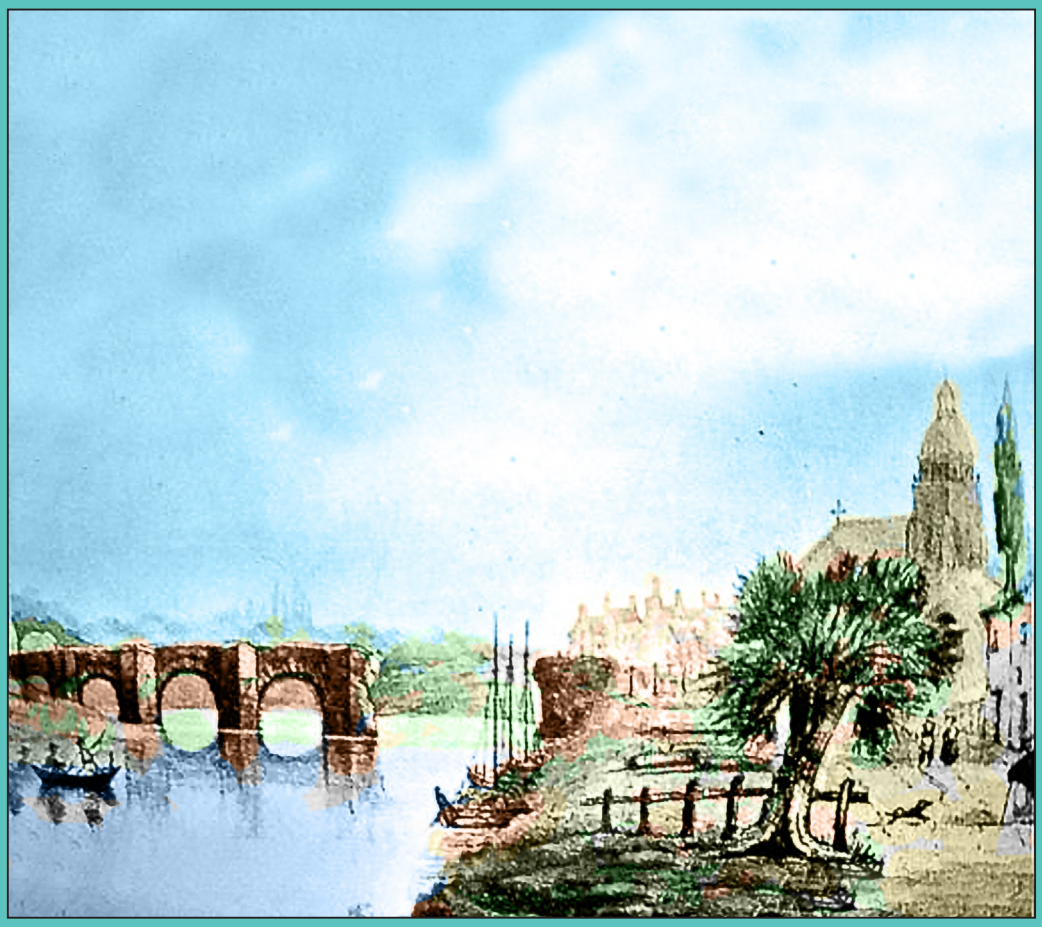
Worcestershire Archaeology Research Report No.13

Archaeological investigations on the

Flood Alleviation Scheme, Upton-upon-Severn



Elizabeth Connolly and Tom Vaughan

Worcestershire Archaeology Research Report no 13

Archaeological Investigations on the Flood Alleviation Scheme, Upton-upon-Severn

(WSM 43246)

Elizabeth Connolly and Tom Vaughan

With contributions by Elizabeth Pearson, Gaynor Western (Ossafreelance) and Dennis Williams

Illustrations by Carolyn Hunt and Laura Templeton

worcestershire county council

2023

Worcestershire Archaeology Research Report no 13

Archaeological Investigations on the Flood Alleviation Scheme, Upton-upon-Severn

Published by Worcestershire Archaeology
Archive & Archaeology Service,
The Hive, Sawmill Walk,
The Butts, Worcester.
WR1 3PD

ISBN 978-1-9998288-6-8

Worcestershire,County Council
County Hall, Spetchley Road, Worcester.
WR5 2NP

This document is presented in a format for digital use.
High-resolution versions may be obtained from the publisher.
worcestershirearchaeology@worcestershire.gov.uk

Front cover illustration: detail from Upton Bridge, 1852, by Mrs Lechmere

Contents

Figures

Summary

In 2014 Worcestershire Archaeology carried out archaeological investigations during the construction of flood defences as part of a flood alleviation scheme at Upton-upon-Severn, Worcestershire (centred on NGR SO 85224 40727). The project was undertaken on behalf of the Environment Agency. The site was located on the south bank of the River Severn, between the A4104 Upton Bridge and Dunn's Lane, on roadways, pavements and grassed areas. The entire footprint of the flood alleviation scheme was subject to an archaeological watching brief and, in addition, two small areas were subject to open area excavation after concentrations of archaeological deposits were identified. These two areas were centred on a former graveyard, located to the east of the present A4104 road bridge across the river (NGR SO 85146 40739); and the former bridge crossing point, in front of the King's Head public house (NGR SO 85214 40729).

The project has provided a wealth of information towards previously identified research priorities, notably the understanding of the transport revolution, and the physical anthropology of the mid 19th century population.

Within the graveyard a total of 31 inhumation burials were recorded of which 24 were exhumed as they lay within the impact level for the new flood defence wall. The burials dated from the Victorian period and were generally in a good state of preservation, allowing full osteological analysis which has revealed extensive information about individuals' age, demographic, health and socio-economic status for comparison with similar groups in this period both locally and regionally. Coffin fittings, including handles, rivets, studs and bolts were recovered from several of the graves. No name plates were recovered however, and therefore no individual biographical information could be determined. Evidence of preparation of the body for burial was present. Pennies were noted in the eye orbits of one sub-adult. This is a rare discovery; only one other example of this practice has been identified in the archaeological record for the post-medieval period in Britain.

In front of the King's Head public house the remains of the red sandstone bridge, completed in 1609, were recorded, along with the later drawbridge, built in 1854, to replace the by then, collapsed stone bridge. Remnants of the swing bridge which replaced the drawbridge in 1883 were also identified.

The report was first drafted in January 2016.

Background

Reasons for the project

Archaeological investigations were undertaken at Upton-upon-Severn, Worcestershire (NGR SO 85030 40420), between 26 September 2011 and 28 February 2012. The project was undertaken on behalf of the Environment Agency who were carrying out flood alleviation works with the construction of a flood wall and embankment. The site was located on the south bank of the River Severn, between the A4104 Upton Bridge and Dunn's Lane, on roadways, pavements and grassed areas. The footprint of the flood alleviation scheme was subject to an archaeological watching brief. An area of a former graveyard to the east of the present A4104 road bridge (NGR SO 85146 40739), and the location of a former bridge crossing point, in front of the King's Head public house (NGR SO 85214 40729) were subject to open area excavation.

The current project followed a number of archaeological investigations undertaken by WA for the Environment Agency, which have been reported on previously. An archaeological watching brief was conducted of works to the east of Upton-upon-Severn Marina, on Ryall Mead, on the north bank of the river (WSM 39863; centred on NGR SO 857 407; Hughes 2008). Archaeological evaluation trenching and watching brief of geotechnical test pits was undertaken either side of New Street and boreholes were monitored along the south bank of the river (WSM 39890 and 39891; centred on NGR SO 850 403; Hughes 2008). A watching brief was also carried out of works to the rear of Old Street and New Street (WSM 43246; centred on NGR SO 8503 4042; Lee 2011). The boreholes along the frontage revealed variable made ground deposits along the south bank of the river, over alluvial clays from 0.50m to 1.70m depth (Hughes 2008, 20).

