a much greater individual variation in the features exhibited by the examined elements at particular ages. Age estimation of adults was assessed from analysis of the auricular surface (Lovejoy et al 1985) and the pubic symphysis (Brookes and Suchey 1990). Each of these methods examines the deterioration of these surfaces and categorises them accordingly. This deterioration is due in part to due to the health status of the individual but can also be influenced by life-style and so the variation produced by these factors results in much wider age categories: Young Adult (20-34), Middle Adult (35-49) and Old Adult (50+) (Buikstra and Ubelaker 1984).

Only 5 subadult articulated remains were recovered (1 foetal, 1 infant, 2 children and 1 adolescent) in comparison to the remains of 19 adults. Of all the individuals, therefore, only 12.5% (n = 3) were estimated to be 3 years or younger at age of death. Given the fertility rates and infant mortality rates from the 1851 data discussed earlier, it might have been expected that more sub-adult remains, especially neonate and infant individuals, would have been present. Data from comparative sites, such as St. Martin's-in-the-Bull Ring (Brickley et al. 2006), where burial registers from 1813, 1814 and 1836 were examined, also showed a significant discrepancy between the numbers of infants recorded as interred at the site: infants (1-3 years) represented 41.6% of the burial population from records whereas the percentage actually recovered at excavation was 16.3%. Results of the analysis of burials within St John's Church, Ousebridge, revealed that almost 75% of all subadult remains were aged 5 years or younger at death, although this group only constituted 19.9% of the overall assemblage (Kausmally 2004). The figures from St. Andrew's are similar; 80% of the sub-adults are aged 5 years or younger but only represent 16.7% of the total population under analysis. It is interesting to note that the high infant mortality rates expected are evident when considering the sub-adult population alone but that there is a large shortfall of sub-adult remains recovered as a proportion of the whole assemblage. This pattern appears to be a consistent finding in the context of these burial grounds and suggests that rather than being due to preservation conditions on site it is more likely to be an artefact of the intense use of the burial sites and the heavily inter-cutting nature of the earth cut graves.

The analysis of the age and sex distribution of the adults was limited by the small number of adults that could be assigned to a category of both criteria. Overall, of the 19 individuals, 4 were classified as 'Male', 3 as 'Possible Male', 4 as 'Female' and 3 as 'Possible Female'. The combined categories results in a ratio of 1:1 Male:Female. However, 2 other adults were considered to be of 'Indeterminate' sex and a further 3 were 'Unobservable', so this result may be artificial. Only 10 of the adults could be assigned an age (4 young adults, 1 middle adult and 5 old adults) leaving 9 individuals categorised as general 'Adults'. Again, the nature of the assemblage means that little can be inferred from these figures, although it is interesting to note the higher number of older adults.

Nine individuals that could be assigned both an age and a sex category, the results of which are below in Table 1:

Age and Sex	Number of individuals
Female/Poss Female Young Adult	2
Male/Poss Male Young Adult	2
Female/Poss Female Middle Adult	0
Male/Poss Male Middle Adult	1
Female/Poss Female Old Adult	4
Male/Poss Male Old Adult	0

Table 1: *Demographic profile of the skeletal assemblage from St. Andrew's*

One further individual was considered to be an 'Old Adult' but the sex was 'Indeterminate'. Of those aged as 'Adult', the sex of 3 was categorised as 'Unobservable', 1 was 'Male', 3 were 'Possible Males' and 1 was a 'Possible Female'.

There is quite clearly a sample bias in the lack of middle adult individuals so it is not possible to draw any firm conclusions from the demographic data provided from this sample of skeletal remains.

3.3.5 Non-metric Traits

Non-metric traits are morphological features that occur both in bone and dentition. These features have no specific functional purpose and occur in some individuals and not in others. The origins of non-metric traits have now been shown to be highly complex, each having its own aetiology and each being influenced to differing extents by genetics, the environment, age and sex of the individual and by physical activity. Generally, the analysis of these traits requires a large sample size. Non-metric traits have been recorded for these skeletons in order to allow future comparisons with findings from other post-medieval assemblages in the Worcestershire area.

The observability and presence of any non-metric traits observed in the assemblage have been recorded in the database provided on the enclosed CD-Rom. The small sample size limited the analysis of these results and no immediate correlations of the presence of any particular traits were apparent.

3.3.6 Stature and Metric Analysis

Stature of adult individuals can be reconstructed from measurements of long bones of the skeleton. Since the long bones of sub-adults have not yet fully developed it is not possible to provide an estimate of stature for immature remains. Stature is the result of many factors including genetics and environmental influences, such as malnutrition and poor health. Height can be used as an indicator of health status and there is a wide range of literature on the relationships between height, health and social status. Estimated stature was calculated by taking the measurements of the individual long bones and using the formula provided by Trotter (1970). Variation in estimated stature can be up to 3cm.

The analysis of stature here was restricted to those individuals for whom sex had been allocated, as overall height is known to vary slightly between males and females with the same length long bones. The results can be seen in Table 2 below:

Sex	Height (m)	Number of Individuals
Male/Poss Male	1.67m (+/- 0.05)	7
Female/Poss Female	1.57m (+/- 0.06)	6

Table 2: *Average Estimated Stature for Males and Females from St Andrew's*

Roberts and Cox (2003) report that the average height for males from this period in Britain is 1.71m and 1.60m for females. The estimated stature for both males and females from St Andrew's is below the national average. This may be a misleading result produced by the small sample size or it may be possible to infer from these figures that these individuals were not of equal health status and a lack of adequate nutrition and increased exposure to disease, especially febrile conditions that may result in temporary cessation of development during childhood and adolescence, prevented these individuals from growing taller. However, it should be remembered that height is also partly dictated by genetic factors and that these individuals could have attained the same stature even in optimal environmental conditions. The remains excavated from the Vaults of the New City Burial ground consisted of 1 male of 1.65m in height and 4 females with an average height of 1.62m (Ogden 2006). Whilst it is not possible to draw any conclusions from the comparison of the data for males, the average stature of the females from these higher status graves is consistently higher. Again, only tentative suggestions may be made as to the nature of this difference on the basis of such a small sample and the fact that the burials from the New City Burial Ground are later in date. Nonetheless, the taller stature of the higher status females may be an indicator of access to a better diet and healthier living conditions during childhood than the lower status females from St. Andrews. More comparative data is required to confirm this hypothesis.

Craniometric data was also recorded but no conclusive evidence could be found from its analysis due to the small number of intact crania and mandibles.

3.3.7 Skeletal Pathology

Palaeopathology is the study of diseases of past peoples and can be used to infer the health status of groups of individuals within a population as well as indicate the overall success of the adaptation of a population to its surrounding environment. Pathologies are categorised according to their aetiologies; e.g. congenital, metabolic, infectious, traumatic, neoplastic etc. Any pathological modifications to the bone are described. The size and location of any lesion is also noted. Distribution of lesions about the skeleton should be noted to allow diagnosis. A differential diagnosis for any pathological lesions should also be provided.

As discussed earlier, both living and work conditions for the population of St. Andrews may have been comparatively harsh and would more than likely have contributed to a higher level of exposure of these individuals to communicable

diseases and occupational hazards. The demographic profile of the population under examination also indicates that the remains of several older adults are present, whom having lived longer would have been exposed for a greater length of time to their surrounding environment and therefore, are more likely to have suffered diseases affecting the skeleton than younger individuals. This phenomenon is known as the 'osteological paradox' whereby those exhibiting skeletal lesions are thought, in actual fact, to represent comparatively 'healthier' individuals in life than those individuals exhibiting no lesions who may well have succumbed to more virulent diseases that leave no trace in the skeleton (Wood *et al.* 1992). Additionally, those skeletons represented by a greater number of skeletal elements and in a better state of preservation are more likely to exhibit observable pathological changes to the bone.

A summary of the results of the comparative percentages of skeletal pathology according to aetiology is given below in Table 3 below. The pathologies recorded fell into the following aetiological categories: Metabolic, Inflammatory (including Infection), Trauma, Joint Disease, Congenital (including Developmental) and Neoplastic.

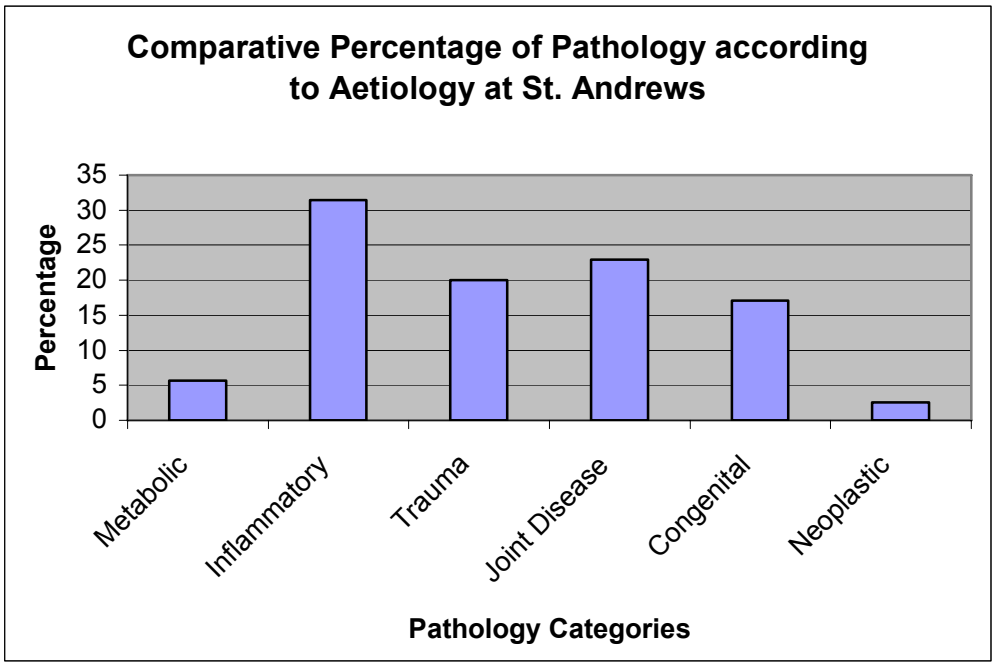


Figure 9: *Comparative percentage of pathology prevalence according to disease aetiology amongst adult individuals*

As can be seen from Figure 9 above, the most prevalent conditions as a percentage of those present amongst adults are inflammatory, trauma and joint diseases. A better insight into the nature of skeletal disease present amongst the individuals can be gained through examination of the actual prevalence rates of each type of disease. Prevalence rates can be calculated as a percentage of the count of each case of pathology recorded in relation to the number of individuals present, known as the Crude Prevalence Rate (CPR) or in relation to the number of the same observable skeletal elements present that could have potentially been affected by the condition, known as the True Prevalence Rate (TPR). The TPR of

SK no:	Completeness	Condition	Sex	Age Group	Pathology
2441	25-50%	Fair	Unobs	Foetal	Congenital/Metabolic/Inflammatory? – Heavy periostitis long bones
167	<25%	Fair	Unobs	Child	
230	25-50%	Fair	Unobs	Child	Probable Rickets distal ulna and radius
187	25-50%	Poor	Unobs	Child	
193	50-75%	Good	Male	Young Adult	Inflammatory – Rib Lesions. Congenital – Minor Scoliosis spine
169	75%	Varied	Male	Young Adult	Inflammatory – Rib Lesions, Osteitis femur & tibia; Congenital – cleft neural arch C1.
242	50-75%	Varied	Female	Young Adult	Congenital – Cervical Rib
245	75%	Good	Female	Young Adult	Inflammation – Periostitis/osteitis femora, tibiae and fibula, periostitis ilia (trauma?), Sinusitis. Congenital – Spondylolysis.
124	75%>	Varied	Male	Middle Adult	Trauma – Fracture 4th Metacarpal & Nasal Bones; Peri-mortem Fracture tibia & fibula; Joint Disease: DJD spine/ribsCongenital – Hallux Valgus bilateral; Neoplastic – Osteochondroma; Surgical Intervention – Craniotomy & Trephination.
220	75%	Fair	Female?	Old Adult	Inflammatory – Maxillary Sinusitis, Rib Lesions; Joint Disease –Osteoarthritis cervical & lumbar spine, Osteoarthritis left wrist
185	75%	Varied	Female	Old Adult	Degenerative Joint Disease in spine.
153	75%	Varied	Female?	Old Adult	Joint Disease – Gouty Arthritis/Pseudogout; Inflammatory – Osteitis. Joint Disease – Osteoarthritis thoracic spine.
177	75%	Good	Female	Old Adult	Trauma – Rib Fractures healed & Ununited, Fracture Fibular head; Congenital – Hallux Valgus bilateral; Joint Disease – poss gouty arthritis/pseudogout, minor DJD spine; Metabolic – poss Osteomalacia, Cribra Orbitalia.
2161	<25%	Good	Indet.	Old Adult	Trauma – Bennet's Fracture of thumb, Rib Fractures. Joint Disease – Osteoarthritis hip, minor DJD spine; Inflammation – Periostitis radius.

Table 3: *Summary Analysis of Pathological Observations*

SK no:	Completeness	Condition	Sex	Age Group	Pathology
2162	<25%	Good	Male?	Adult	
135	<25%	Fair	Unobs	Adult	
198	<25%	Fair	Unobs	Adult	
233	<25%	Varied	Indet.	Adult	
130	25-50%	Good	Male?	Adult	Trauma – Rib Fractures; Inflammatory – Rib Lesions. Joint Disease – Minor DJD and Schmorls Nodes Spine.
248	<25%	Poor	Female?	Adult	
201	<25%	Varied	Male?	Adult	
226	<25%	Poor	Unobs	Adult	
136	25-50%	Varied	Male?	Adult	

Table 3 (cont): *Summary Analysis of Pathological Observation*

a disease is much more accurate and representative of the rate of pathology since this method implicity allows for the condition and completeness of the skeletal material. The CPR rate only gives a crude estimate of the disease prevalence rate and where skeletal assemblages have undergone a high level of post-depositional disturbance, the CPR can be misleading. However, CPRs are perhaps more representative in the calculation of prevalence rates of diseases which result in pathological changes that are disseminated or generalised throughout the skeleton. Additionally, CPR's are commonly the only comparative data available from many skeletal reports. Where possible and appropriate, both types of rates will be presented here, though it should be remembered that the TPR rates for small assemblages are still only approximate indications of the true rate of each disease.

Congenital Conditions

A disease classified as 'Congenital' is defined as a disease that was present at birth. Several diseases that were considered 'Congenital' are now considered 'Developmental'; For example, Congenital Hip Dysplasia is now better understood and is though to be a result of trauma at birth, such as the common practice of holding newborns upside by the legs and subsequently dislocating the hip, rather than being an inherent condition. Most of the diseases considered to be 'congenital' have an underlying genetic component in their aetiology as well as some being due to environmental factors present prior to birth i.e. diseases transmitted from mother to foetus of a non-genetic origin.

No congenital diseases were observed that would have had a serious impact on the life or health status of those individuals with them. The most common congenital pathology was Adolescent Hallux Valgus, bilateral in both individuals (SK [117] & [124]), one a middle aged adult and the other an older adult (n = 2, CPR = 10.5%, TPR = 22.2%). This thought to be the result of a correction of an original Metatarsus Primus Varus defect in the big toe, where in infancy the big toe is pointing outwards, away from the foot. During development this deformity can correct itself by the presence of shoes pushing the big toes laterally. However, overcorrection may occur, with the big toe pointing into the midline of the foot (see Plate 3 below). No associated secondary joint disease was present so it is likely that little boney discomfort was associated with the condition.

Plate 3: SK124 exhibiting bilateral Hallux Valgus.

Other congenital conditions present were related to minor developmental anomalies in the spine and included the presence of a cervical rib ([SK242]), a cleft neural arch of the 1st cervical vertebra (SK[169]) and of sacral neural arches 4 & 5 (SK [185]), 2 cases of sacralisation of 1st coccygeal vertebra (SK[193] & [245]), partial lumbarisation of the 1st sacral vertebra (SK[245]) and sacralisation of the 5th lumbar vertebra (SK [169]). Skeleton [193] presented several asymmetrical vertebrae causing a minor scoliosis of the spine (*n* = 1, CPR = 5.3%). One case of bilateral spondylolysis in the fifth lumbar vertebra (*n* = 1, CPR = 5.3%, TPR 10%) was observed in SK [245] illustrated in Plate 4. This is also a developmental anomaly of the spine of an unknown aetiology, thought to arise from a congenital weakness in the neural arches of L4 or L5. This leads to a separation of the *pars interarticularis* (lower part of the back portion of the vertebra) by fibrous tissue from the main body and upper part of the neural arch. Clinically, it is seen in approximately 10% of all adults and generally is of no consequence to the individual affected (Salter 1999). However, it can create a greater susceptibility to trauma in the lower spine. No evidence of any secondary changes was present in this individual.

Plate 4: *Spondylolysis of L5: developmental separation of the pars interarticularis from the main body of the vertebra (SK [245]).*

One further individual exhibited pathological changes to the bone that are classified here as 'congenital' as the individual, SK2441, was a 31-32 week old foetus and technically 'preterm' (Scheuer and Black 2004). The remains were excavated as disarticulated but examination of the remains found the long bones to be paired and to have consistent pathological changes, leading to the conclusion that the bones may well be associated. All of the longs bones exhibited thick deposits of periosteal new bone formation (see Plates 5, 6 and 7). Whilst the skeleton at this age is developing rapidly and new bone formation would be expected as a result of appositional growth of the long bones, it was felt that the periostitic deposits observed here were abnormal. Some porotic bone deposits were also observed on the mandible but it was not possible to categorically say that this was abnormal; however, it may well be linked to the changes in the long bones.

Plates 5 & 6: *Femora and Tibiae (Left) and Ulna and Radii (Right) of SK2441 exhibiting marked periostitis along the diaphyses*

Plate 7: *Close-up of Periostitic Deposit on the Posterior Aspect of the Left Femur*

The periostitis observed along the diaphyses was mainly thickly deposited but not in an entirely consistent manner; in some bones a new bone layer had been deposited along the entire length of the diaphysis whereas on another side only a discrete area of periostitis was observed (see Plate 8 below).

Plate 8: *Localised deposit of periostitis on the distal radius*

Periostitis in sub-adults has been reviewed in the literature and several causes have been cited; congenital syphilis, infantile cortical hyperostosis, battered baby syndrome, infantile scurvy, rickets and tuberculosis (Lewis 2000). The age of the individual and the observable distribution of the lesions suggest that congenital syphilis, or some other metabolic or inflammatory condition passed on from mother to foetus, caused these lesions. No teeth were developed sufficiently to identify the enamel defects associated with congenital syphilis.

Metabolic Conditions

There are a number of diseases that are classified as metabolic and three different conditions were noted in the St Andrew's population. One case of cribra orbitalia (CPR = 5.3%, TPR = 12.5%) and a possibly case of osteomalacia (CPR = 5.3%) were both recorded in SK [177], an elderly female. Cribra orbitalia (recorded here according to categories set out by Stuart-Macadam 1991), commonly the result of iron-deficient anaemia, is denoted by the presence of porosity in the eye orbits resulting from the expansion of the trabeculae in the bone produced by the body's expansion of the marrow to increase production of red blood cells (Roberts and Manchester, 1997). The cribra orbitalia recorded in this individual was not severe. The presence of mild anaemia in an individual of this age may well be the result of a poor diet, although it could be the case that the lesions occurred during childhood and remain unhealed, being inactive lesions at time of death. This individual also exhibited a 'buckled' second lumbar vertebra, illustrated in Plate 9.

Plate 9: *Buckled Second Lumbar Vertebra from SK [177], possibly the result of osteomalacia*

The cause of this malformed vertebra is not clear but it may be the result of the early signs of osteomalacia, a condition where insufficient quantities of osteoid matrix is being ossified into bone due to a lack of Vitamin D. (Salter 1999). This disease is similar to rickets in its aetiology but is found mainly in elderly adults with poor dietary intake and less exposure to the sun. It is a difficult disease to diagnose without the presence of extreme pathological changes and work is currently ongoing to determine diagnosis from more subtle and possibly more common criteria previously overlooked (Brickley et al 2005). It is known that the second lumbar vertebra bears the most weight of the lumbar region of the spine so that any 'softening' present in the bones may well manifest itself earlier in this vertebra. The vertebral body appears buckled and pinched anteriorly and is slightly wedged anteriorly and laterally as a result. The associated vertebra, however, do not appear to be undergone any such remodelling, although they did display some osteophytic growth to enable compensatory load-bearing. This individual also presented several rib fractures, healed and unhealed. Plate 10, below, illustrates the lack of healing present in one of the ribs with spiculated bone surrounding the periphery of the fracture site. This has also been noted to be highly prevalent in individuals with osteomalacia (Brickley et al 2005). However, it may well be that the unhealed fractured ribs are unrelated to the malformed lumbar vertebra and are the result of peri-mortem injury. This will be discussed in more detail below in the 'Trauma' section. The diagnosis given is tentative and differential causes of the misshapen vertebra may well be due to some localised congenital or developmental anomaly or perhaps some sort of well-healed trauma.

Plate 10: One of several ununited fractures present in Sk [177], possibly associated with osteomalacia.

A probable case of rickets, the juvenile version of osteomalacia, was identified in SK 230 (*n* = 1, CPR = 33.3%). Unfortunately, the individual was relatively incomplete and preservation was only 'fair'; however, this infant, aged 1-2 years at death from developmental dentition and bone formation, exhibited distinct coarsening and porosity of the distal metaphyses of both the ulna and radius and "roughening" of the underlying epiphyseal growth plate surface, as illustrated in Plate 11 (Mays et al 2006). These changes would be graded as category 4 according to Ortner and Mays (1998).

Plate 11: Ante-mortem roughening (grade 4) of the distal radius, SK [230]

No other defects were observed in these bones (i.e. bending from mechanical stress) and only two other incomplete long bones were present; these (a humerus and a femur) demonstrated no changes. Rickets is a disease of infancy where bone changes due to metabolic disturbance (i.e. the "roughening of the epiphyseal growth plate surface) are clinically observed to most pronounced in the distal radius and ulna (Mays 2006, Salter 1999) and are likely to be manifest prior to the occurrence of gross bending deformities. A lack of observable irregular erosive lesions indicates that no secondary hyperparathyroidism was active in the individual, implying that it is more likely that vitamin D deficiency was the cause of this case of rickets, rather than renal osteodystrophy (Salter 1999). Typical scenarios of Vitamin D Deficiency Rickets involve children whom have been breastfed since birth without receiving supplementary vitamins and whom have not been outside and exposed to sunlight, with onset of the disease occurring at about 1 year of age (Salter 2000). However, alternative explanations of the disease may be explained by the presence of chronic intestinal or hepatic disorders causing malabsorption of the vitamin from the intestinal tract (Salter 1999), though these are relatively rare. The nature of the lesion observed in this infant suggests that the condition was active at death (Ives, *pers. comm*.).

The presence of rickets, osteomalacia and cribra orbitalia suggest that some individuals may have had a poor standard of dietary intake and may not have received adequate exposure to sunlight for what could be a number of cultural and environmental reasons.

Inflammatory Disease

Inflammation occurring to the bones can be observed at three levels; one involving the outer surface of the bone, known as periostitis, a second called osteitis where the inner cortex is involved and thirdly, when the whole transverse section of the bone is involved including the medullary cavity, known as osteomyelitis. Inflammation can occur as a result of many causes; for the most part, inflammation is associated with infection. It should be remembered, however, that whilst infection will always create an inflammatory reaction, conversely many pathological processes can potentially result in inflammation. Some infections produce a particular distribution of lesions around the skeleton allowing a specific diagnosis to be given to certain infectious conditions, such as syphilis and tuberculosis. Most infections resulting in an inflammatory reaction are, however, non-specific.

It can be seen from Figure 9 above that inflammation was the most common type of pathology amongst the individuals from St Andrews. In the comparatively unsanitary and crowded conditions that most people would have lived and worked in this pre-antibiotic period, it is not surprising that so many individuals would have succumbed to some kind of infection at one time or another. The most common location of inflammatory reaction was seen in the ribs as periostitic visceral surface lesions occurring as a result of inflammation or infection of the lungs, otherwise known as 'intrathoracic disease' (n = 5, CPR = 26.3%, TPR = 12.7%). Comparative crude prevalence rates from St Martins-in-the-Bullring at 12.2% (Brickley and Buteux 2006) and from Newcastle Infirmary at 4.6% (after Roberts and Cox 2003) suggest that the sample studied here had a much higher rate of lesions. Whilst many lesions of this nature have been strongly associated clinically with individuals who have died from tuberculosis (Santos and Roberts

2000), other diseases of the chest, such as chronic bronchitis and pneumonia, may also cause similar lesions (Mays *et al*. 2002). It is, therefore, difficult to establish the rib lesions as being related to tuberculosis without the presence of associated lesions in other skeletal elements. The rib lesions at St. Andrew's were observed to be present in 2 young adults, both male, 1 older adult female and 1 other adult, a possible male. All lesions present mainly consisted of porous woven bone, indicating that the lesions, and hence the inflammations/infections were active at the time of death. The cause of death of the adult female is known not to be tuberculosis and whilst this does not exclude the possibility that this individual may have had tuberculosis, it is unlikely that the active lesions found on the visceral surfaces of her ribs are attributable to the disease. However, it is known that tuberculosis during this period was one of the main causes of death in young adults and tuberculosis is certainly a differential diagnosis of the cause of the rib lesions seen in the young adults.

Inflammation, possibly linked to irritation of the respiratory tract, was also present in the form of maxillary sinusitis (n = 2, CPR = 10.5%). This is exhibited through new bone formation deposited in the paranasal sinuses as a result of infection in the throat, ear, chest or sinuses themselves (Roberts and Manchester 1997). Unfortunately, in complete skulls it is not possible to observe the sinuses without the use of an endoscope and it is, therefore, likely that rates are considerably higher than generally reported from archaeological populations. Roberts and Cox (2003, p.299) report that the average rate for this period is a CPR of 6.88%, but only 3 contemporary sites at the time of their publication had reported CPR's for sinusitis and figures vary considerably.

Other cases of inflammation included 3 cases of osteitis (some possibly remodelled heavy periostitis) and 2 cases of periostitis. One individual, SK [245] thought to be a young female, displayed periostitis in the pelvis, on the surface on ilia (see Plate 12) and also around the lesser trochanter of the left femur, the attachment site of the iliacus muscle (see Plate 13).

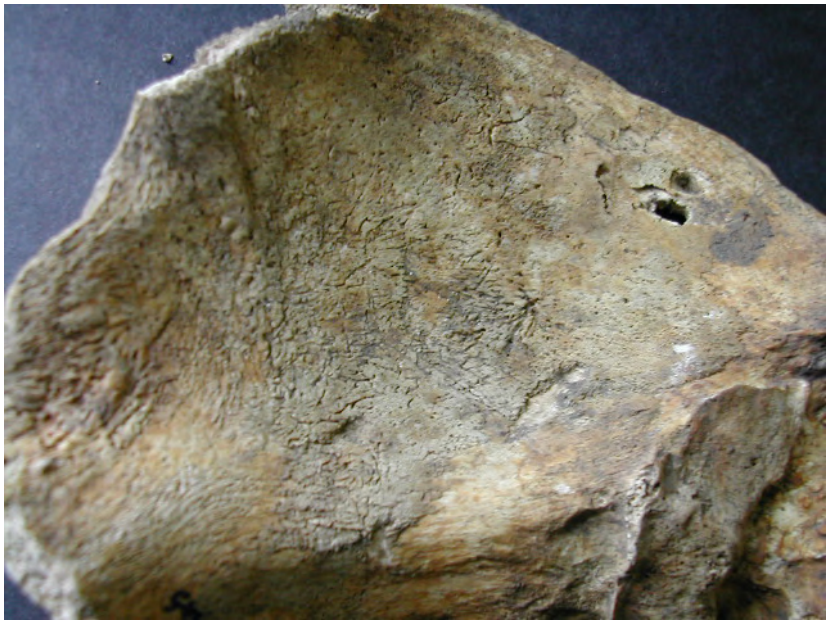


Plate 12: *Periostitis in the right ilium of SK [245]*

Plate 13: *Woven bone periostitis (denoted by dark brown boney deposits) in the intertrochanteric region of the femur.*

Other discrete areas of remodelled periostitis/osteitis were observed on the right femur and both tibiae. The aetiology of this inflammation is unclear; cases of localised heavy periostitis on the lower legs are sometimes caused by leg ulcers and this may well be the underlying cause of the localised lesions seen here as well as on the lower legs of skeletons [153] (an elderly female) and [169] (a young male) (CPR = 15.8%). The periostis seen in the ilia of SK [245] consisted of a mixture of remodelled and unremodelled bone and appears, therefore, to have been an ongoing condition, active or in the process of healing at time of death. It may be that the origin of the inflammation was traumatic, with some sort of rupture to the ililacus muscles but it is unusual for trauma to result in bilateral lesions. Another explanation is that there was an infection in the gut and inflammation has tracked down the iliacus muscle. Osteitis/heavy periostitis was present in the left fibula, resulting in a swollen appearance of most of the bone. This may have been the result of the haematogenous (i.e. via the blood) spread of infection if endosteal bone deposition has occurred. A diagnosis of hypertrophic osteoarthropathy was considered since the lesions are similar to other reported cases (Mays et al 2000) but the majority of incidents of this disease are known clinically to be extrapulmonary, the lesions usually involved usually display a more bilateral distribution and involve the radius and ulna (Aufderheide & Rodriguez-Martin 1998, Ortner 2003). These bones were not affected in this case and there was no skeletal evidence of pulmonary disease was found in this individual. The presence of chronic maxillary sinusitis, however, would indicate the low health status of this individual.