The project conformed to the *Standard and guidance for archaeological excavation* (IfA 2008a), the *Standard and guidance for an archaeological watching brief* (IfA 2008b), and *Standards and guidelines for archaeological projects in Worcestershire* (WCC 2010).

The event reference for this project, given by the HER is WSM 43246.

The aims and scope of the project were identified in the model project proposal (WA 2010).

Methodology

Personnel

The fieldwork was led by Simon Sworn (BA). The report preparation was undertaken by Elizabeth Connolly (MA) and Tom Vaughan (MA, AIfA), the project manager responsible for the quality of the project. Illustrations were prepared by Carolyn Hunt (B.Sc., PG Cert, MIfA). Gaynor Western (MSc, Ossafreelance) contributed the Osteological Report. Dennis Williams (PhD) contributed the Artefact Report and Elizabeth Pearson (M.Sc.) contributed the Environmental Report. Online publication preparation was by Laura Templeton (BA MCIfA).

Documentary research

A desk-based assessment of the site was prepared prior to construction works (Entec UK Ltd 2008). The report suggested that there was the potential during excavation of foundations of the flood wall to expose part of the stone work of the 1607 or 1854 bridges at Upton. The presence of surviving remains of the earlier, wooden bridge was considered less likely.

The report also suggested that there was potential for former quays to survive behind the current stone wall to the river edge, and also that associated artefacts from a Civil War skirmish at Upton on 28 August 1651 might survive along the route of the proposed embankment.

It was recommended that it would be appropriate for any effects on structural remains or deposits of archaeological interest to be mitigated by a programme of archaeological sampling, recording and reporting.

Fieldwork strategy

No specification was prepared by WA prior to the commencement of fieldwork. However the works conformed to the model WA written scheme of investigation (WA 2013) and the *Standards and guidelines for archaeological projects in Worcestershire* (HEAS 2010).

Archaeological investigation was undertaken in phases (Trenches 5–11). It initially consisted of a watching brief of the groundworks, following the progress of the construction team. Trenches 1–4 were recorded as part of the earlier watching brief rear of Old Street and New Street (Lee 2011). Two areas of greater interest were identified during this element (both within Trench 8), which were then fully excavated to record significant deposits and structures within the impact horizon of the flood scheme foundations.

Fieldwork was undertaken by Worcestershire Archaeology (WA), between 26 September 2011 and 28 February 2012. The site reference number and site code is WSM 43246.

Structural analysis

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

Osteological Methodology

Gaynor Western

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). Full recording forms are supplied separately to be archived with any other archaeological recording forms. All skeletal data has been recorded using an MS-Access database(s) and is on the CD-Rom in the archive.
- 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 is on the CD-Rom in the archive.
- The material was analysed without prior knowledge of associated artefacts so that the assessment remained as objective as possible.
- Comparison of the results was made with published osteological data from contemporary skeletal populations. Data was compared to overall prevalence rate averages from post-medieval sites as reported in Roberts and Cox (2003). Particular attention was given to comparison of this assemblage from St Peter and St Paul's with local sites dating to the same period: *St Andrew's, Worcester (Technical College).* An assemblage excavated from the former Victorian churchyard of St Andrew's in Worcester city centre, comprising of 24 articulated individuals from inhumation burials and 1,703 disarticulated fragments of human bone (Western 2006); *Tallow Hill, Worcester*. Excavations in the former cemetery at Tallow Hill in Worcester city centre led to the exhumation of 10 individuals originally deposited in vaults. The vaults date to the mid Victorian period, though some vaults were still in use until 1904 (Ogden 2005); *St Martin's-in-the-Bull Ring, Birmingham*. A large late Georgian and early Victorian period assemblage consisting of 505 analysed individuals interred in both vault and earth-cut graves (Brickley, Berry and Western 2006).

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

The Disarticulated Assemblage; Methods and Process

The disarticulated assemblage was analysed macroscopically and recorded using a Microsoft Access database, which is on the CD-Rom in the archive. 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). Age of sub-adults was assessed using both dental development (Smith 1991) and eruption (Ubelaker 1989) as well as long bone lengths (Schaefer *et al* 2009) and epiphyseal fusion (Scheuer and Black 2004). 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.

The minimum number of individuals (MNI) represented by the assemblage was calculated according to the number of repeated elements or parts of elements in tandem with observations of age at death according to development.

Artefact methodology

Dennis Williams

Artefact recovery policy

The artefact recovery policy conformed to standard WA practice (2012, appendix 4).

Method of analysis

All hand-retrieved finds were examined. They were identified, quantified and dated to period. *Terminus post quem* date ranges were produced for stratified contexts, where possible. These were used for determining the broad dates of the phases defined for the site. All information was recorded on *pro forma* sheets.

The pottery and ceramic building material was examined under x20 magnification and recorded by fabric type and form according to the fabric reference series maintained by the service (Hurst and Rees 1992 and www.worcestershireceramics.org).

Environmental archaeology methodology

Elizabeth Pearson

Sampling policy

Samples were taken according to standard WA practice (2012). A total of 41 samples (each of 5 litres) were taken mostly from discreet areas of burials from the graveyard (head, pelvis, feet, etc.), to recover small hand or foot bones, foetal bones or gall/kidney stones. Samples for assessment were selected from the more complete burials and/or those known to contain artefacts or coffin furniture (Table 25).

Processing and analysis

The samples were processed by flotation using a Siraf tank. The flots were 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. A magnet was also used to test for the presence of hammerscale. The flots were scanned using a low power MEIJI stereo light microscope and plant remains identified using modern reference collections maintained by WA, and a seed identification manual (Capper *et al* 2006). Nomenclature for the plant remains follows Stace (2010).

Discard policy

The following samples will be discarded after a period of 6 months after the submission of this report, unless there is a specific request to retain them.

- Samples from (8150) <140> and (8147) <141>

All remaining soil samples from burials will be submitted with the human bone (hand-collected and recovered from samples) for reburial.

Statement of confidence in the methods and results

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

The application site

Topographical and archaeological context

Tom Vaughan

The archaeological background to this stretch of the River Severn is presented in *River Severn bank-side survey: Worcester to Tewkesbury* (Hurst and Miller 2008).

The town of Upton-upon-Severn lies on the western bank of the River Severn, at a height of *c* 15m AOD. It sits on a section of second terrace gravels over argillic brown earths of the Bromyard Association and over brown alluvial soils of the Lugwardine Association. In turn, these soils overlie a geological sequence of Downtonian Raglan Mudstone and riverine alluvium (Dalwood 1996). The alluvial soils are considered to be deposits from flooding episodes, particularly in the later medieval and post-medieval periods (Entec UK Ltd 2008).

The site lies within Upton-upon-Severn Conservation Area (Malvern Hills District Council 2008). A desk-based assessment of the site has previously been prepared (Entec UK Ltd 2008). The following expands on a previous report by HEAS (Hughes 2008, 4–5).