Trauma

Trauma appears to have been another common place occurrence at St Andrew's, accounting for a fifth of all skeletal lesions present. Out of the 19 adult individuals present, 3 presented multiple rib fractures (CPR = 15.8%, TPR = 8.9%). This is higher than reported average reported rates of 4.2% from this period (Roberts and Cox 2003). Ribs fractures occur when they strike or are struck by a hard object (Salter 1999); commonly today, for example, rib fracturing occurs when falling out of and hitting the bath. Four unhealed rib fractures were present in SK [177] (see plate 14); the fractures may have been caused by trauma but may have also have had an underlying on contributory factor of osteomalacia, as discussed above (see 'Metabolic Conditions'). Not only does this disease soften the bones, rendering them much more vulnerable to fracturing but can also inhibit the normal rate of healing.

Plate 14: *Multiple ununited rib fractures from SK [177]*

Alternatively, these ribs may have remained unhealed due to death prior to the completion of the healing process. Clinically, non-union of rib fractures in living patients is "almost unknown" (Salter 1999, p.605). In addition, one healing rib was present as well as 4 healed ribs, indicating that either more than one event of trauma had occurred to the rib cage, which would conform to the pattern of rib fractures expected should there have been the underlying contributing factor of osteomalacia in this elderly female (Brickley et al 2005). A fracture of the fibular head was also present in this individual (n = 1, TPR = 11.1%). It is rare for such a fracture of the fibula to occur in isolation to any similar trauma to the tibia and there is little literature on its incidence. The fracture was healed with little displacement or overlap of the bone present; the callus formation consisted of

porous lamellar bone, indicating that remodelling had occurred and the fracture had been incurred some time prior to death.

Both other cases of trauma to the rib cage (SK [130] and SK [2161]) consisted of well-healed fractures. Interestingly, SK [2161] also exhibited a Bennett's Fracture of the thumb (see Plate 15) (n = 1, CPR = 5.3%, TPR = 14.3%). This intra-articular fracture of the left 1st Metacarpal was well healed so this injury is likely to have been sustained earlier on in life of this older adult. In almost all cases, this fracture is associated with a dislocation of the bone from the wrist (Salter 1999) and medical attention is usually required to ensure adequate reduction of the dislocation and healing of the bone with no deformity. Although an enthesophyte was present in close proximity to the fracture, little displacement of the fractured bone had occurred, indicating that this fracture was probably attended to professionally.

Plate 15: *Well-healed Bennett's Fracture of the thumb*

Bennett's fractures can occur as the result of a fall onto a flexed thumb, sometimes linked to occupational activity using reciprocating machinery or to riding accidents but are also associated with boxing (Brickley and Buteux 2006), fracturing as a result of the force of a miss-hit punch upon a clenched fist. A fracture of the 4th Metacarpal (n = 1, CPR = 5.3%, TPR = 12.5%), likely to be what is known as a Boxing fracture (more commonly affecting the 5th Metacarpal), as well as a broken nose (n = 1, CPR = 5.3%, TPR = 20%) was found in SK [124] a middle aged adult male. In addition, this individual exhibited a comminuted peri-mortem fracture to the lower midshaft of the right tibia (see Plate 16). This area of the bone was broken into several fragments without any bony remodelling. The colouring of the inner surfaces of the bone and the smoothness of the fracture edge and surface (some post-mortem damage is superimposed) suggest a peri-mortem fracture rather than a typical post-mortem break.

A similar peri-mortem fracture fragment of the associated fibula was present, although this bone had suffered heavy post-mortem damage and it was not possible to reconstruct the true extent of the fracture. It is unclear whether this was the result of a severe trauma, such as a fall from a great height or a collision at speed as in a 'road accident', occurring around the time of death. Given that this body was subject to surgical attention (see Surgical Intervention below), it may even be possible that that the lower leg was crushed at some point after death whilst the body was being handled for autopsy or burial, or even whilst the body was in the ground with soft-tissue still present. However, the blow to the lower leg would certainly have had to have been a heavy one to create such a fracture.

Plate 16: Comminuted peri-mortem fracture of the tibia (one fragment illustrated) SK[124] (Note: superimposition of post-mortem damage present).

Injury recidivism, where several injuries occur in the same individual over a period of time, has been associated with young adults, especially males of lower socio-economic status, and is often associated with interpersonal violence (Judd 2002). However, it should also be noted that the late Georgian and early Victorian period saw the early flourishing of formal, regulated sports, such as bare-knuckle boxing and horse racing, as well as the increased hours of intensive labour, more likely than not leading to an increased frequency of work-related accidents. It is, unfortunately, not possible to differentiate between the causes of such injuries from the fracture alone. With the exception of the one case described above, all the fractures were well healed, indicating that some medical care was at hand and that the individuals were likely to have been cared for adequately enough for the bones to heal well.

Whilst the relatively high level of trauma recorded may well reflect the quite brutal risks involved in life in St Andrew's from a number of sources, it may also be the result of the higher number of older individuals contained in the sample who would have been exposed to such threats over a longer period of time and

more likely to experienced such injuries, especially those caused accidentally through falls.

Joint Disease

Primary osteoarthritis and degenerative joint disease (DJD) are undoubtedly an inevitable consequence of old age when the body's tissues begin to break down and are unable to repair themselves adequately (Salter 1999). All of the older adult individuals recovered from St. Andrew's suffered spinal degeneration in the form of either osteoarthritis or DJD (n = 5), 4 of which were thought to be female. Clinically, this condition is most common in adult women, though it occurs in 80% of women and men over the age of 75 years (Salter 1999). This is diagnosed through the appearance or osteophytes round the periphery of the vertebral body, increased porosity of articulating surfaces and additionally subchondral cysts due to the breakdown of the subchondral bone surface and in the most severe cases, eburnation of the articulating surfaces created as the bones' surfaces abrade each other.

One of these elderly females suffered particularly severe osteoarthritis of the neck and lower spine as well as of the wrist (see plate 17 and 18).

Plate 17: Severe Degenerative Joint Disease in the Cervical Vertebrae of SK 220

Plate 18: *Osteoarthritis in the left zyapophyseal joint of L5 in the lower spine.*

Another primary degenerative condition associated with old age was observed in SK [2161]. This individual had suffered osteoarthritis of the hip (*n*=1, CPR = 5.3%), illustrated in Plate 19.

Plate 19: *Osteoarthritis of the left acetabulum or hip joint*

In this case the bone on the inferior margin has been completely eroded away exposing the subchondral trabecular bone and substantial osteophtic growth has occurred around the periphery of the joint in response to the altered load. It is

possible that these changes were the response to an earlier trauma to the hip but no direct evidence of this was present.

No young adults were observed to have any joint diseases, primary or secondary to trauma and only one middle-aged individual exhibited such changes. This middle-aged male, who also had a 'Boxing' Fracture and a broken nose also has several ribs with degenerative changes to the vertebral articular surfaces. It is likely that these changes were secondary to trauma given the comparative lack of degenerative changes in the rest of the spine. Secondary osteoarthiritis and DJD is more common in adult men (Salter 1999). However, even taking this case of DJD into consideration should it not have been linked with trauma, there is a clear association between age and the primary degenerative conditions at St. Andrews (See Figure 10).

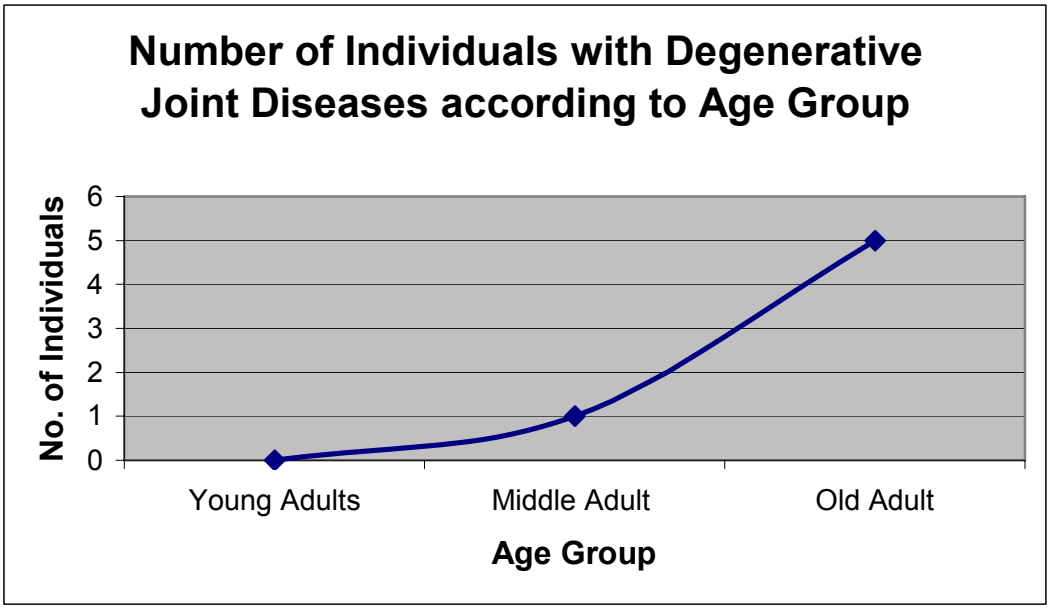


Figure 10: *Number of individuals with one or more degenerative joint diseases according to age group (with observable vertebrae)*

Two further examples of joint disease were recorded. Both were likely to be cases of chronic tophaceous gouty arthritis or pseudogout, indicated by the erosive cyst like lesions present bilaterally in the distal end of the 1st metatarsals (see Plate 20) (*n*=2, CPR = 10.5% TPR = 22.2%).

Plate 20: *Chronic Tophaceous Gouty Arthritis or Pseudogout in SK [153]*

This condition is most commonly seen in elderly males, although SK [153] was recorded as female. In almost half the conditions there is a familial incidence of clinical gout or hyperuricemia (Salter 1999) despite the disease being traditionally linked to overindulgence of rich food and drink (Roberts and Manchester 1997). When uric acid levels are too high, urate crystals can be formed to lower the levels in the blood and these, known as *tophi*, are deposited in the hands and feet, most commonly in the 1st metatarsal. There is also a condition known as pseudogout, the symptoms and lesions of which mimic gout, where crystals of calcium phyrophosphate dihydrate are deposited in a similar manner but this condition generally affects that hands and wrist more (Salter 1999). This disease primarily affects the elderly and is triggered by trauma or illness. It is suggested here that whilst the deposition of tophi in the 1st metatarsals of this individuals is highly likely to be due to gout, the differential diagnosis of pseudo-gout should not be ignored. A second individual, SK 177 (an older female) also showed a cyst like lesion in the distal end of one 1st metatarsal that could also be attributed to gout or pseudogout.

Neoplastic Disease

Only one incident of a neoplastic disease could be securely diagnosed. This was a single pedunculated osteochondroma located on the distal femur of SK[124], a middle-aged male (See Plate 21). Osteochondromata are observed to occur during adolescence when an abnormal outgrowth of bone and cartilage occurs from the growth plate and extends in the wrong direction. The most common site affected is the distal femur. Generally, osteochondromata are not particularly problematic unless they are unusually large and prominent and impinge on surrounding nerves and muscle (Salter 1999).

Plate 21: *Small protruding bony nodule (seen here on the right hand side) diagnosed as an osteochondroma from SK124.*

Of course, many neoplastic conditions are difficult to differentiate from other diseases causing lesions of a similar nature without the aid of radiographic evidence and few examples are reported in archaeological material. It may well be

that some of the pathologies here described as osteitis could actually be the result of reactive growth to a neoplastic condition. However, there was no evidence present to be able to state this as being the cause.

Surgical Intervention

One middle-aged male was found to have undergone two surgical procedures; one peri-mortem and one post-mortem. The peri-mortem procedure was that of a trephination to the left side of the frontal bone adjacent to the temple area. As can be seen in Plate 22, the edges are sharp and no boney remodelling has occurred, indicating that the individual did not survive the operation long, if at all.

Plate 22: *Unhealed Trephination (SK [124])*

Incision marks running parallel with each other across the posterior-anterior on the superior and inferior edges of the circular cut indicate that the scalp had been reflected as was general procedure (illustrated below in Plate 23). The circular hole was approximately 25mm in diameter and had been cut with a trephine (see plate 23). This was a common piece of surgical kit carried by practitioners during this period and was used to alleviate headaches thought to be brought on by intracranial pressure as well as commonly being used to treat depressed cranial fractures and even mental illness in some cases. Since only one roundel has been removed and there is an absence of radiating fractures from the site, it is more likely that the relief of intracranial pressure was sought. Increased intracranial tension or pressure will cause secondary injury to the brain. It results from: cerebral swelling from the accumulation of carbon dioxide in the brain, hypoxia, hypotension and epidural, subdural and intracranial haematomas. The clinical features of increased intracranial pressure include: deteriorating level of consciousness, slowing of the pulse, dilating pupils, focal seizures, hemiparesis and/or extensor posturing of the limbs (WHO 2006). Plate 23 illustrates an engraving showing in detail three stages in a trephination operation, taken from

Volume 6 of 'Anatomie de L'Homme' by Jules Germain Cloquet (1790-1883) printed by C de Lasteyrie from 1821-1831.

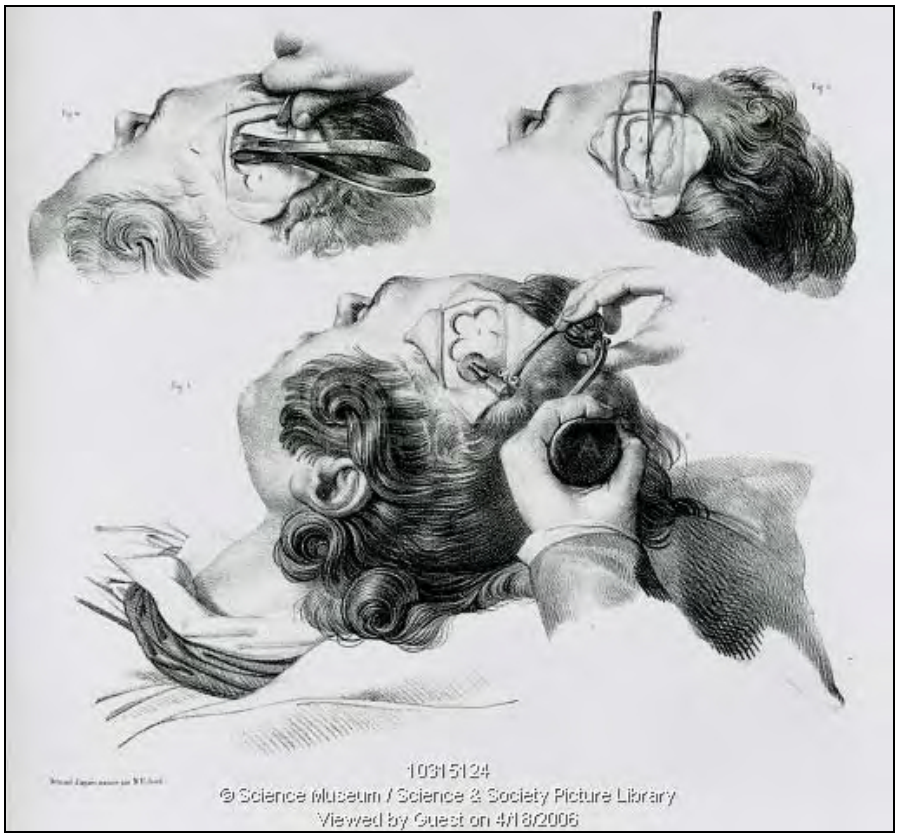


Plate 23:*Engraving showing in detail three stages in a trephination operation by Jules Germain Cloquet (1790-1883) (after Science Museum/Science and Society Picture Library 2006).*

It may be a possibility that the example here is actually the result of an apprentice surgeon practising on a cadaver as there is no boney remodelling to indicate that the patient was alive when the trephination was made. Undoubtedly, experimentation and training would have occurred on cadavers frequently during this period. If this operation was carried out whilst the individual was alive, it certainly was not successful in saving his life. Further investigations into his death had been carried out by way of a craniotomy, removal of the top of the skull (the calvarium), in order for an examination of the brain to be made, possibly to establish to cause of death. Firstly the scalp had been ressected; several fine incision marks were observed around the line of the craniotomy cut, some parallel to each other, around the sides of the head (see Plate 24). A further fine linear incision mark was observed running in the coronal plane (although slightly angulated) across the entire frontal bone approximately 5cm anterior to the coronal suture right through to the site of the trephination (see Plate 25).

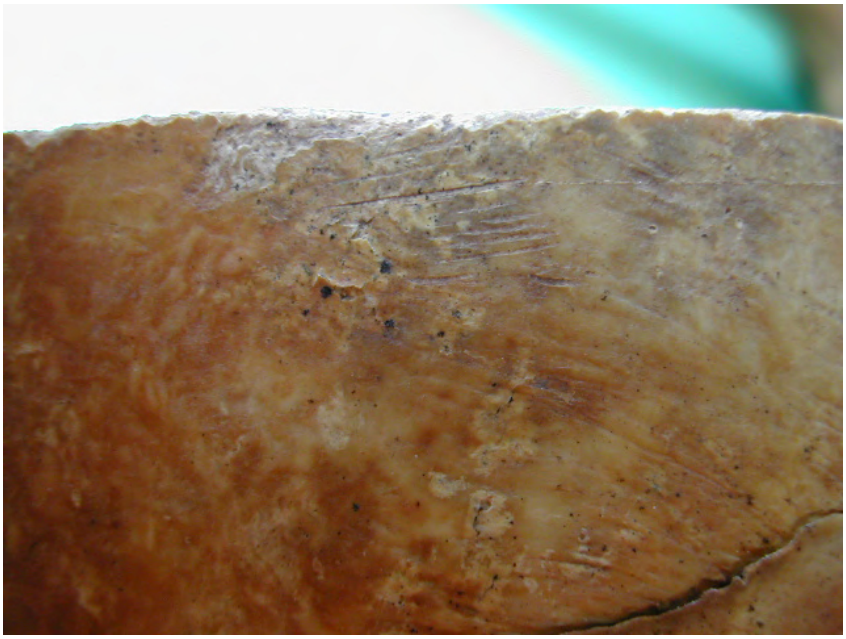


Plate 24: *Parallel incision marks resulting from scalping*

Plate 25: *Coronal Incision Mark running across the Frontal Bone of SK [124]*

A further series of short parallel incision marks were observed on the occipital bone at the back of the head. These were deeper superiorly, shallower inferiorly and were made from the superior aspect (see Plate 26). It is likely then that the scalp from the top of the head was removed by cutting across the front and along the sides, (roughly following the hairline in front but cutting through it posteriorly) and then lifting the scalp back, making subdermal incisions to the back of the head to further the reflection of the scalp to allow the craniotomy.

Presumably the scalp over the brow was also reflected with similar subdermal incisions though no evidence of this was left.

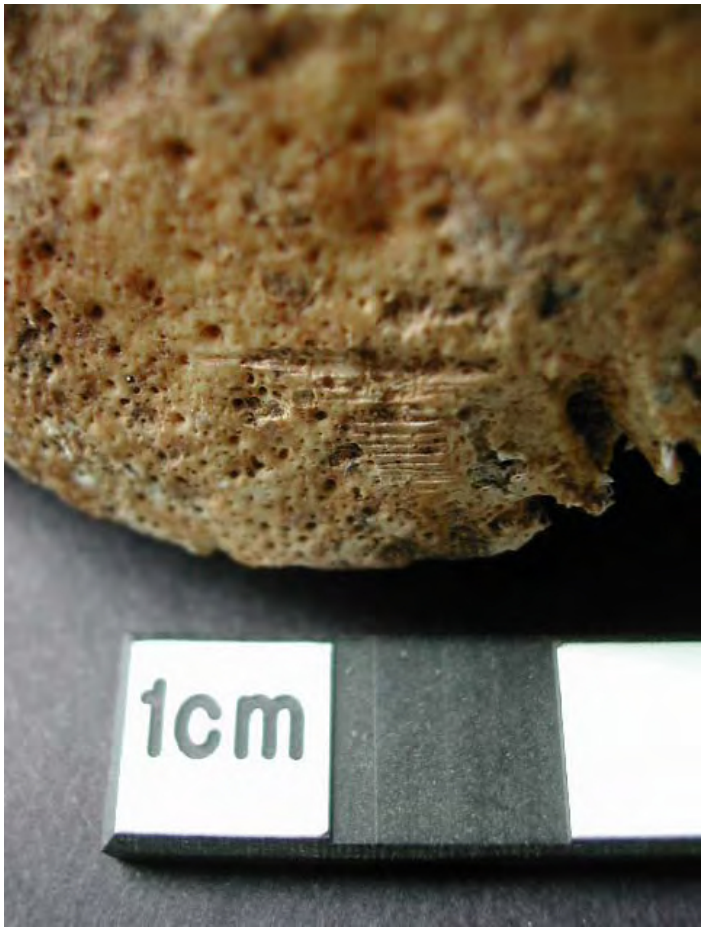


Plate 26: *Series of incisions made from the superior aspect on the the occipital bone, at the back of the head.*

Today, the removal of the scalp is achieved through a cut following the hairline around the back of the neck and up behind the ears, with the scalp then pulled forward over the face, so that the scar can be easily hidden once the scalp is replaced. This is to allow the body to be viewed without causing distress to the mourners. It would appear that the same level of care had been taken in removal of the scalp of this individual, although the actual method was different from modern day practice. Whilst autopsies were becoming increasingly accepted by society at this time, generally there was a great deal of suspicion held about them, particularly those of the body, and very often permission was sought from relatives before an autopsy was performed (Adams, *pers. comm.*). Comparatively low rates of evidence for autopsy have been found from archaeological sites of this period, ranging from a CPR of 0.72 to 3.38% (Roberts and Cox 2003), the highest rate being found at a Cross Bones burial ground in London, a site known to have been used for poorer residents of the area.

Subsequent to the removal of the scalp, the exposed calvarium was then removed using a saw; several careful cuts had been made. The left hand side, the front and the right hand side of the cranium had been completely sawn through with the exception of one bony spur protruding from the frontal bone. The superior most portion of the temporal squame had also been removed during this event. A series of saw marks could be observed continuing around the calvarium as the surgeon worked his way around the head (see Plate 27). Several bony spurs were protruding from the occipital bone and the calvarium appears to have been in part levered off at this site.

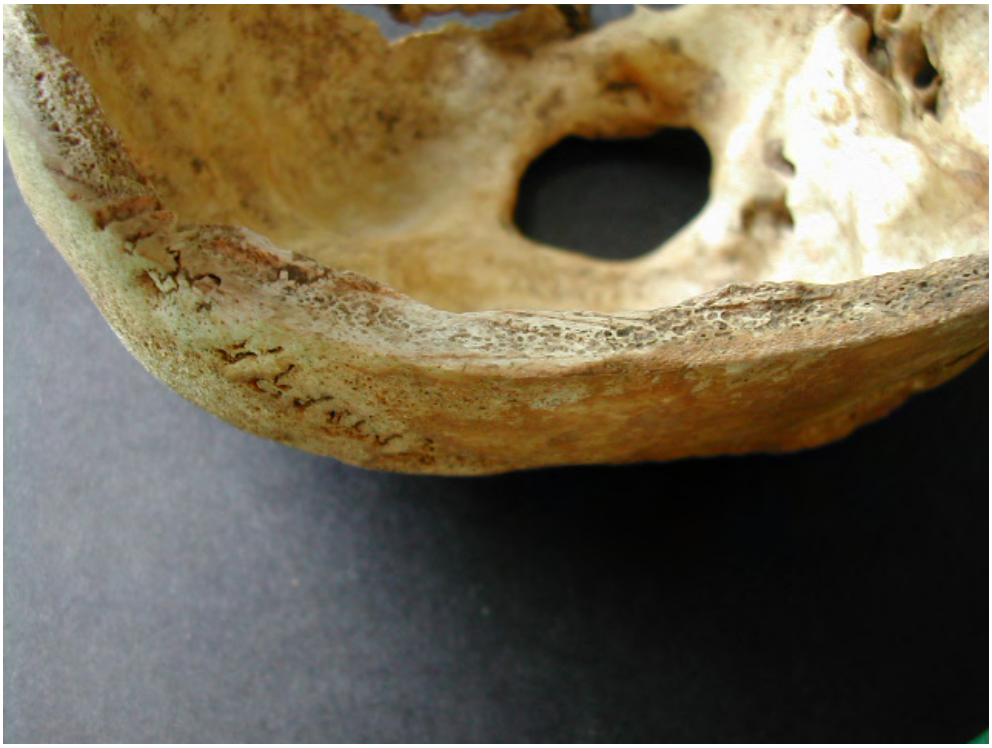


Plate 27: *Saw marks and bony spurs evident around the occipital area of the calvarium (SK[124]).*

There was no skeletal evidence to suggest that any post-mortem examination had taken place on the torso.

These two examples of surgical intervention testify directly to the growing influence and practice of the medical profession. It is likely that it is no coincidence that both were carried out on the same individual, though it is not clear whether he would have been an inpatient of the Worcester Infirmary at the time. Hospitals during this period, such as the Newcastle Infirmary (Chamberlain, 1999) did have their own burial grounds and there has been no systematic study as of yet as to which individuals were interred here and who would have been buried back in their parish burial ground, as the parish should have paid a deposit for a funeral prior to admittance to the hospital (Lane 2001). The evidence from Newcastle Infirmary suggest that at least some of the patients were given 'decent' burials in coffins, suggesting that mourners may have been present, though this could well have been motivated by the need to masquerade post-mortem dissections that had been carried out on bodies illegally (for example, one burial here was found to contain the upper half of an individual adjacent to a large stone in the coffin, evidently placed there to make up the weight of the missing lower half of the body and prevent any arousal of suspicion) (Chamberlain 1999). It is highly likely that many bodies interred in the hospital grounds were either considered to be contagious or were unclaimed by relatives, like many of those interred within the pauper burial ground. It would seem likely then that having been interred within the parish burial ground, this man would have had some relatives or close friends and accordingly received a traditional, respectful burial.

3.3.8 Dental Disease

The late Georgian and Victorian periods saw many changes in the understanding of teeth and the treatment of their diseases; unfortunately, these at the time had little impact on levels of oral hygiene, which for the most part, remained poor. There was, however, a dramatic increase in medical intervention during this period and 'dentists' could be consulted in barber shops should money be available to pay for treatment. Dental work involved extractions, fillings and the fitting of prosthetics. An increase in the availability of sugary foods and refined carbohydrates through this period resulted in a general increase in caries (Roberts and Cox (2000, p.324), for example, report a 6% increase in the true prevalence rates of caries) and perhaps the need for such dental treatment. Without the presence of fillings or dentures, evidence for dental treatment is difficult to detect; whilst an extraction would be observed as 'ante-mortem' tooth loss it is not possible to differentiate this from a tooth that has been knocked out or has rotted away and fallen out. It is likely during this period that given the social status of the majority of the population in St. Andrew's, many would not have been able to afford dental treatment directly, though basic provision for extractions may have been made through friendly societies.

Prevalence rates of dental diseases are presented here as a percentage of the number of observable teeth present or number of observable sockets. Juvenile and adult data are treated separately.

In total, 186 adult permanent teeth were recorded as observable in addition to 30 deciduous juvenile teeth. Some juveniles did have mixed dentition but the permanent teeth in these instances were unerupted and therefore considered as 'unobservable' in relation to prevalence rates of disease. The prevalence rate of antemortem loss was calculated according to number of observable tooth sockets in individuals with permanent dentition present (n = 216) as was the prevalence rates of abscesses. Prevalence rates for dental diseases present are shown below in Table 4:

Disease	Caries	Calculus	Ante-mortem Loss	Abscesses	Periodontal Disease	Enamel Hypoplasia
Number of teeth/sockets affected	31	172	48	5	136	56
Prevalence (%)	16.7	92.5	22.2	2.3	73.1	30.1

Table 4: *Prevalence rates of Dental Disease*

The rate of caries amongst the sample under analysis here is slightly higher than levels reported for the period by Roberts and Cox (2000) and reflect the cariogenic nature of the diet of the individuals from St Andrew's during this period. Ante-mortem loss is approximately the same as the national average; having increased dramatically from the medieval period it would appear that the data with St Andrews is consistent in testifying to a higher level of ante-mortem loss of teeth than experienced in any other period. This could be due to a number of reasons; this period sees an increase in the number of people living to an older

age who are, therefore, more likely to have lost teeth. An analysis of the rates of ante-mortem tooth loss according to age category of the data from St. Andrew's shows that of the young adults, 19% (TPR) of teeth were lost antemortem, whereas 29.5% (TPR) had been lost in the older adults group. Another contributing factor could have been ante-mortem loss through higher rates of associated dental disease or perhaps more teeth were being extracted during this period than previously. A combination of these factors is likely to explain the high prevalence.