Upton-upon-Severn is first mentioned in records of 897, when the church at Worcester was granted an estate of five hides upon the death of the then incumbent Wullaf (VCH IV 214; Hurle 1988, 1). Upton is mentioned in the Domesday Book survey of 1086 when it was amalgamated with Ripple (Thorn and Thorn 1982, 173b; Hurle 1988, 3). The earliest settlement was focused around the Old Church of St Peter and St Paul (now known as the Old Church), of which only the west tower remains, the 'Pepperpot', and which dates from the 14th century (VCH IV, 216). The settlement was not well documented prior to the 15th century, although there is a record of a ferry in 1307–8 (VCH IV, 213; WSM 19748) and of a kiddle (fish net barriers) by 1377 (Hurle 1988, 12; WSM 18765).

The present town has a planned medieval layout and had been granted the right to hold a market by 1416 (WSM 12310; VCH IV, 213). It was laid out along the axis of High Street and Old Street, delimited by the River Severn, the rear of the burgage plots off Backfields Lane, Church Walk, Oak Street and Severn Drive (WSM 11503; Dalwood 1996). It comprises many fine timber-framed and brick built buildings of the 17th–19th centuries, for example, the Anchor Inn on the High Street (WSM 12369).

The first timber bridge had been built by 1480–82 when it is documented alongside references to the ferry being redundant in consequence (VCH IV, 213). It was one of the few bridging points across the river, and was mentioned by John Leland in his Itinerary of 1539. It was located at the northern end of the High Street (Hurle 1988, 14–6).

In 1575 the wooden bridge was documented as being in a state of disrepair, and a charity was founded in 1576 to raise money for the repair of both the bridge and the church adjacent. £700 was raised and two arches built by 1593. However the work had to be suspended due to a lack of funds and part of the bridge collapsed by 1605–6 (VCH IV, 213). Following 'An Acte for re-edifying of a bridge over the River of Seaverne neere the Towne of Upton upon Seaverne' (Hurle 1988, 18) in 1605–6, it was finally rebuilt between 1606 and 1609. The new structure, of red sandstone, consisted of five high arches and massive buttresses.

In the early years of the English Civil War (1642–51) two of the arches are reported to have been broken; in 1643, and, although repaired, the bridge was again documented as impassable in the Spring of 1644 (VCH IV, 213; Atkin 1995, 2). On 22 August 1651, the bridge was deliberately slighted by the Scots under the command of the Presbyterian Royalist General Edward Massey. The southern arch was demolished, which was then made accessible with easily removable wooden planks. This action did not prevent Parliamentarian forces, under Major-General Lambert, from entering the town and wresting control of this important river crossing from the Royalists on 29 August 1651, just a few days before the decisive Battle of Worcester on 3 September which saw the final Parliamentarian victory. The damaged arch was re-built soon after the conclusion of the conflict, following the collection of £130 to pay for a mason and two surveyors (Hurle 1988, 18; Atkin 1995, 132–4).

A mid 19th century plan of the bridge indicates that it comprised six arches and five buttresses which is at variance with the 17th century description (above; Figures 2 and 3). In early 1851 the bridge was struck by a barge, the Blaina, and the weakened arch was subsequently washed away by flood waters in February of either 1851 (Hurle 1988, 19) or 1852 (Figure 4; VCH IV, 213; http://www.upton.uk.net/history/bridge/bridge.html). The bridge was replaced in 1853–4 by a structure with four wrought iron spans. The southernmost section was a drawbridge, which could be drawn back on rollers underneath the approach platform which lifted to accommodate it (The Illustrated London News 1854). By the 1880s the slowness of the mechanism and the increased level of road traffic had rendered the drawbridge obsolete. In 1883, at a cost of £1,500, the retractable span was replaced with a swinging section, which pivoted on the abutment on the south bank (Figure 5; Hurle 1988, 20).

The swing bridge itself was replaced at a cost of £50,000 by the present riveted iron bridge in 1940, approximately 80m upstream to the north-west (Figure 1). The bridge was designed by Worcestershire County Council's County Surveyor B C Hammond, using the smaller bridge at Fladbury built in 1937 as a template. It was built by Thomas Vale & Sons Ltd. (Wilkinson *c* 2007; http://www.happypontist.blogspot.co.uk/2011/05/worcestershire-bridges-7-upton-upon.html). The viaduct over the floodplain on the north bank has been recently raised and modified, and the bridge is still in use today, carrying the A4104.

The southern ramp of the 1940 bridge lies across the graveyard extension of the Old Church, which is indicated on the 1st edition Ordnance Survey map of 1885 (Figure 5). The tithe plan of 1841 shows the same discrete plot (no. 307), although it is unidentified on this document (Figure 2; WRO ref. BA 1572). The graveyard took the form of a roughly triangular portion of land, between the more north-westerly previous alignment of Church Street and Church Cottages, set back approximately 15m from the river bank. No records appear to exist which indicate what was done with any burials which would have been disturbed during the excavations for the bridge foundations.

The Old Church of St Peter and St Paul

Gaynor Western

Historic and demographic background

In 1801, Upton was populated by a total of 1,858 individuals but by 1851 this had risen to 2,693 so it is clear that the town was growing rapidly in the early 19th century, thereby creating a need for a new churchyard. The graveyard was established in 1836, and was used

until 1865–6, when land for a new cemetery was allocated off Rectory Road as part of the Enclosure Award (pers comm Simon Wilkinson; Hurle 1988, 38, 93 and 97). Parish records for Upton-upon-Severn survive and contain a complete record of all the burials in the new extension graveyard dating to between 1836 and 1866. A total of 1,486 burials are registered in the records. Based on this figure, it is estimated that between 49 and 50 burials were interred in the extension graveyard every year. No plan of the burials is known but it is likely that burials were located according to social status and that there were family plots, as is common in graveyards at this time. Burials of individuals from the Union workhouse are also noted in the parish records.

During 1866, two further burials were noted to have taken place in the new cemetery, established during this year, and one interment took place in the vault in the Old Churchyard. It should be noted that it is possible that a few other individuals may have been interred in the Old Churchyard, or during 1866 in the new cemetery, without a note being made in the register.

Approximately half of the burial records, covering the period 1851–1866, were available as a transcribed document (http://huntleygenerations.jimdo.com/death-burial-records/). The records consist of demographic information concerning the name, age and sex of the deceased as well as the year of their burial. The sample consisted of 756 individuals (50.9% of the total). The youngest individual in the sample of records was James Sheen who was only 8 hours old. The oldest, Mary Oakley, however, reached the great age of 95 years. The sample was used to obtain a mortality profile of the Upton population (Figure 6).

The mortality profile demonstrates that although people frequently survived and died in old age, as is the case for modern populations (Figure 7), there was a very high rate of mortality for infants and young children, with the highest proportion of deaths occurring between the ages of 0 and 1 year. There are also more deaths in the younger and middle age categories than found in the modern UK population. This is due to the epidemic and endemic diseases prevalent in society at this time which were particularly virulent amongst children, such as whooping cough, typhus, measles, tuberculosis and cholera. Tuberculosis, for example, 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 (Lane 2001). 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 1940s (Lane 2001).

Causes of death recorded by the Registrar General for infants and young children (0–5 years old) in Upton from 1851 to 1860 indicate that ‘diseases of the brain’ caused the greatest number of deaths followed by diseases of the lungs, gastro-intestinal complaints and tuberculosis (http://www.visionofbritain.org.uk/unit/10139211/cube/CoD_DS_1850s). Death due to scarlatina, diseases of the stomach and liver as well as ‘violent deaths’ were also common in the under 5 year olds.

Overall, life expectancy in Britain during this period was 41 years for males and 43 years for females (Roberts and Cox 2003) though this is in part exacerbated by the high infant mortality rates described above. 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 borne out by both demographic and archaeological data (Kausmally 2004; Roberts and Cox 2003). The

burial registers from the Old Church of St Peter and St Paul show that of the adult population, 15% would be classified as young adults (20–34 years old), 19.9% as middle adults (35–49 years old) and 65.0% as old adults (50+ years).