The levels of calculus seen are much higher than reported from other sites of the period, though these are true prevalence rates rather than the crude prevalence rates commonly referred too. Even so, the crude prevalence rate for calculus is 84.6% (n = 11 out of 13 individuals with permanent dentition present) is still relatively high compared to the 68.97% recorded at Ennis Friary and 68.54% at Newcastle Infirmary (Roberts and Cox 2003). Very few of the individuals observed with calculus had severe deposits and most observed were recorded as 'small' or grade 1 (Buikstra and Ubelaker 1994). Still, these levels of calculus are almost certain to have contributed to the relatively high percentage of periodontal disease. This would seem to reflect overall a poor standard of dental hygiene amongst these individuals as is associated with soft-tissue gum disease or gingivitis (Roberts and Manchester 1997). However, only 2.3% had dental abscesses; much the same as the national average (Roberts and Cox 2003). Several of these abscesses were associated with severely cariogenic teeth, often with no tooth left above the alveolar margin.

Enamel hypoplasia rates of 30.1% (TPR) is similar to the rate reported from the population of St. Martin's-in-the-Bullring (Brickley and Buteux 2006). Hypoplastic defects in the teeth are caused by bouts of childhood illness or severe malnutrition. The crude prevalence rate of hypoplasia from St. Andrew's is 53.8% (n = 7). When comparing crude prevalence rates at St. Martin's, there was a significant difference between those individuals from the vault burials and those from earth-cut graves (Brickley and Buteux 2006), suggesting that those children of higher socio-economic status were less vulnerable to severe acute illness and malnutrition that those of a lower status. The crude prevalence rate of enamel hypoplasia at St Andrew's is considerably lower that the 73.5% reported for the individuals excavated from earth-cut graves at St. Martin's. It would appear, therefore, that the population of St. Andrew's endured less biological stress during childhood. It may well be the case that infants and children, conversely, suffered severe fatal diseases where no enamel defects would have occurred; it would be interesting to compare the number of juveniles recorded in the burial registers from St. Andrew's to those in St. Martin's to assess whether the difference in enamel hypoplasia reflects whether better or worse conditions were experienced by infants and children in Worcester than in the urban areas of the much larger, industrialised city of Birmingham.

Evidence of behavioural practices were also present in the dentition; two individuals, 1 male and 1 possible male displayed wear facets on the anterior dentition associated with pipe-smoking, as illustrated below in Plate 28.

Plate 28: *Pipe smoking groove on the mandibular left canine and 1st premolar (SK [136])*

Grooves were found on both sides of the jaw in SK [124] indicating that the pipe was frequently swapped from side to side whilst smoking. One individual from the New City Burial Ground at Tallow Hill was reported as having a pipe-smoking groove (Vaughan 2006) and 11 were reported from St Martin's (Brickley and Buteux 2006). Smoking seems to have been a habit of both those of higher and lower socio-economic status from the funerary evidence, although at this time restricted to males.

No dental disease was observed amongst the deciduous dentition of the subadult-population.

3.3.9 Mary Roden: A Member of St. Andrew's Community

A well-preserved coffin plate was excavated in association with one of the skeletons excavated from St. Andrew's (see Plates 29 and 30 below). The name, age and date of death of this individual were still partially legible.

Through analysis of the preserved lettering, the name 'Mary Rod-n' could be read along with the date of death being in –4th of June, 1844 at the age of 87 years. A search of the Birth, Marriage and Deaths records revealed that a Mary Roden had died in the June quarter of the year 1844 in the Worcester district and a death certificate was obtained from the General Registry Office.

The details of the death certificate (Plate 32) confirmed that this was indeed the correct individual – Mary Roden, who had died at Blackfriars, Worcester on the 14th June, 1844 at the age of 87 years old. She was the wife of a labourer, Francis Roden and had died of 'Decay of Nature'. The informant was Charles Deem from nearby Newport Street (see Plate 1) and the registrar was Richard Hill, who was also the registrar noted on some of the death certificates from the New City Burial Ground, Tallow Hill (Vaughan 2006).

Plate 29: *The remains of SK [220] with coffin plate in situ in the pelvic area*

Plate 30: *Close up of coffin plate associated with SK [220]*

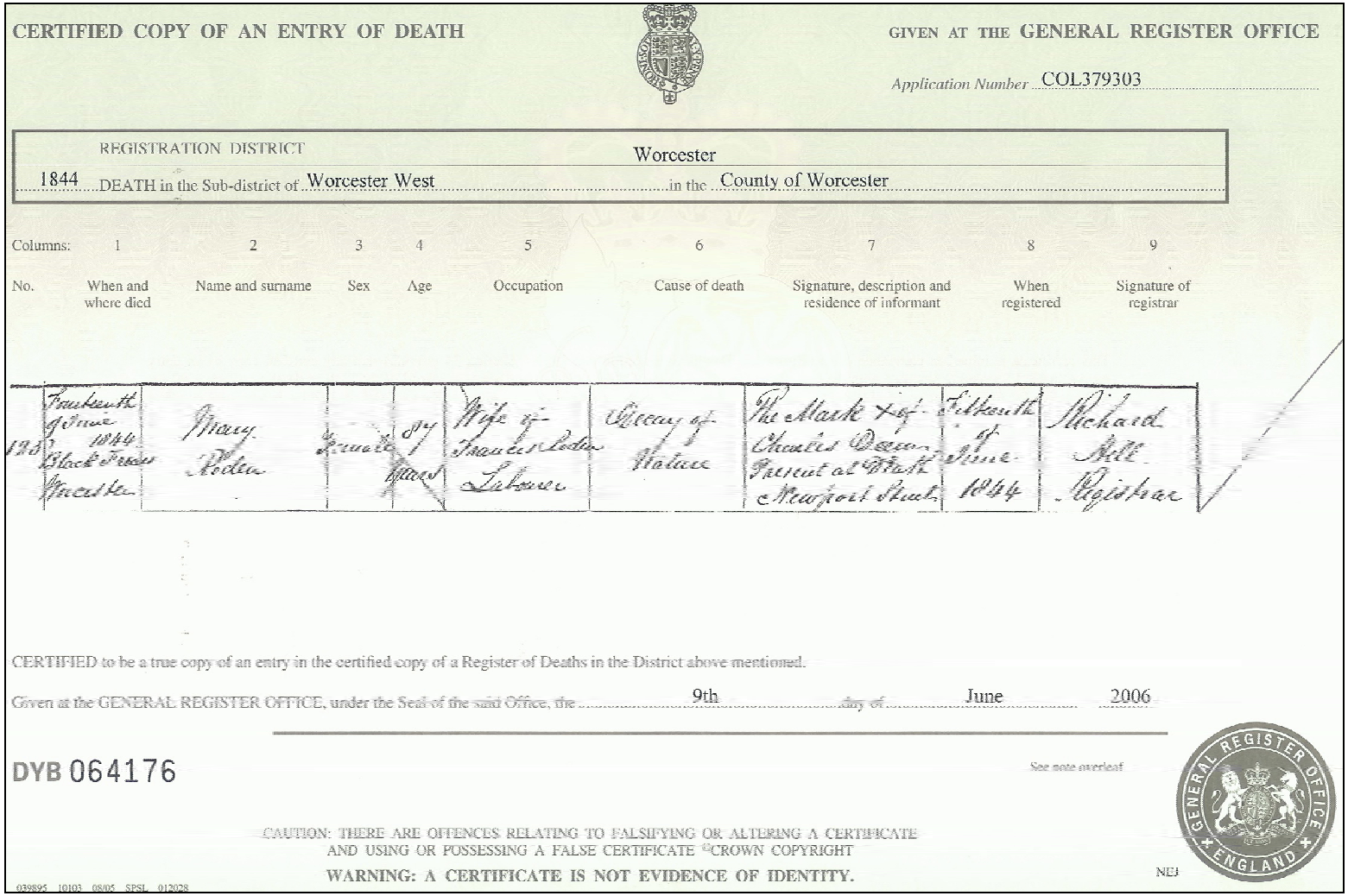
It is emphasised here that the remains of SK [220] were analysed without knowledge of the any data known from the coffin plate, as is standard practice to prevent any bias in observations.

The remains of SK [220] were indeed found to be those of an elderly adult, a possible female. Some masculine features were observed in the cranium but overall it was small with some feminine features. Masculinized skulls in elderly females are frequently reported in the literature (Walker 1995; Brickley and Buteux 2006). Most of the pelvic features observed for estimating sex were not observable but those present were judged to be definitely female. Metric assessment of the femoral humeral head also fell in the female category. Analysis of the partially surviving auricular surfaces revealed a very eroded surface that consisted of degraded surface with micro- and macroporosity present, with subchondral bone degeneration resulting in coarsening of the surface. There was evidence of clear retro-activity and irregularity to the surface margins (see Plate 31).

Plate 31: *Auricular surface of SK [220]; known age at death, 87 years*

The changes observed in the auricular surfaces were assessed as being grade 8 (Lovejoy 1985) and representing an individual over the age of 60 years old.

The stature reconstruction from the long bone measurements provided an estimated height of 1.58m during life. It is likely that due to her age she may well have been several centimetres shorter towards the end of her life due to denegeration of the soft tissues in the spine and joints.



CERTIFIED COPY OF AN ENTRY OF DEATH

GIVEN AT THE GENERAL REGISTER OFFICE

Application Number COL379303

REGISTRATION DISTRICT Worcester

1844 DEATH in the Sub-district of Worcester West in the County of Worcester

Columns:	1	2	3	4	5	6	7	8	9
No.	When and where died	Name and surname	Sex	Age	Occupation	Cause of death	Signature, description and residence of informant	When registered	Signature of registrar
1753	Fourteenth June 1844 Black Pool Worcester	Mary Roden	Female	87 Years	Wife of Francis Roden	Decay of Nature	The Mark ✕ of Charles Dean Present at Death Newport Shrop.	Fifteenth of June 1844	Richard Hill Registrar

CERTIFIED to be a true copy of an entry in the certified copy of a Register of Deaths in the District above mentioned.

Given at the GENERAL REGISTER OFFICE, under the Seal of the said Office, the 9th day of June 2006

DYB 064176

See note overleaf

CAUTION: THERE ARE OFFENCES RELATING TO FALSIFYING OR ALTERING A CERTIFICATE AND USING OR POSSESSING A FALSE CERTIFICATE

WARNING: A CERTIFICATE IS NOT EVIDENCE OF IDENTITY.

039895 10103 08/05 SPSL 012028

NEJ

GENERAL REGISTER OFFICE ENGLAND

Plate 32: *Death Certificate of Mary Roden, 1844*

Her skeletal remains testify to some chronic conditions present when she died. Likely to be related to her age, she suffered severe osteoarthritis in her neck and lower spine (see Plate 17) as well as in her left wrist. She had endured two chronic inflammatory conditions; the first, maxillary sinusitis (see Plate 33) and the second, pulmonary inflammtion or infection (see Plate 34). As the death certificate of Mary Roden suggests that she died of old age, it is likely that these rib lesions, active at the time of death, were caused by chronic bronchitis or pneumonia.

Plate 33: *Plaque-like deposit of bone in the maxillary sinus.*

Plate 34: *One of the 4 observable rib lesions from SK [220]*

Of the observable dentition, all of the maxillary and most of the mandibular dentition had been lost ante-mortem. Two externally draining sinuses were present in the mandible as well as 3 carious teeth, one completely destroyed. Mild calculus was observed on all 5 teeth present. Two teeth displayed hypoplastic defects in the enamel.

Born in 1757, Mary Roden must have experienced several of the changes occurring in West Midlands at the time, principally the rapid expansion of urban centres and the mechanisation of production. Married to a labourer, she would have belonged to what was considered at the time to be one of the lowest socio-economic groups. It is unknown whether she was born and raised in Worcester or whether she had migrated into the city with her husband to work. Despite the poor living conditions, epidemic outbreaks and rising numbers of occupational hazards, she survived until what even these days would be considered a very respectable old age, though not without suffering the ravages of time. When she died, it is likely that she was accorded a funeral by her husband, (as she is recorded as a wife, not a widow, on her death certificate) who provided a decent but simple burial at in their local parish burial ground. No personal effects were found or at least survived but the provision of a coffin plate would no doubt have been seen as a mark of respect.

3.3.10 The Articulated Material: Conclusions

Analysis of the articulated material has provided a wealth of information regarding the life of the people living in St Andrew's, even though the sample was small. It is clear that the preservation of the material from the burial ground is, on the whole, good and that significant data can be retrieved from skeletal remains excavated there. Whilst it is difficult to draw firm conclusions from comparisons of the assemblage to other contemporary sites, the physical evidence of high levels of inflammation and trauma throughout all age categories would seem to support historical evidence St Andrew's parish provided a harsh environment for people to live and work in, with high levels of pulmonary complaints and other infections of a chronic nature as well as trauma to the chest and hands. Although underrepresented in the assemblage due to high levels of inter-cutting burials and post-mortem disturbance, a comparatively high number of deaths was seen amongst the youngest of the sub-adult population, reflecting the high infant mortality rates recorded at this time. One of these was thought to have active rickets at the time of death, probably from a lack of sunlight, possibly in addition to poor diet or other contributory illness. However, despite the numerous perilous threats, some individuals lived to a considerable age and as a result, several incidents of joint disease were seen, some severe, probably quite painful and debilitating. The growing authority and knowledge of the medical is also testified to through peri- and post-mortem operations carried out on one individual, the first physical evidence reported from Worcester of the prominent medical developments in the city historically testified to.

It is hoped that future archaeological excavations of comparative sites in and around Worcester will reveal more evidence of health, disease and living

conditions during this period and that the information presented here can then be put into a wider context in order to further our understanding of the life of individuals from both rural and urban Worcestershire as well as different socio-economic classes in the post-medieval period.

3.4 The Disarticulated Assemblage: Methods and Process

The disarticulated assemblage was analysed macroscopically and recorded using a Microsoft Access database, which can be found on the CD-Rom enclosed. Each element recorded was given a unique identification number and recorded by context. In each instance, the identification, side and portion of the bone was noted, along with completeness, taphonomy and observable joint surfaces. Any metrics that would provide an estimation of sex or of stature were taken where possible. The pelvic or skull bones were also analysed for sexually dimorphic traits where preservation allowed, using the criteria set out by Buikstra and Ubelaker (1994). Age determination was carried out using epiphyseal fusion, analysis of the pubic symphysis and of the auricular surface, where appropriate, and classified according to Brookes and Suchey (1990) and Lovejoy *et al.* (1985). Dental attrition was recorded but not used to provide an age estimate due to the consistent problems experienced with the application of this technique to populations of this period (Brickley *et al.* 2006). The same methods of assessment were applied to the disarticulated as to the articulated assemblage so that fair comparisons could be made between the two samples.

3.4.1 Preservation of Material

The preservation of material was assessed using the same criteria as for the articulated skeletons (see 3.3.2). The majority of skeletal material was found to be well preserved, as shown in Figure 11 below:

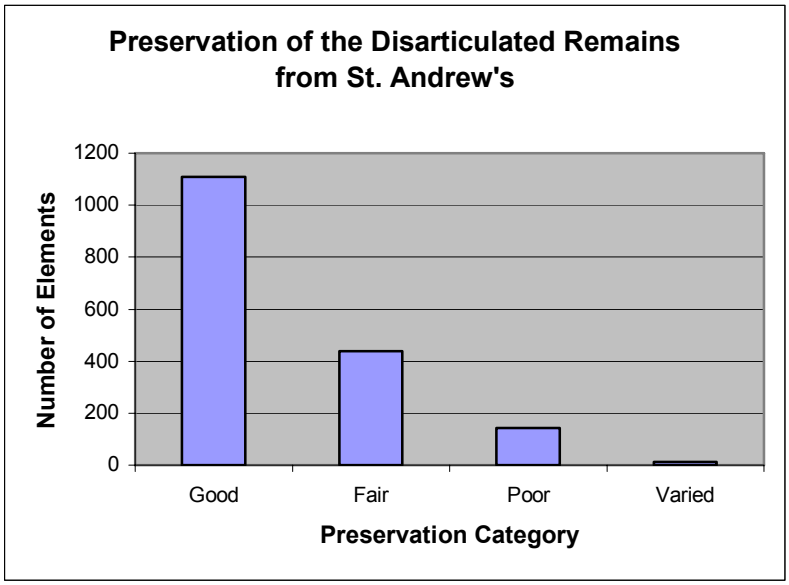


Figure 11: Preservation of the Disarticulated Skeletal Remains

The lack of elements with 'Varied' preservation compared to the articulated assemblage is due to the analysis being based on single element observation rather than on a number of elements, where preservation is likely to be more varied. The 'Good' state of preservation of the vast majority of bones should result in a high level of observability of the bones under analysis.

3.4.2 Completeness of Elements

Completeness of elements is also an indicator of how much data may be collated from the bones, particularly that based upon metric analysis. This was recorded using the same criteria for the articulated sample (see. 3.3.3). Figure 12 below shows that a large proportion (40.8%) were less than 25% complete, whereas only 30.2% were over 75% complete. This would indicate that the quality of the data may be compromised, especially that based on metric data. However, an assessment of the most represented elements reveals that the most numerous element were rib fragments (*n* = 173), which are used for neither age nor sex estimation nor stature reconstruction. The next most frequently recorded elements were femora (*n* = 145) and tibiae (*n* =126). These can be used for providing basic age, sex and stature estimations, depending upon preservation and completeness. Of these, 34 tibiae and 20 femora were assessed as being over 75% complete. From this assessment, demographic data is likely to be limited to a small sample.

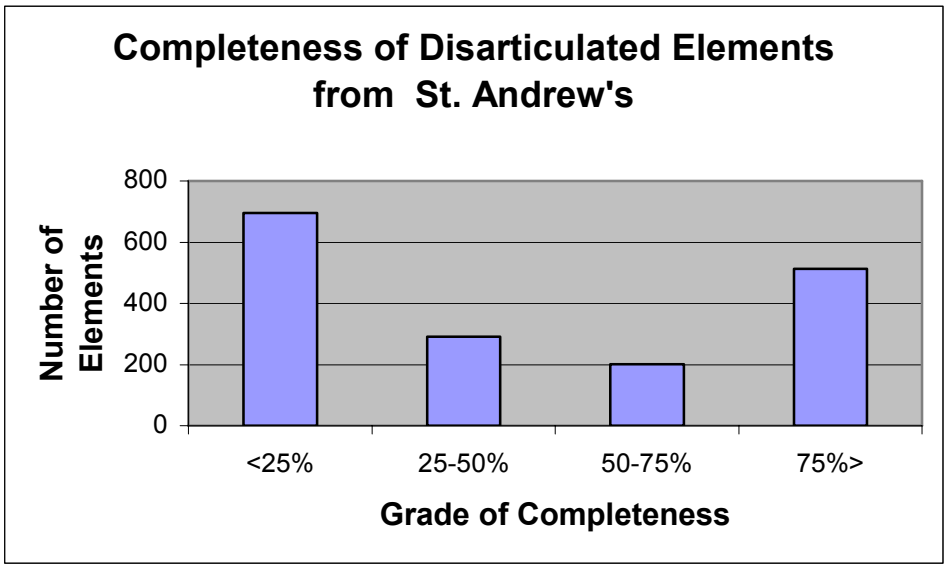


Figure 12: Completeness of Disarticulated Skeletal Elements from St Andrews

3.4.3 Minimum Number of Individuals

A total of 1703 human skeletal fragments of disarticulated remains were subject to osteological analysis. The minimum number of individuals (MNI) represented by the assemblage is calculated from the number of repeated skeletal elements within the sample taking age into account. It can also be important to consider the context of the individual elements, since one context should represent a single event of deposition of skeletal material. In this case, it could be argued that elements recovered from different contexts are likely to belong to different

individuals. It is difficult to prove this, however, in such an intensely used burial ground, where inter-cutting of graves has been such a frequent occurrence. It is highly probably that the elements belonging to one individual may have become spread over several contexts with the cutting and re-cutting of graves. Since this is known to have been taking place at St. Andrew's, it may be more realistic to consider the contexts together as one sample; however, both sets of figures are presented below (see Table 5) for comparative purposes:

MNI by Context	MNI Collated Assemblage
115	33

Table 5: *Minimum Number Estimates calculate by context and from the collated assemblage*

It can be seen that calculating the minimum number of individuals by context increases the number dramatically as an artefact of the number of contexts excavated. Whilst it is likely that some remains were scattered throughout a number of contexts, it is also a possibility that the space in the graveyard was used on a rotational basis, and that some contexts will contain the remains of separate individuals. A more representative estimate of the number of individuals probably lies between these two figures. The absolute minimum estimate, however, is 33 individuals.

3.4.4 Demographic Data

Age assessment was carried out where possible and each element placed into the same age categories used as those for the articulated assemblage. The results can be seen in Table 6 below:

Age Group	MNI by Context (c)	MNI Collated Data (cd)
Adult MNI	65	22
Foetal MNI	1	1
Neonate MNI	3	1
Infant MNI	6	1
Child MNI	6	2
Juvenile MNI	12	3
Adolescent MNI	13	3
Total	106	33

Table 6: *Number of Individuals by Age*

Again, it can be seen from the disarticulated remains that the minimum number of adults, whether calculated by context or from the collated data, that a much greater proportion of the sample are adults (61.3% c, 66.7% cd) than would be expected from historical sources. Furthermore, even when considering the subadult population alone the percentage of children 5 years or less at age of death (39% c or 45.5% cd) is also lower than expected. It is, therefore, surmised that the method of retrieval as well as the post-depositional disturbance of disarticulated elements on site favours the recovery of adult, juvenile and adolescent remains over the smaller elements of the foetal, neonate, infant and child remains. These factors appear to considerably distort the demographic data. However, it is

interesting to note that a relatively higher number of juvenile and adolescent elements were recovered and highlights a lack of remains belonging to this age group in the articulated sample.

Sex estimation was possible for 40 individuals from the analysis by context; 20 were assessed as male/possible male and 20 as female/possible female. When the collated dataset was analysed, two elements were assessed for sex estimation; the right proximal femur head and the right pelvis. Of the first element, based on metric analysis, 7 of the 10 individuals were thought to be male/possibly male, whereas only 3 were thought to be female/possibly female. The right pelvis provided a minimum estimate of 3 males/possible males and 4 female/possible females. The ratio of 1:1 males:females is nearest the ratio that would be expected; the results from the analyses of morphological features from the pelvis are 0.75:1 males:females, which is slightly lower than expected for males from the census data of the living population. The results of the metric analysis alone on this small sample (cd) provided inaccurate results that are unrepresentative. Since metric data used in combination with the morphological data on the larger sample (c) provided more accurate results it does not seem likely that the method is inappropriate and preservation bias towards males equally does not seem to be responsible. It is more likely that purely the sample size has created this unrepresentative result.

Only the larger sample analysed by context could provide any comparative data when taking both age and sex into account. The results, illustrated in Table 7 below, indicate that more middle adults were present in this sample than the articulated remains. However, fewer old adults were represented.

	Young Adult	Middle Adult	Old Adult
Male	3	4	1
Female	4	3	1

Table 7: *Demographic Data of Disarticulated Sample*

Specific age categories for adults can only be determined on the basis of estimating an age at death based on the pubic symphysis or the auricular surface, both parts of the pelvis. The relative lack of old adults represented in the disarticulated sample may be either the product of small sample size again or could be attributable to the preservation conditions, with the more fragile bone of older individuals perhaps not surviving the heavy post-mortem disturbance as well as the younger adult bone. The older articulated individuals would have been interred in the last phase of burial and, therefore, would not have been subject to such intense re-use of the site, giving the remains a much better chance of survival. The presence of the middle adults again highlights the bias of the sample of articulated remains, where only 1 middle-aged adult was recorded.

3.4.5 Stature

Stature was assessed according to the metric analysis of long bones of adults using the formula provided by Trotter (1970). The averages presented in Table 8 were based upon only estimations of stature of individuals for whom sex could be assessed.

Sex	Height (m)	Number of Individuals
Male/Poss Male	1.71m (+/- 0.04)	6
Female/Poss Female	1.50m (+/- 0.05)	4

Table 8: *Stature Estimation according to Sex of the Disarticulated Remains*

There is a significant different between the two sexes in this sample as was also found to be the case in the articulated assemblage. However, compared to the articulated remains, the average height of males is higher whereas height for females is lower. The height in this sample of males is the same as the national average for males but the females are well below (Roberts and Cox 2003). This, variation in results is, again, likely to be due to the small numbers of individuals analysed.

3.4.6 Skeletal Pathology

Limitations to the Study

Only TPR rates can be estimated for the skeletal pathology prevalence rates of disarticulated material. This allows for some comparison of rates and collation of data with the articulated data. However, for the most part the age and sex of the individual is not known and the distribution of lesions about the body cannot be assessed due to the disarticulated nature of the assemblage. The diagnosis of many lesions to a specific disease in many cases will, therefore, not be possible and no pattern of prevalence amongst different age or sex groups can be analysed. None the less, the recording of lesions that can be diagnosed from clinical criteria confirms the presence of the diseases from the physical evidence, rather than having to rely on speculative historical documents where clinical knowledge was rapidly changing and medical terminology was not uniform.

Overall, of the 1504 fragments of identifiable adult bone, 10% showed pathological changes. Of the 199 sub-adult assemblage, only 1.5% exhibited any pathology. The difference is likely to be explained by adults living longer, allowing pathological conditions to affect the skeleton, as younger individuals succumbed more quickly to particularly perilous epidemic and endemic diseases.

The comparative rates of pathologies by aetiology, shown in Figure 13, are different in their distribution in this assemblage, particularly with regard to a seemingly much higher rate of joint disease prevalence. However, this is largely down to the different methods of prevalence rate calculation. For example, joint disease rates appear much higher as this figure is calculated as a percentage of all observable joint surfaces (i.e. a true prevalence rate). Degenerative Joint Disease in the Spine is a condition that is likely to affect several vertebrae in the same individual, so the same condition in the same individual may affect several different elements. In addition, two vertebral elements are required to make what would be recorded as one vertebral joint in an articulated individual and therefore, if any of the disarticulated vertebrae belonged to the same individual the count of joint disease of these elements would be doubled. Using the TPR method of rate calculation, therefore, produces a much higher percentage than the CPR rate. As

will be discussed later, 44% of joint disease was recorded as having occurred in the spine, so the rate of joint disease may not be a fair comparison. Disregarding joint disease, the overall pattern of the aetiology of disease is similar to the articulated assemblage, although the actual percentage rates vary.

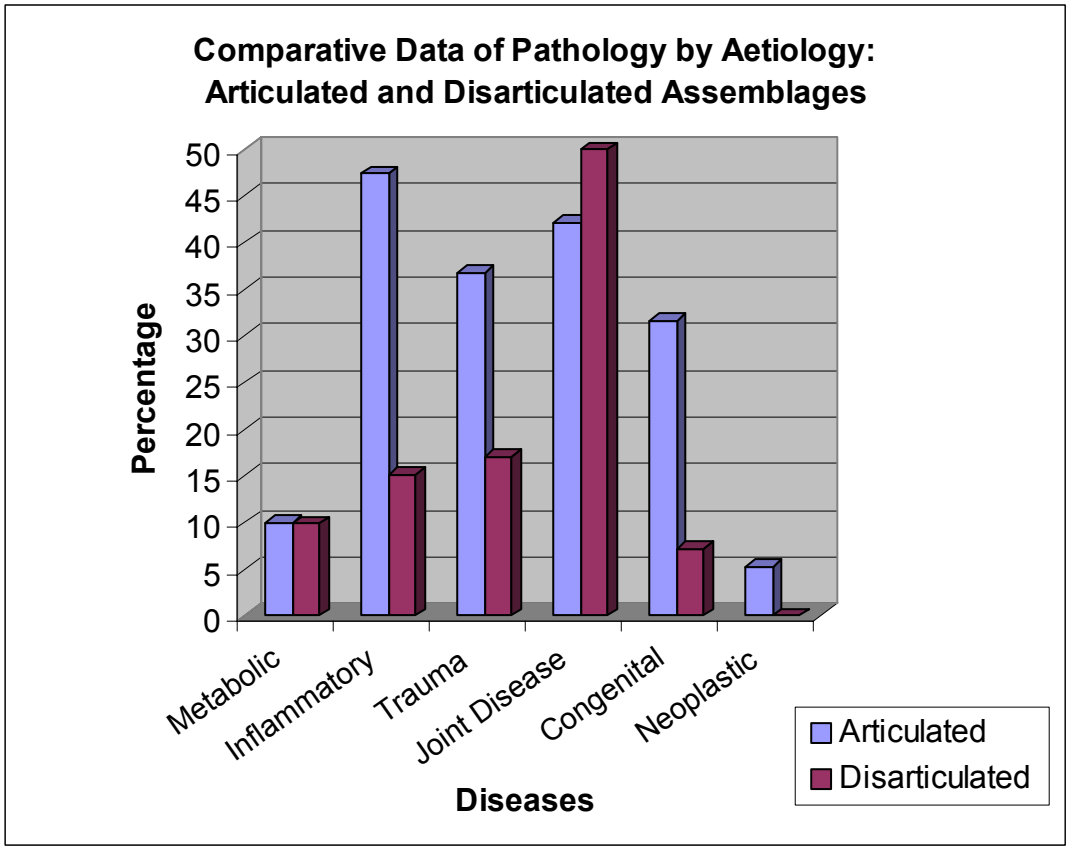


Figure 13: *Comparative Rates of Pathology Prevalence according to aetiology*

Inflammatory and traumatic conditions are still the two of the most common causes of pathological lesions in the assemblage; again, however, it should be noted there are problems comparing the inflammatory rates of disease, ribs were fragmented and it was not possible to tell if any fragments belonged to the same bone or to the same individual. The rate of rib lesions, will, therefore, be an absolute minimum and probably will be comparatively underestimated.