In addition to death from disease, deaths due to accidents and occupational hazards were also higher in number. Transcriptions of the Berrow's index of Coroner's cases record the unknown or sudden deaths of 24 individuals from Upton between 1814 and 1833. Twelve of the individuals were identified as male and six female, with no note of forename or sex for the remaining six individuals. The vast majority of accidental and sudden deaths of all known individuals noted in the index involve men, however. Unfortunately the cause of death was not noted in majority of cases. However, the cause of death of four individuals was determined as accidental drowning, and a further three men were stated to be 'watermen'. One of the individuals was a child aged 5 who had drowned whilst swimming in the river. A similar case was noted in the burial registers of a 2 and a half year old who had drowned accidentally in a well in 1866. One unfortunate lady, Jane Williams, a brewer, was scalded in a 'skeel of hot wort' in 1826. Another had been administered a 'quantity of corrosive sublimate' in 1830 in an attempt to induce an abortion by her husband, who was subsequently charged with her murder. One individual of unknown identity was found dead in the river.

The high rate of accidental deaths is perhaps reflected by the fact that the burial records sample contained twice as many middle adult males (n=61) than females (n=30) (aged 35–49) and a third more young adult males (n=40) than females (n=30) (aged 20–34). In old age, however, males are only slightly over-represented (n = 153), with approximately 8% more males present than females (n=141) in this age group. Males are also over-represented in the sub-adult group, with 184 males aged 19 or below compared to 119 females. Overall, the ratio of males to females is 1.37:1 in the burial record sample. Sex distribution amongst a population may vary with age and migration but generally populations are found to have a ratio of 1.05 Male: 1 Female, males having a slightly higher mortality rate in all age categories in modern populations (Chamberlain 2006). The over-representation of males in all age groups amongst the burial population, working out at approximately 6 or 7 extra male burials a year, is partially evident by the census records for the period. However, these show only slightly more females than males living in recorded households in Upton from 1831 onwards, as may be generally expected (http://www.visionofbritain.org.uk/unit/10348031/cube/GENDER). It is known that a harbour for barges was located at Upton-upon-Severn; the transient nature of this lifestyle may also have contributed to an influx of itinerant male residents, some of whom may have died and been buried at Upton without being included in the census count. Further research would be needed to clarify the over-representation of males.

The census records from 1831, which would have included all the local population buried in the extension graveyard aged 5 years and over, also provide an insight into the economic and social status of males and some females (though only servants) living in Upton at the time (Figure 8) (Raw data from http://www.visionofbritain.org.uk/unit/10348031/cube/OCC_PAR1831).

The majority of males were employed in retail and handicrafts as well as in agriculture. A number of non-agricultural labourers were also present. In terms of socio-economic status, labourers and servants constituted 44.1% of the population while 38.4% were the 'middling sorts' (including small-scale farmers not employing labourers, with masters and skilled workers

in the manufacturing and handicraft trades). Employers and professionals made up 11.0% of the town's inhabitants (http://www.visionofbritain.org.uk/unit/10348031/cube/SOC1831). The vast majority of men in Upton were therefore employed in manual labour.

Health, Disease and Medical Treatment in the Victorian Period

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. In 1831, Upton had a total of 536 houses (514 of which were occupied) and this number had risen to a total of 584 by 1851. During the period that the new graveyard was in use, housing was expanding and in demand. The population estimates for Upton from the census information suggests that each house in 1831 had four to five residents, a level of occupancy that remained stable through to 1851. Overcrowding, therefore, does not seem to have been an issue in the town unlike at St Andrew's, an inner city suburb at Worcester, where a third of occupied houses were shared by two families and the average occupancy for each residence was five to six people (See Western 2006). The burial registers from the Old Church of St Peter and St Paul from 1851–1866 show that of the adult population, 65% were old adults (50+ years), indicating that having survived to adulthood, individuals in Upton had a considerably better chance of surviving into old age compared to their urban contemporaries at St Martin's, Birmingham where only 52% of the population died in old age according to the records (Brickley, Berry and Western 2006). The population of Upton may, therefore, have enjoyed a relatively better health status but with many being generally of a lower socio-economic status, access to costly physicians and medicines may have been problematic.

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. There was a variety of practitioners who could be could called 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 on a scale of the difficulty 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 classified as paupers could have sought Poor Relief and 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.

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 hospital catered for patients from both the city and the surrounding towns and

villages. However, the admission of poor patients to the hospital 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. This demand for medical attention was concomitant 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). For example, 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 2014).

A parish workhouse was already present by 1776–7 in Upton-upon-Severn in Court Street, with a capacity for 70 inmates (Higginbotham 2014). Subsequently, in 1835, following the New Poor Laws of 1834, The Upton-upon-Severn Poor Law Union was formed, after which neither financial nor medical support was administered in the parish community. The Union workhouse in Upton was built in 1836 and was designed to serve a catchment area covering 22 of the nearby towns and villages, including Hanley Castle, Great Malvern and Kempsey, with the aim of accommodating 150 inmates (Higginbotham 2014). Some inmates of the Union workhouse are recorded as being buried in the extension graveyard. Generally, the workhouses employed their own physician and it 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 1800s. 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).

Some of the population of Upton-upon-Severn, 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 without their own subscriptions. The foundation of Women's Friendly Societies, therefore, 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).

Burial Practices

The majority of the burials excavated from the new graveyard at the Old Church of St Peter and St Paul were typical of the desired 'decent' burial during this period and followed the predominant Christian practice of aligning the body in an east to west orientation with the head at the west end in preparation for facing Jerusalem at the time of the Resurrection (Figure 12). Intercutting of burials was rarely seen, suggesting that though the graveyard became full and was subsequently closed only 30 years after it was opened, there was little issue with restrictions on space for burials in the town. This is in contrast to the intercutting present at the burial ground of St Andrew's in Worcester, the inner-city suburb, where a large quantity of disarticulated human bone from disturbed burials was also discovered. Here, a contemporary report documents the complaints made by local residents about the stench arising from the over-crowded burial grounds in the city and that the sextons at St Andrew's were unable to dig new graves without disturbing older coffins, which were often smashed to make room (Curtis n.d.). The archaeological evidence from the excavations at Upton suggest, however, that there was no such pressure on space and burials remained relatively undisturbed during the time the graveyard was in use.

Those people not following the Anglican faith during this period, such as the Baptists and Quakers, were known as 'Dissenters' or later 'Non-conformists'. Private cemeteries founded by local institutions and authorities after the 1852 Burial Act generally had a designated area of burial for Non-conformists and very often a separate chapel in which their funerals were conducted. Such a cemetery was founded in 1866 in Upton with a separate chapel for Non-conformists aligned on a north to south axis abutting the east to west aligned Anglican chapel. Prior to this, there appears to have been no alternative burial ground in Upton for Non-conformists, though the burial records for the new graveyard at the Old Church of St Peter and St Paul indicate that some burials were officiated by a 'minister' rather than by the Anglican 'reverend'. Burials for many Christian religions were very similar in their physical rites (i.e. Catholic and Protestant burials) but the burials of some Non-conformist groups are aligned on a north to south axis instead of the traditional east to west. This orientation was a key element of expressing the rejection of a belief in the practice in intercession (Chenoweth 2009), an act or prayer which was thought to aid the transition of the soul from its corporeal to its ethereal

state. For some, east to west burial was tantamount to intercessory practice pertaining to the Resurrection and was met with disapproval. Evidence of north to south burials (or variations such as north-east to south-west) have been found at Hemingford Grey in Cambridgeshire, at the Quaker burial ground at Kingston-upon Thames and at the Quaker burial ground at Bathford, Bath (Tarlow 2011; Chenoweth 2009). More locally, north-west to south-east orientated burials were excavated from the Kings Fee site in Hereford, used as a burial ground by Baptists from 1837 until the 1880s (Archenfield Archaeology 2001).