In spite of these limitations, most other pathological prevalence rates can be calculated per observable number of elements and, therefore, are comparative to the articulated sample.

Congenital Conditions

Eleven elements with congenital or developmental defects were observed amongst the disarticulated assemblage. The results of the analysis are presented in Table 9 below. With the exception of the lateral wedging and asymmetry observed in 5 vertebrae, likely to have been the result of scoliosis of the spine, as well as the deformed rib head, also likely to have been associated with scoliosis, none of the other pathologies here were observed in the articulated assemblage.

This, importantly, included a case of coxa vara (angulation of the neck of the femur to approx. 90°) that was likely to have been the result of congenital/developmental dysplasia of the hip in an adult male (see Plate 35). Developmental Coxa Vara is the sequela of an ossification defect in the neck of

Pathology	No.	Total Number of Elements	TPR (%)
Partial calcaneonavicular bar	1	13	7.7
Klippel-Feil	1	19	5.3
Coxa Vara/DDH	1	15	6.7
Lateral Wedging, asymmetry, scoliosis (all [151])	5	62	8.1
Curly Toe (Varus deformity)	1	9	11.1
Cleft Sacral Arch	1	11	9.1
Rib	1	60	1.7

Table 9: *Congenital Conditions observed in the Disarticulated Assemblage.*

the femur, whereas this specimen exhibited none of the associated shortening of the neck (Salter 1999).Coxa Vara is a condition that can be also be the result of either a slipped femoral epiphysis (where secondary avascular necrosis would have been expected, which is not present in this case), generalised and disseminated bone disorders such as rickets (no bowing of the femoral shaft was evident) and also occasionally in the dislocation or subluxation of the hip at birth, where the femoral head slips out the socket (Oldnall, N, 2006). If completely dislocated, a pseudo-acetabular joint is formed. This joint is much shallower and much less stable and although mobility is possible, it produces a distinct gait. The abnormal forces exerted through the joint general lead to secondary osteoarthritis, as was the case in this example (see Plate 36). A large peripheral osteophytic growth around the entire joint surface as well as micro-, macroporosity and eburnation on the posterior surface were present and are likely to have caused considerably pain for this individual.

Plate 35: *Coxa vara seen in the femur of an adult male from context [151] (normal femur on the left side for comparison)*

Plate 36: Severe Secondary Osteoarthritis on the posterior aspect of the femur exhibing Coxa Vara [151].

A second condition observed, also with secondary osteoathritis present was that of Klippel-Feil Syndome, where a failure of the segmentation of the individual vertebrae occurs (Barnes 1994). In this case, the second and third cervical vertebrae were fused together and the block vertebrae were thus classified as a type 2 defect (Barnes, 1994 p.69). A type 2 defect in itself generally associated with no symptoms but the severe secondary osteoarthritis associated with this particular example must have been brought discomfort and restrictions upon neck movement.

Other congenital conditions observed were due to reasonably common variations in bone formation and would have had no serious impact.

Metabolic

Two metabolic conditions were observed in the disarticulated assemblage and these were also observed in the articulated sample. Cribra Orbitalia, associated with iron-deficiency anaemia, was found in 9 out of the 64 observable eye orbits, a prevalence rate of 14.1% TPR. This is similar to the TPR rate found in the articulated assemblage. The second metabolic condition was a case of rickets, the childhood version of osteomalacia. The affected femur exhibited anterior bowing to the proximal third of the diaphysis in addition to platymeric remodelling of the shaft (see Plate 37 below). Coxa vara was also present (see Plate 38). No secondary degenerative changes had occurred to the joints. The medial condyle of the distal femoral condyle was much longer than normal and would have resulted in a genu valgum deformity at the knee (see Plate 39). This would have caused the leg to bend inwards at the knee with the lower leg being displaced outwards or laterally in relation to the upper leg. These are all classic changes associated with rickets resulting from a lack of vitamin D during childhood. There is still much debate as to whether such changes found in an adult bone indicate that the

condition was ongoing into adulthood or whether the changes are residual (i.e. healed) and the condition was not active at time of death. Since this example does not exhibit gross deformity due to ongoing mechanical failure to bear stress, it is likely that the changes seen here represent a case of residual rickets (Ives 2006, *pers. comm*.).

Plate 37: *Rickets of the left femur with model of normal femur for comparison*

Plate 38: Coxa Vara, exhibited by the decreased angle between the femoral head and the shaft, in addition to the anterior bowing exhibited in this rachitic femur [151].

Plate 39: *Genu Valgum deformity of the medial condyle of the rachitic femur with model of normal femur for comparison*

Inflammatory Conditions

As with the articulated remains, several lesions associated with inflammation were observed in the skeletal elements of the disarticulated assemblage. Table 10 presents a summary of the adult elements exhibiting inflammatory changes:

Inflammatory conditions here recorded here are likely to be related to non-specific infection. Some involved periostitic reactions only (2 fibulae, 1 frontal, 1 parietal, 5 ribs and 6 tibiae), representing a local trauma or infection, some exhibited either very heavily periostitic lesions or osteitic lesions, involving the cortex of the bone (1 femur, 1 humerus, 1 third metarsal and 1 tibia), and some appeared to have changes involving to cortex of the bone only (osteitis), with no surface periostitis and on some occasions visible expansion of the trabeculae into the medullary cavity of the bone (1 femur and 3 tibiae).

Element	Number	Total No. Of Elements 25%>	TPR
Frontal	1	35	2.9
Parietal	1	48	2.1
Femur	2	61	3.3
Tibia	10	65	15.4
Fibula	2	24	8.3
Humerus	1	49	2
Metatarsal 3 of MT2,3,4	1	48	2.1
Rib	5	173	2.9

Table 10: *Summary of Inflammatory conditions (non-specific) observed amongst the adult skeletal disarticulated remains*

The elements placed in to latter category all have a differential diagnosis of being caused by neoplastic disease; although rare in archaeological material, it is difficult to differentiate between these diseases without radiographic examination and cannot be ruled out as a possible cause of the lesions. If inflammatory, these lesions may have been caused by haematogenous spread of bacteria into the bone. No evidence of osteomyelitis, however, with draining sinus holes or *cloacae*, typical of haematogenous infection, was observed.

One juvenile frontal bone was observed as having localised periostitic reactions on the internal (endocranial) surface in the form of small areas of porotic bone formation with capillary impressions (see Plate 40) (*n* = 1, TPR 100%).

Plate 40: Areas of endocranial periostitic reaction of a juvenile frontal bone [244]

The relatively smooth nature of these lesions along with the presence of the capillary impressions may well indicate that these lesions were healing at the time of death (Lewis 2003). The cause of this type of lesion is inflammation to the

meninges, either related to trauma or infection. The specific aetiology is unknown and can be caused by a number of conditions: primary or secondary infection, tumours, tuberculosis, syphilis or vitamin deficiencies of A, C or D (Lewis 2003).

Trauma

Several incidents of trauma were observed amongst the disarticulated remains and there was a much higher number of fractures, as can be seen in Table 11. This included some unusual and interesting fractures, including a fracture-separation of the proximal radial epiphysis, a fracture to the ramus of a jaw and an ununited fracture of an ulna and a crush fracture to a finger.

Trauma	Number	Total number of elements	TPR (%)
Fracture Distal Fibula	1	24	4.2
Fracture Distal Humerus	3	40	7.5
Fracture Mandible Ramus	1	36	2.7
Fracture Metacarpal 3/of MC2/3&4	1	26	3.8
Fracture Prox Hand Phalanx	1	37	2.7
Fracture Radius Epiphyseal plate	1	28	3.6
Fracture Rib	7	173	0.6
Ununited Fracture Ulna	1	43	2.3

Table 11: Summary of Fractures from the Disarticulated Skeletal Elements

The fracture-separation of the radial head would have occurred during childhood principally as a fracture through the growth plate prior to fusion of the epiphysis. The blood supply to the intra-articular radial head is precarious and such a fracture would have cut off at least some of the supply, causing avascular necrosis of the epiphysis itself (Salter 1999). This necrosis of the radial head has caused it to become 'mushroom' shaped rather than being a concave (see Plate 41) and therefore, the radius would not have been able to articulate with the humerus in its normal ball- and-socket type joint at the capitulum.

Plate 41: *Fracture dislocation of the radial head*

This type of fracture is caused by a fall onto the elbow, exerting forces of compression and abduction onto the joint (Salter 1999). It is possible that there was an idiopathic osteochondrosis of the proximal radial head, where similar avascular necrosis would have occurred. The aetiology of the ostechondroses are unknown but trauma is suspected to play some role in their occurrence as their incidence rate is higher amongst juvenile boys. Whilst this remains a tenable differential diagnosis, the radial head is not a common site of this epiphyseal disorder and it is likely that a true fracture had occurred.

The fracture of the ramus of the jaw is also fairly unusual in archaeological material and great force is required to break this particularly resilient bone. Fractures of the jaw occur upon collision, falling or a blow from a violent assault (Salter 1999). Consequences can be serious, since not only is the fracture of the bone itself very painful, requiring immobilisation of the mouth to heal, the force exerted can also cause damage to the teeth. Almost certainly upon healing the teeth will of the maxilla and mandible will be out of alignment, making chewing of food more difficult.

Plate 42: *Well healed but misaligned fractured mandible.*

As can be seen in Plates 42 and 43, the fracture, located across the mandibular angle has healed well but the body of the mandible has been medially displaced. There appears to have been no damage incurred to the teeth present and there is no calculus on the occlusal surface of the teeth, implying that the teeth were still be being used to chew after the fracture had occurred.

Plate 43: *Medial Displacement of the mandibular body as a result of the fracture*

The third fracture was that of an ulna. This fracture was ununited, either through failure to immobilise the forearm or because the individual had died prior to completion of the fracture healing. Little callus has formed around this fracture and the lack of pseudoarthrosis ('false joint') suggests that the fracture may well be peri-mortem (see Plate 44).

Plate 44: *Unhealed Fracture of the Ulna.*

One final fracture that was of interest was that of a crush fracture to a proximal hand phalanx (see Plate 45). The fracture had occurred to the distal metaphyseal/epiphyseal area of one side of the phalanx; it was well healed but one side of the bone was malformed and a lamellar callus protruded laterally and superiorly. In the anterior-posterior aspect, this part of the bone is flattened and the anterior surface is irregular, with no defined articular surface remaining. This is likely to be the result of a crushing or a hyperextension injury (Salter 1999) and this type of fracture often occurs as the result of an occupational injury, especially working with machinery. It may even have been the case that the rest of the digit was lost as a result of the accident, perhaps resulting in the lack of articular surface for the middle phalanx and the irregular protruding bony mass.

Plate 45: *Crush fracture to the distal end of a proximal hand phalanx (normal bone on right for comparison)*

In addition to fractures, 5 cases of myostitis ossificans were recorded. This is the ossification of soft tissue around an area where trauma has occurred. This is very often represented by 'enthesophytes' or small bony projections around muscle and ligament attachments. One fibula, one third metacarpal, one ischium and two tibiae had been affected by skeletal soft tissue trauma: one case had led to the bony ankylosis or fusion of the tibia to its associated fibula.

There was evidence of one possible shoulder disclocation, with the glenoid fossa of the scapula exhibiting a smooth lamellar extension to the anterior aspect of the joint surface, making the anterior joint cupped (see Plate 46). The superior posterior margin of the joint surface exhibits a small plateau, rather than being having a clearly demarcated edge, and there is osteophytic lipping around the inferior margin of the joint. In addition, the acromion process has entheophytes projecting anteriorly with microporosity on the inferior surface. The acromio-clavicular articular surface also exhibits microporosity. This may be indicative of an anterior-superior subluxation of the joint. Only 13 skeletal elements were recovered from this context and consisted of a left scapula, left clavicle and 11 rib fragments. It is suggested here that these elements are associated elements are highly likely to belong to one individual. Two of the rib fragments were had been fractured and these may have been linked to the injury to the shoulder. The rib fractures were well healed and occurred well before death, so there is a possibility that these injuries were the result of separate events. The lack of degenerative joint

disease is indicative of a relatively successful reduction of the dislocation or perhaps reflect the fact that the individual did not live long enough to develop any degenerative joint disease.

Plate 46: Possible Subluxation and Rib Fractures from Context [120]

Joint Disease

As discussed earlier, it would appear that the largest percentage of pathologies recorded amongst the disarticulated remains were joint diseases. As can be seen in Table 12 below, the majority of joint disease was recorded in the vertebrae (44%) and it cannot be categorically stated that these vertebrae were completely disassociated.

All the changes seen in the vertebrae were degenerative in nature, with the exception of one vertebra exhibiting a large osteophyte on the right hand side of the anterior aspect of the vertebral body. This large, flowing osteophyte may have been associated with DISH (Diffuse Idiopathic Skeletal Hyperostosis), skeletal changes of which are generally associated with older men who had a rich diet and possibly suffered type II diabetes. However, it is not possible to diagnose DISH without the presence of 4 fused vertebrae.

Element	Number	Total Number Obs.	TPR (%)
Axis	3	8	37.5
Cervical Vertebra	2	13	15.4
Clavicle	1	7	14.3
Femur	9	74	12.2
Ilium	4	7	57.1
Ischium	3	11	27.3
Lower Thoracic Vert	6	7	85.7
Lumbar Vertebra	9	29	31
Metacarpal 1	2	10	20
Metatarsal 1	1	16	6.3
Middle Foot Phalanx	1	1	100
Middle Thoracic Vertebra	6	9	66.7
Os Coxa	3	8	37.5
Patella	4	10	40
Radius	1	16	6.3
Rib	5	67	7.5
Scapula	3	13	23.1
Thoracic Vertebra	3	12	25
Upper Thoracic Vert	2	7	28.6
Vertebra	5	8	62.5

Table 12: *Summary of Degenerative Joint Diseases/Osteoarthritis Observed in the Disarticulated Population*

The majority of the extra-spinal joint disease was degenerative or osteoarthritic in nature; these changes could be age-related or may also be secondary to trauma. One example is a very severe case of osteoarthritis of the wrist seen a distal radius. This consists of large area of eburnation with a groove worn into the articular surface, as well as microporosity (see Plate 47). This area of the bone articulates with the scaphoid bone in the wrist and may have occurred as some repetitive action involving pressure on the thenar (thumb) region of the wrist or perhaps was secondary to some trauma at this site.

Plate 47: *Osteoarthritis of the wrist (distal radius)*

Two elements exhibited resorptive periarticular lesions and may well be the result of rheumatoid arthritis, an inflammatory joint disease. One element was a 1st metacarpal (n = 1, TPR = 10%) and the other was the distal end of an ulna (n = 1, TPR = 11.1%)(see Plates 48, 49 and 50).

Plate 48: *Resorptive Lesions Distal Metacarpal 1 with normal bone on left for comparison (Above left)*

Plate 49: *Resorptive Lesions Proximal Metacarpal 1 with normal bone on left for comparison (Above right)*

Plate 50: *Resorptive Lesions Distal Ulna (Left)*

These lesions are very similar in appearance and are likely to have the same aetiology. Rheumatoid arthritis is a relatively recent disease and is rarely seen in archaeological material. The early stages are known to affect the periarticular regions of the bones as it is primarily a disease of connective tissue and affects the synovial membranes of joints and tendon sheaths. An inflammatory granulation tissue forms across the joint surface, cutting off nutrition of the articular cartilage of the joint and erodes the subchondral bone at the margins of the joint to form osteolysis or erosions in the bone (Salter 1999). In the early stages, the hands and wrists are the primarily locations of the disease with larger joints becoming involved latterly. It is not possible to give a conclusive diagnosis of the disease to this diarticulated material since that would require an examination of the distribution of the lesions about the skeleton, as this disease is usually affects the bones bilaterally. However, the changes recorded in these individual elements are consistent with those clinically observed.

Neoplastic Disease

No categorical evidence of any neoplastic conditions were found amongst the disarticuated material from St. Andrew's. Nonetheless, some of the lesions decribed as osteitic may well have resulted from neoplastic disease. However, it would not be possible to diagnose this without radiographs and even less likely purely on the observations of a single skeletal element.

Dental Disease

Dental disease amongst the disarticulated remains was recorded according to the same methods as the articulated assemblage. Prevalence rates of dental diseases are presented here as a percentage of the number of observable teeth present or number of observable sockets. Juvenile and adult data are treated separately.

In total, 101 teeth and 283 sockets were recorded as observable amongst the permanent adult dentition. In addition, 37 observable teeth were recorded amongst the sub-adult dentition consisting of only deciduous teeth; 7 permanent teeth were also recorded as present but unerupted. The total number of mixed sub-adult tooth sockets was 61.

Disease	Caries	Calculus	Ante-mortem Loss	Abscesses	Enamel Hypoplasia
Number of teeth/sockets affected	17	69	105	4	26
Prevalence (%)	16.8	68.3	37.1	1.4	25.7

Table 13: *Dental Disease Prevalence Rates for the Adult Disarticulated Material*

A comparative analysis of the data from the articulated and disarticulated assemblages shows a similar pattern of the true prevalence rates of the different dental diseases (see Figure 14). Calculus and ante-mortem tooth loss are the most prevalent diseases. The rates of calculus are a lower amongst the disarticulated remains but this may be due to preservation of the calculus as deposits can be knocked off through post-mortem action. However, this rate is very similar to crude prevalence rates reported from other sites.

Ante-mortem loss was actually higher amongst the disarticulated remains. This may in part be due to the presence of one mandible that was completely edentulous (see Plate 51). The level of alveolar bone remodelling was unusually similar along the entire body of the ramus, suggesting that all the teeth from the jaw may have been lost at a similar time. Natural tooth loss generally occurs a one tooth or a few teeth at a time with age or as a result of disease, so that some teeth may have been lost ante-mortem and some, usually in the anterior dentition remain. As a result of being unable to chew using the gum in the gaps left by the sporadic ante-mortem tooth loss and also due to habitual use of the remaining anterior dentition for chewing, it is more usual to find that the edentulous parts of

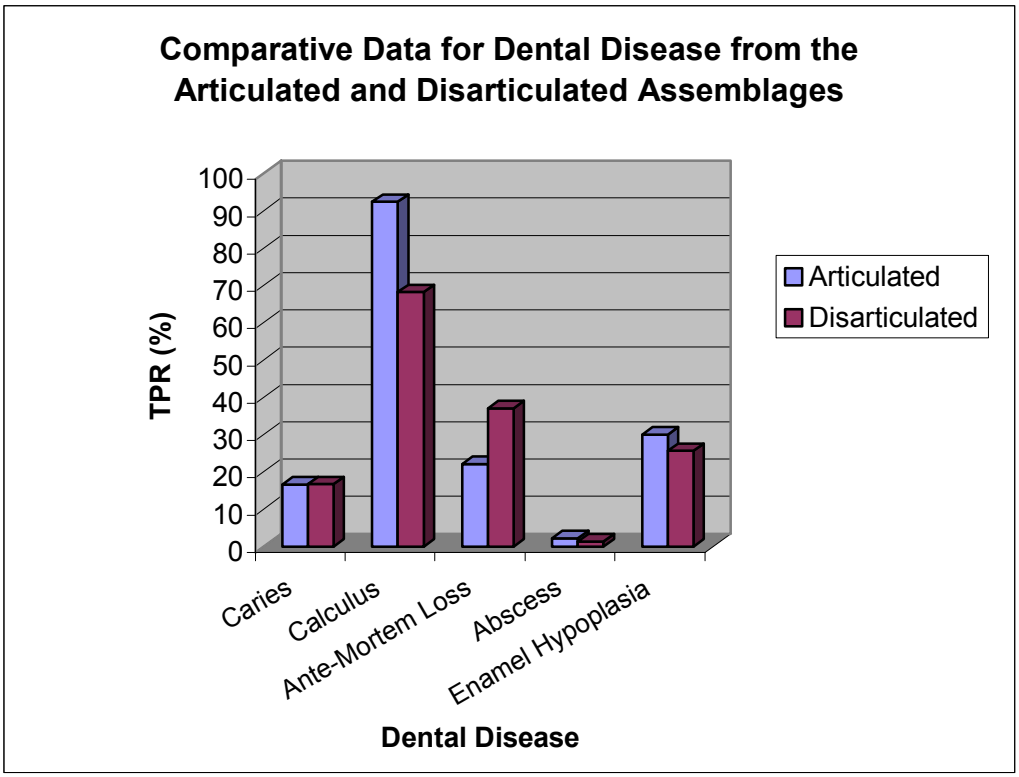


Figure 14: *Comparative Prevalence Rates of Dental Disease from the Articulated and Disarticulated Assemblages*

the jaw bone have been resorbed and is somewhat atrophied. However, this jaw is very robust and it seems that this individual may still been using the edentulous jaw for chewing, should the teeth have been removed some time prior to death. This is not uncommon, as the soft tissue of gums can harden if they continue to be used to chew.

Plate 51: *Edentulous Mandible with Similar Levels of Alveolar Remodelling*

Unfortunately, it is not possible to tell if the teeth have been removed as a result of dental practice or have fallen out subsequent to a disease such as scurvy, perhaps, where teeth become loose in their sockets as membranes breakdown. It has been

documented historically that some people had all their teeth removed voluntarily at a young age to avoid any later dental problems (Roberts and Cox 2003). It is also known clinically that diseases such as advanced pyorrhoea (gum disease) can lead to dangerous levels of haemorrhaging and requires immediate extraction of all teeth to stop the bleeding.

No evidence of dental disease was exhibited in the sub-adult dentition.

3.4.7 Peri- and Postmortem Modifications

Two examples of peri-mortem modifications to bone were recorded, both likely to have been very old post-mortem breaks. These have been recorded as peri-mortem here since they appear to have occurred only a short time after death and should not be confused with more recent post-mortem modifications.

Both modifications affected femoral heads that appear to have been fractured off the diaphysis by way of a blow with a digging tool i.e. a mattock or spade. This has produced a sharp edged chop with an undulating but smooth surface of trabecular bone, which is the same colour as the outer cortex. The line of the break is roughly that of the line of the angle of the femoral head contained within the acetabular joint (see Plates 53 and 53).

Plate 52 & 53: *Peri-mortem severing of two femoral heads*

It seems likely that this may represent the removal of the leg from the rest of the body whilst cutting a new grave through a pre-existing one. It is a possibility that, due to the colouration of the bone, that the bone was chopped through whilst soft-tissue was present, which would confirm the contemporary records of the parish burial grounds being so full that relatively recent burials had to be disturbed in order to make way for new interments. However, the smoothness of the trabeculae could have been created through abrasion of the bone if it has moved around in the soil after becoming disarticulated. Nonetheless, the angle of the line of the break across the femoral head suggests they were indeed in articulated anatomical position before being hacked through.

Another example of a post-mortem modification was that of a subcircular hole in the distal end of a tibia. In this example, only one side of the bone was perforated

(See Plate 54). It is unclear as to what has caused this hole, it may well have been due to natural taphonomic causes, for example, perhaps the growth of a root through the anterior surface of the bone or insect damage, but the circular nature of the hole could equally be due to artificial causes. Many post-mortem holes are recorded in assemblages of this period but there currently is no literature on their likely causes. It is known that sextons used boring rods to test ground prior to reuse of an area but no details known as to the size of these rods. It might well also be the case that the hole was made with the tip of a pick-axe.

Plate 54: *Post-mortem hole in the anterior surface of a distal tibia.*

3.4.7 The Disarticulated Assemblage: Conclusions

Analysis of the disarticulated material has provided new and important physical evidence of the diseases and environment the population of St. Andrew's lived in. Although the analysis of single skeletal elements is more limited than that of articulated remains, many pathological changes were recorded amongst this assemblage that were not observed in the articulated assemblage. This included a greater range of inflammatory and joint diseases, as well as a variety of fractures, that otherwise would have gone unobserved. This included important and rarely reported diseases, such as a possible case (or cases) of rheumatoid arthritis, a relatively recent disease whose documented history is important in tracing its aetiology. In addition, the greater number of fractures occurring outside the rib cage in the disarticulated assemblage indicates the perilous nature of life in Worcester at this time, either as a result of the increasing industrialisation of

occupations, high levels of violence or simply the fact that the ever-increasing population density of these inner city parishes resulted in a greater risk of accidents. Although there are limitations to the comparison of the prevalence rates of the diseases and also in the analysis of demographic data from a disarticulated assemblage, it is clear from this analysis that important information was retrieved, particularly in the light of the small sample size of the articulated remains and that the assessment of the disarticulated material not only complemented but also expanded upon the data compiled from the articulated assemblage.

4: Conclusion: Life in St Andrew's

Aspects of life in St. Andrew's throughout the late Georgian and early Victorian period are illustrated through many different sources and these all indicate that although life was much more labour intensive at home and at work, In addition, the climatic changes experienced during this period may have exacerbated some conditions. It is known that the late Georgian and Victorian period saw an increasing number of colder winters and hot summers, making people more susceptible to infections during the winter months and living conditions generally more difficult (Roberts and Cox 2003). Compounding these factors, the period saw an exponential increase in the use of coal in industry and at home, causing air pollution in many urban areas (Roberts and Cox 2003). The causes of disease at this time were, therefore, manifold and interrelated, especially in the urban environment. This is reflected in both the high infant mortality rates and the presence of conditions such as rickets, a disease of infancy, as well as by the chronic inflammatory diseases endured by the adult population of St. Andrew's. Most people, however, adapted well both socially and physically to overcome the harsh environment of the Industrial period. Increasingly strategies were devised regarding the provision of medical care and financial support in an effort to compensate for the overcrowded housing, poor sanitation and hazardous working conditions. This ensured that the majority of the population, despite many in communities like St. Andrews receiving a relatively low wage, had access to some provision of medical care, a fact testified to be the number of well-healed fractures in the population.

Though the population was afflicted by seamlessly endless epidemic and endemic diseases, those who were biologically strong enough to survive these diseases in childhood stood a good chance of getting to old age, despite suffering chronic conditions resulting in skeletal lesions, such as inflammation and degenerative joint disease. The physical evidence from both the articulated and disarticulated material suggest that the concern of contemporary physicians regarding chest diseases was well founded, with visceral surface rib lesions being one of the most commonly observed inflammatory conditions. Although the source of these lesions cannot be specifically identified, lung inflammation from silicosis as an occupational disease and endemic tuberculosis, testified to by contemporary reports, seem at be plausible explanations of the high prevalence rates exhibited by the skeletal remains. The several examples of trauma also testify to the busy lifestyle and high risk of accidental (or possibly intentional) injury from living in a populous community.

There is no coincidence between the evidence from the burial ground itself, with multiple inter-cutting interments and large quantities of disarticulated material and the presence of the overcrowded maze of streets and courts in its parish just yards away.

Plate 55: *Rear of Copenhagen Street from St Andrew's Churchyard in the 1930's (After Worcester City Museums, 2006).*

It is also a testament to the contemporary conditions of the burial ground and the parish that both went out of use not long after this period, being no longer tenable as serving the community that had been based in this ancient area of Worcester. The intensive use of the graveyard as portrayed in historical accounts now has some testament in the physical evidence from both the excavation of the graveyard and the peri- and post mortem damage that has occurred to the remains themselves.

The evidence gained here from the human remains has made a valuable contribution to our understanding of the physical conditions of life at St. Andrew's, albeit based on a small number of remains, as well as the contemporary attitudes towards health, disease and death. It is hoped that future work in this field, integrated with data from historical and archaeological research, will allow a greater insight to be gained into the nature of the changing environment of Worcester city through time.

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THE ARCHIVE

Type	No	Type	No
Skeleton Recording Form A	24	Skeleton Recording Form L	6
Skeleton Recording Form B	19	Skeleton Recording Form P	5
Skeleton Recording Form D	19	Skeleton Recording Form Q	10
Skeleton Recording Form E	13	Skeleton Recording Form R	2
Skeleton Recording Form F	2	Skeleton Recording Form U	1
Skeleton Recording Form G	2	Skeleton Recording Form V	1
Skeleton Recording Form H	16	Skeleton Recording Form W	11
Skeleton Recording Form I	16		
Skeleton Recording Form J	12		
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