Analysis

Structural analysis

The site narrative includes evidence gained from both the watching brief and excavation stages of the project. The fieldwork was undertaken in a number of specific areas (Trenches 5–11; Figure 1). Trenches 1–4 were part of a previous phase of works, previously reported on (Lee 2011, fig 2). For discussion here the results will be treated as a whole rather than by area.

Phase 1: Natural deposits

Natural deposits were noted in all the trenches and excavation areas. They consisted predominantly of brown silty clay alluvial deposits associated with various flooding episodes, dating from the medieval and post-medieval periods (Figure 25).

Phase 2: Post-medieval - late 16th–17th century

The stone bridge

The remains of the stone bridge (8106, 8157) completed in 1609 to replace the earlier, medieval, timber bridge were exposed in Trench 8 (Figures 9 and 10, 22–24). It lay adjacent to the King's Head public house, at the northern end of the High Street. The location has been well documented, although the state of preservation was unknown prior to the archaeological works.

The bridge survived at 0.80m below the existing tarmac road surface. The exposed remains comprised a north to south aligned wall (8106), made with well-dressed red sandstone blocks, roughly 0.80m x 0.30m x 0.30m, forming a well-faced west-facing upstream edge. It was 1.20m wide and extended beyond the limit of excavation to both the north and the south and also below the impact level. One of the stones on the outer face contained a well-defined mason's mark (Figures 10 and 23). This mark was a carved circle 0.24m diameter with incised lines within. The core of the wall was made from un-dressed sandstone and lias blocks of varying sizes within a lime mortar.

Adjoining the north to south wall to the east was a wall running east to west (8157), parallel to the flow of the river (Figures 10, 11 and 24). Both walls were keyed in, indicating that they were contemporary and both formed part of the original bridge structure. This east to west wall was constructed from un-dressed sandstone and lias blocks and bonded with a lime mortar. The wall was 0.60m at the top, but widened to 1.60m at the base with a substantial rubble core foundation. It is interpreted to have been the foundation for the first span of the bridge out across the river from the bank.

From within the stone make-up of the bridge, a single roof tile fragment was recovered, which dated to 1600 – 1900, which very loosely ties in with the recorded construction date of the bridge.

The eastern, downstream side of the bridge did not survive in as good a state of preservation as the western side. It had been truncated during the construction of the 1854 drawbridge replacement (8163; see below).

There was no sign of any construction cut for the bridge, which at the depth observed is likely to have been through shifting alluvial material, derived from various flooding episodes. The footings of the bridge were sealed by a deposit of thick mid reddish brown clayey silt with occasional sand (8150). This layer contained material from 1300 – 1600, which is either likely to have been re-deposited through flooding, as it sealed the bridge structure, or is contemporary with the end of this date range as the bridge construction started in the late 16th century, but was not completed until 1609.

Phase 3: Post-medieval - 19th century

Graveyard

Located adjacent to the eastern side of the present A4104 bridge across the river, the flood alleviation scheme extended over the site of a former graveyard. Excavation was undertaken of this area (Trench 8), within which a total of 31 human burials were recorded. Of these 24 were within the impact level of the development so were recorded and exhumed (Figures 1, 12 and 28–35). The osteological analysis of the human remains is presented in Section 5.2 below.

Articulated skeletal remains were found at a maximum height of 11.53m AOD and extended below the construction impact depth. They individuals were found to have been buried within coffins, with handles and sometimes evidence of coffin plates. The coffin wood had largely disintegrated although samples were retrieved. A number of the graves had been disturbed by concrete piles, inserted as part of the flood alleviation scheme (Figure 12).

It was generally not possible to determine any clear phasing or sequence of burial across the area of the graveyard excavated, as very few were observed to be intercut. The grave cuts were sometimes indeterminate within the homogenous graveyard soil (8001, 8002 and 8073), and only identified when a trace of coffin wood or articulated skeletal material was exposed. A small number of grave cuts were found to contain more than one individual (e.g. 8010 and 8013; 8023 and 8032 Figures 28 and 29), although in each case only the upper burial lay within the impact horizon and was removed.

Twenty two of the burials were aligned roughly east to west, with the head to the west, as is the norm within the Western Christian tradition. However, two of the burials were found to be orientated north to south, with the head to the south (8121–4 and 8137–40). These two graves lay adjacent, at the north-east edge of the excavated area, just inside the graveyard boundary. They were found to have been truncated by two later east to west aligned burials (8133–6, Figures 34 and 35), and were in a worse state of preservation, both of which indicates that they were of an earlier date. As with the others, they had been buried within coffins, at least one of which originally had a coffin plate (disintegrated fragments of which only survived) and coffin handle. Within the graveyard was a large pit (8056) that truncated some of the burials and was of a later date (Section 5.1.4 below).

The foundation for the curving north-eastern boundary wall of the graveyard was exposed (8072). It was comprised of red machine made bricks, 240mm x 113mm x 85mm, bonded in an off-white lime mortar (Figure 36).

Demolition of the late 16th–17th century stone bridge

Sealing the early 17th bridge was a brown silty deposit (8156). This was 0.30m thick and contained no datable material, although stratigraphically was later than the stone structure. This deposit was overlain by a later wall (8146), constructed from roughly hewn sandstone and lias blocks, 0.60m wide. The later wall followed the alignment of the earlier east to west wall for the original bridge (8157). Silty deposit (8156) indicated that the two were not contemporary. This later wall may relate to the re-building of the bridge after the span was destroyed in the Civil War in 1651, although the nature and size of the wall appeared insufficient for this task. It is considered most likely that it was built using material from the early bridge, once the bridge had been superseded by the drawbridge in 1854. There was a single re-used carved sandstone block incorporated into the wall, this stone was retained.

The extant remains of the stone bridge, and the possible later wall (8146) were sealed by a sequence of mortar and sandstone fragment rich deposits (8098–8105, 8147, 8148, Figure 25). There was no sign of any roadway associated with the early bridge, this may have been located much higher than the present surface, and therefore had been truncated some time ago. No dating was recovered from these deposits, but their location, butting and overlying the demolished bridge indicate that they derived from a period after the bridge went out of use in 1852.

The mid 19th century drawbridge

To the east of the post-medieval bridge, part of the later drawbridge was observed, comprised of two parallel walls (8158 and 8172). Both were 0.80m wide and extended below the impact level, so their full depth was not ascertained. The two walls were set approximately 7.50m apart and the space between in-filled with modern backfill (8167). Both walls were constructed from hewn blue lias stones, roughly 0.30m x 0.20m x 0.10m, and bonded with a hard concrete mortar (Figures 11 and 27).

Capping the eastern wall (8172) was a single course of large squared granite blocks (8171), 1.42m long x 0.74m wide and 0.45m deep (Figure 27). On the internal face of these blocks, a clear step was cut into the blocks, 0.15m deep. This step is likely to have supported the rollers onto which the retractable section of the drawbridge could be drawn back, to allow tall ships passage along the river (Figure 26).

The late 19th century swing bridge

The remains of the pivot area and the retaining wall are still visible along the waterside. During the excavations, part of the demolition of the drawbridge was visible, with cut (8164) dug for the present retaining wall. Within this, and forming the in-fill of the swing bridge wall, were further large granite blocks, which are most likely to be derived from the western drawbridge wall (Figure 27).

Other walls and culverts

On the western side of and butting the stone bridge was a deep vertical sided cut (8112) that contained a brick culvert that ran alongside the earlier structure. This culvert contained a series of deposits. The cut truncated the series of ash, charcoal and clay deposits to the west

of the bridge. The material recovered, the size of the bricks and the height at which the culvert was dug would suggest that this feature was no later than Victorian in date. It is considered likely that it took rain water from the main street out, and into the river.

Towards the eastern side of the development (Trench 10: Figure 1 and 37) a brick culvert (10009), roughly 0.85m diameter ran towards the river. This was constructed of bricks, 225mm x 105mm x 65mm, bonded with a lime mortar and truncated deposits which dated to the late 18th – early 19th century. These earlier deposits were very similar in nature too those noted on the western side of the medieval bridge and the eastern side of the graveyard wall (see below).

Additional small sections of brick wall footings were also noted during the watching brief.

Deposits between the graveyard and the stone bridge

Between the graveyard and the site of the post-medieval stone bridge, the impact level for the new flood defence wall was roughly 1.80m deep and cut through a sequence of made ground layers. These layers consisted of deliberately dumped material of clays, ash, and charcoal (8113–8120, 8151–8154). There was little datable material recovered, however from deposit 8153 pottery and clay pipe was recovered that could be dated to 1720–1770. Also recovered from this ash rich deposit was a rectangular red sandstone block, 270–300mm wide by 610mm high, with the letters 'ML' clearly carved in *serif* font into the top of the stone (Figure 53). This stone is likely to have been a 'Dole Stone' which marked the ownership of particular parcels of land. It is therefore considered that the 'ML' are initials, rather than Roman numerals. This stone is similar to those still present in Ham Meadow close-by, where the initials on the stones have been painted red (Ed Wilson pers comm).

The relationship between these deposits and the post-medieval stone bridge were unclear, as the interface had been truncated by the later brick culvert (8112)

Phase 4: Modern - 20th century

Pits

Within the graveyard was a large irregular pit (8056; Figure 12), which truncated burial (8058). It appeared to be sub-rectangular, although extended beyond the south-eastern edge of the excavation area. The full depth of the pit was not identified as it continued below the impact level. Material recovered from within the pit contained disarticulated human bone, residual Victorian material dating to the 19th century along with modern 20th century material such as concrete. This pit may well relate to the construction of the adjacent A4104 road bridge in 1940, and have been dug for reinterment of human bone revealed during excavations for the bridge foundations.

Petrol pump pit

Cutting through the deposits sealing the demolished post-medieval stone bridge, and truncating the later east to west wall (8146) was a large, possibly rectangular pit (8160). The pit, with vertical sides, was not fully exposed as it extended to the north of and below the extent of the construction works. The pit was clearly modern, containing old oil drums and

other 20th century material, along with brick and stone rubble (8159). The pit is located in an area that was the site of a former petrol pump, and is therefore considered to have been the location of a petrol tank, now removed.

Present bridge

Aligned over the 19th century graveyard and forming the western boundary to the flood alleviation scheme was the present A4104 road bridge, built in 1940. The construction cut (8005) for this bridge cut through the grave soil (8001, 8002 and 8073). It had not cut through any of the burials excavated during this project, however it almost certainly disturbed burials to the west.

Services

Throughout the site, a number of modern services were recorded.

Osteological Analysis

Gaynor Western

The Physical Evidence in Summary

A total number of 24 inhumated articulated individuals were exhumated from the burial ground of the Old Church of St Peter and St Paul, Upton-upon-Severn, Worcestershire. Additionally, the re-deposited, partial and disarticulated remains of one individual SK[81332] were recovered from the backfill of the grave containing SK[8133]. This east to west grave truncated the earlier north to south aligned grave containing SK [8138] (Figure 12). There were no repeated elements contained by these two sets of skeletal remains, so it is possible that the skeletal elements from SK[81332] originated from SK[8138]. However, SK[8138] was truncated in the torso region by the grave for SK[8133] while the SK[81332] skeletal elements consisted of leg bones. Although a second grave was identified cutting through the grave for SK[8138] in the leg region, the relative timing of these two later grave cuts cannot be independently determined and it is, therefore, not possible to firmly establish that set of re-deposited remains belonged to SK[8138]. For the purposes of this report, the two sets of remains have been reported on separately and SK[81332] is included in the section on the disarticulated assemblage below.

Some contexts contained the remains of more than one individual manifest by the presence of repeated skeletal elements. This was the case for SK[8016] and SK[8019], where the remains of the two individuals were buried as a stack in one grave and had subsequently become commingled due to ‘coffin tumble’. The presence of additional hand and foot elements in SK[8039] and SK[8134] were again likely to be result of ‘coffin tumble’ from stacked remains, though in these cases the second individual was not present in the assemblage analysed here.

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 (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 4 grades of condition).

Overall, 66.7% (n = 16) of the skeletons analysed were classified as being of 'good' condition, with the remaining 33.3% (n = 8) being considered to be in a' fair' state of preservation (Figure 13). The human skeletal remains were generally in very good condition, allowing observation of joint and bone surfaces for the analysis of pathological conditions as well as metric analysis for both the assessment of stature and morphometric variation in adults in addition to age assessment in sub-adults. No correlation between age and condition was observed, with sub-adults comprising 25% of those individuals in both the 'good' and 'fair' condition categories.

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. Completeness of remains 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 14 illustrates that 54.2% (n = 13) of the skeletons excavated from the Old Church of St Peter and St Paul were more than 75% complete, while 2 were 50–75% complete (8.3%), 4 were 25–50% complete (16.7%) and 5 individuals were only represented by <25% of the skeleton (20.8%). Although sub-adult skeletal remains are generally less robust than adult remains (Henderson 1987), age was not a significant factor in the completeness of the remains from St Peter and St Paul, given that only 33.3% of those individuals being represented by 50% or less of the skeleton were aged as sub-adult. This corroborates the earlier observation made that the condition of the remains was not related to age. The completeness of the remains, therefore, is likely to be determined by post-deposition truncation and disturbance rather than environmental conditions on site.

Age and Sex Assessment

Establishing the age and sex of individuals from an archaeological assemblage not only provides an insight into the demographic profile of the population but can also be used to inform us of patterns in pathological distributions in the group. 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'. Sex was ascribed on the basis of metrics alone where no sexually dimorphic traits were observable. Where sex was not observable be either metric or morphological observations, it was recorded as '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, Schaefer *et al* 2009) and eruption (Ubelaker 1989) as well as long bone lengths (Schaefer *et al* 2009) and epiphyseal fusion (Scheuer and 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 (0–1 month), Young Infant (1–6 months), Older Infant (6–12 months), Child (1–5 years), Juvenile (6–12 years) and Adolescent (13–19 years).

Assessment of adult age at death 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 (Cox 2000). 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). Grading of dental attrition was not used as a supplementary age assessment technique due to the observation that dental attrition during the post-medieval periods does not correlate well with that found in older archaeological assemblages upon which such age assessment methods (i.e. Miles 1963) are based (Brickley, Berry and Western 2006 and Ogden 2005). This is thought to be due to the refinement of foods and food preparation methods during the later historical period. Dental attrition does, therefore, not provide a reliable method for age estimation in Victorian populations.

Demographic Profile

Of all the 24 individuals examined, 70.8% (n = 17) were found to be adult and 29.2% (n = 7) to be sub-adult. As illustrated in Figure 15, of the observable sub-adults, two were classified as 'Older Infant' (SK [8053] and SK[8049]), one was identified as 'Child' (SK[8061]) and two as 'Juvenile' (SK[8046] and SK[8091]). The age of two further sub-adults, SK[8007] and SK[8145] could not be determined due to the under-representation of skeletal elements. SK[8145] was thought to be at least one year old, due to the length of the incomplete long bones present, and may have represented a 'child' but this could not be ascertained with certainty.

Due to the good condition of the skeletal remains, all but three of the adult individuals could be assigned an age and sex category (Table 1). The majority of the sample that could be assigned an age category were either 'Middle Adult' (n =5, 45.5%) or 'Old Adult' (n=5, 45.5%). Only one individual was assessed as a young adult (9.0%).

	Male	Possible Male	Female	Possible Female	Indeterminate	Unobservable	Total
Young Adult	0	0	1	0	0	0	1
Middle Adult	3	2	0	0	0	0	5
Old Adult	2	2	0	1	0	0	5
Adult	0	2	1	0	0	2	5
Unobservable	0	0	0	1	0	0	1
Total	5	6	2	2	0	2	**17**

Table 1: Demographic Profile of the Adult Skeletal Assemblage

Comparison of the archaeological to the documentary demographic profile is limited due to the small sample of skeletal remains for which age could be assessed (n=16). Nonetheless, comparison between Figures 16 and 17 illustrating the relative age composition of each sample highlights a similarity in the number of sub-adults and older adults. Middle adults are comparatively over-represented in the archaeological sample, however.

Sex distribution amongst a population may vary with age and migration but generally populations are found to have a ratio of 1.05 Male: 1 Female (Chamberlain, 2006). At the Old Church of St Peter and St Paul, a total of 15 individuals could be assigned to a sex category. Eleven individuals were identified as males or possible males (73.3%) and only four individuals as females or possible females (26.7%). The sample was, therefore, heavily biased towards males. The sex of three individuals could not be determined due to a lack of observable elements; no individuals were identified as of ‘indeterminate’ sex.

The bias towards males in the assemblage is likely to have been produced at least partly by the artificially small size of the sample, though the burial records for the period between 1851 and 1866 do indicate that there is a male bias in the burial population. The remains from seven further identified contexts were not exhumated and analysed. Fourteen individuals were buried in pairs as part of a stack in a grave but only ten of these individuals were exhumated (Table 2). Thus, demographic information pertaining to the stacked pairs is limited; it is likely that at least some of these individuals were husband and wife and that potentially the four individuals remaining in situ were female, creating a male bias in the sample.

Sex	Age	SK Upper	SK Lower	Age	Sex
Male	Old Adult	8010	8013	–	–
Poss. Male	Middle Adult	8023	8032	–	–
Unobservable	Adult	8016	8019	Young Adult	Female
Sub-adult	Juvenile/Adolescent	8007	8037	Adult	Male
Male	Middle Adult	8039	8042	–	–
Male	Middle Adult	8078	8081	–	–
Male	Old Adult	8069	8131	Adult	Female

Table 2: Age and sex profile of the Stacked Burials

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 and by physical activity. A review of the current literature suggests that the undetermined specific origins of these traits and the fact that there is more genetic variation within populations than between them can prevent useful conclusions regarding their presence or absence in skeletal remains from being drawn (Tyrell 2000).

The observability and presence of any non-metric traits observed in the assemblage have been recorded in the database provided in the archive. The small sample size limited the analysis of these results. Non-metric traits have been recorded for these skeletons in order to allow future comparisons with findings from other post-medieval burial grounds.

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 (Floud et al 1990), 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.

Complete long bones were present in eleven individuals for whom stature could therefore be estimated (Figure 18). Only two of these individuals were female, however. The overall estimated stature for males/possible males was 1.70m (St Dev. 0.03, N = 9) whereas for females the average was 1.58m (St Dev. 0.11, N = 2). The overall average stature was estimated to be 1.68m (St Dev. 0.06, N=11).

Roberts and Cox (2003, 308) report that the average height for males from this period in Britain is 1.71m for males and 1.60m for females. The estimates from the Old Church of St Peter and St Paul population appear to reflect the national average height for males and females and fit in well with the current data. The mean stature for males from St Andrew's burial ground, Worcester was slightly shorter at 1.67m (N=7) though approximately the same for females at 1.57m (N=6) (Western 2006). In comparison, the mean stature at Tallow Hill for males was 1.67 (N=2) compared to 1.62 (N=4) for females (Ogden 2005). St Andrew's parish is known to have been of generally low socio-economic status compared to the middle class occupants of the vaults at Tallow Hill. Unfortunately, the sample sizes are small and only tentative inferences may be drawn from the data but the stature estimations may indicate that the males from Upton were more likely to be taller than their counterparts in the St Andrew's, possibly reflecting a healthier childhood in a rural environment. The females from the middle class vaults at Tallow Hill are taller than the females from both Upton and St Andrew's, and this may reflect their higher socio-economic status. The average height for males from St Martin's-in-the-Bull Ring, Birmingham was 1.71m (St Dev. 0.06, N=173) and for females was 1.59m (St Dev. 0.06, N=124), with no statistical difference observed between individuals in earth cut

graves compared to those interred in higher status vaults, highlighting the role that biological variation plays in the overall stature obtained by an individual in addition to the potential socio-economic factors discussed above.

Morphometric analysis was also undertaken on the femora and tibiae, which were sufficiently well preserved to establish the platymeric and platycnemic indices respectively (Tables 3, 4, 5 and 6). These values reflect the cross-sectional shape of the proximal femur and tibia, acting as an indicator of flatness (Bass 1995). Analysis has shown some variation of these values between populations while variation can also related to pathological changes to bone where the diaphysis has undergone remodelling (i.e. residual rickets). The data has been presented here for future comparison with other populations but has also been referred to in relation to some pathological cases (Tables 3, 4, 5 and 6)

SK	Right Femur A–P Diameter	Right Femur M–L Diameter	Platymeric Index	Category
8010	32.7	35.3	92.63	Eurymeric
8023	33.7	35	96.29	Eurymeric
8039	30.8	33.7	91.39	Eurymeric
8069	29.6	36.8	80.43	Platymeric
8078	26.7	38	70.26	Platymeric
8083	28	36.4	76.92	Platymeric
8086	29.7	30.6	97.06	Eurymeric
8127	30.6	35.3	86.69	Eurymeric
8131	28.5	34.1	83.58	Platymeric
8134	32.7	36.3	90.08	Eurymeric

Table 3: Platymeric Index according to Right Femur

SK	Left Femur A–P Diameter	Left Femur M–L Diameter	Playmeric Index	Category
8010	31.7	32.8	96.5	Eurymeric
8016	26.1	39.7	65.74	Platymeric
8019	28.3	30.7	92.18	Eurymeric
8023	33.4	36.9	90.5	Eurymeric
8039	30	35	85.71	Eurymeric
8078	28.7	35.8	80.17	Platymeric
8083	31.5	38.1	82.68	Platymeric
8086	27.3	28.9	94.4	Eurymeric
8134	29.4	36.3	80.99	Platymeric

Table 4: Platymeric Index according to Left Femur

SK	Right Tibia A–P Diameter	Right Tibia M–L Diameter	Platycnemic Index	Category
8019	33	24.3	73.64	Eurycnemic
8023	35.9	27	75.21	Eurycnemic
8028	32.7	20.1	61.47	Mesocnemic
8037	36.9	27.9	75.61	Eurycnemic
8039	35.6	24	67.42	Mesocnemic
8069	33.4	24.5	73.35	Eurycnemic
8078	33.3	25.2	75.68	Eurycnemic
8083	31	27.1	87.42	Eurycnemic
8127	34.2	24.4	71.35	Eurycnemic
8131	32.9	24.1	73.25	Eurycnemic
8134	33.8	25.7	76.04	Eurycnemic
8010	37.3	27.2	72.92	Eurycnemic

Table 5: Platycnemic Index according to Right Tibia

SK	Left Tibia A–P Diameter	Left Tibia M–L Diameter	Platycnemic Index	Category
8019	33.7	24.1	71.51	Eurycnemic
8023	35.2	23.6	67.05	Mesocnemic
8028	32.9	19.8	60.18	Mesocnemic
8037	37.2	27.3	73.39	Eurycnemic
8039	34.2	22.4	65.50	Mesocnemic
8078	31.3	25.9	82.75	Eurycnemic
8083	32.4	24.8	76.54	Eurycnemic
8127	35.6	24.6	69.10	Mesocnemic
8134	35.4	25.7	72.60	Eurycnemic
8010	31.6	25.4	80.38	Eurycnemic

Table 6: Platycnemic Index according to Left Tibia

Craniometric data was also recorded for a limited number of individuals where preservation allowed and is included within the archive.

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. This report presents a summary and discussion of the pathological changes observed; detailed observations recorded for each pathology can be found in the archive.

An insight into the nature of skeletal disease present in a population can be gained through examination of the 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 total number of individuals present, known as the Crude Prevalence Rate (CPR), or in relation to the total number of observable and repeated skeletal elements present that could have potentially been affected by the condition, known as the True Prevalence Rate (TPR).

The TPR of a disease is much more accurate and representative of the rate of pathology since this method implicitly controls for the condition and completeness of the skeletal material under analysis. Well preserved skeletal elements are by default more likely to exhibit pathological changes and therefore, comparing prevalence rates derived from poorly preserved assemblages to those from well preserved assemblages can be problematic. The CPR only gives a crude estimate of the disease prevalence rate and where skeletal assemblages have undergone a high level of post-depositional disturbance or are poorly preserved, 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 where lesions are interrelated. 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.

Not only must be the condition of skeletal remains be taken into account when considering evidence for pathology in archaeological populations but also the fact that more skeletal pathologies are likely to be present in older individuals, who have lived long enough to sustain chronic disease processes. This relates to the phenomenon 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 either more virulent diseases that leave no trace in the skeleton or to have died before a potentially observable disease affected the skeleton (Wood et al 1992).

Congenital and Developmental 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 thought 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; to reflect this aetiology this condition is now clinically referred to as Developmental Dysplasia of the Hip. Most of the diseases considered to be 'congenital' have an underlying genetic component in their aetiology although some are due to environmental factors present prior to birth i.e. diseases transmitted from mother to foetus of a non-genetic origin.

Table 7 records a summary of the congenital and developmental pathologies observed amongst this population. Only three conditions were noted.

Pathology	No. of cases	No. of observable elements	TPR	CPR (N=24)
Spondylolysis	1	20	5.0%	4.3%
Cubitus valgus	1	21	4.8%	2.2%
Symphalangism (2 DIP joints, toe)	2	151	1.3%	8.3%

Table 7: Summary of Congenital and Developmental Conditions

Spondylolysis of the 4th lumbar vertebra was observed in SK[8010], an old male adult. The condition consists of a separation of the inferior portion of the neural arch from the superior part at the site of the pars interarticularis. This defect is generally asymptomatic and its aetiology is unclear, though it is thought to occur as a result of repeated trauma creating stress to this narrowest part of the neural arch where there is a pre-existing fibrous tissue defect (Salter 1999). Although it is most commonly seen in the 5th lumbar vertebra, approximately 15% of lesions are noted in the 4th lumbar vertebra. It has been recorded in approximately 10% of adults in living populations and its incidence increases with age (Salter 1999).

One case of cubitus valgus was also noted affecting the left humerus of SK[8019], a young adult female. The distal epiphysis of the humerus was angulated superiorly by approximately 10º to the lateral side, resulting in a greater carrying angle at the elbow joint. The angulation was minor and there was no secondary joint disease observed at the joint. This type of defect can be associated with congenital syndromes but can also occur as the result of trauma leading to defective epiphyseal development (Salter 1999). No other congenital defects were observed in the skeleton so it is possible that the individual sustained an injury to the elbow during childhood that damaged the epiphysis or epiphyseal plate, causing the growth defect, which may be better considered a ‘developmental’ condition.

Symphalangism of the distal interphalangeal joint of the toe was present in two individuals, SK[8037] and SK[8131], an adult male and an adult female respectively. This is a relatively common congenital anomaly most frequently affecting the 5th, or sometimes the 4th, toe (Barnes 2008) and is of no clinical significance (Freyschmidt 2003).

Generalised and Disseminated Conditions

There are a number of diseases that are classified as generalised and disseminated conditions and many of these are associated with metabolic or endocrine disorders.

Metabolic disorders are generally associated with a lack of a particular vitamin in the diet or an imbalance of a hormone that is essential to maintaining normal functions of organs in the body and an adequate health status. A lack of intake of vitamins can occur for several reasons. It may be that the individual simply has insufficient access to a particular vitamin in their diet, such as a lack of Vitamin C arising from a lack of fresh fruit, leading to scurvy (Roberts and Manchester 1997). It may also be the case that an individual has acquired or inherited a condition preventing the body from absorbing a particular vitamin, even if it is in plentiful supply in the diet. For example, anaemia can be caused by a high intake of lead into the body or by a number of genetic disorders, such as thalassaemia or sickle-cell anaemia.

Other metabolic and endocrine conditions, such as osteoporosis, are very often caused by a change in the level of the production of hormones vital for producing or maintaining bone. In this condition, too little bone is produced; bones become rarefied (thinned) and brittle, making them vulnerable to fractures. The condition is frequently seen in the elderly, particularly post-menopausal females (Salter 1999). The majority of diseases seen in the skeleton that have an

underlying metabolic aetiology are generalised conditions, in that the mechanism for producing and maintaining bone is abnormal and, therefore, all bones are affected. This is also the case with conditions such as osteomalacia and rickets, where the body is deprived of vitamin D, most commonly from lack of exposure to the sunlight though sometimes from dietary deficiencies or due to an underlying medical condition. The lack of vitamin D results in the body being unable to produce sufficient mineralised bone and therefore bones become 'soft' and bow (Brickley and Ives 2008).Disseminated conditions such as Paget's disease, on the other hand, display pathological changes in discrete localised areas and unaffected bones are normal. Examples of these diseases are recorded in the archaeological record but are much rarer than the majority of the metabolic conditions. Cribra orbitalia (recorded here according to categories set out by Stuart-Macadam 1991), commonly the result of 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). This is a response to anaemia that occurs during childhood (Aufderheide and Rodriguez-Martin 1998). A recent review of the clinical literature highlights that only megaloblastic or haemolytic anaemias directly result in erythropoietic hyperplasia, associated with a dietary lack of vitamin B or specific parasitic infections arising from polluted water such as giardiasis, diphyllobothriasis (Walker et al 2009) or possibly malaria (Gowland and Western, 2012).

Pathology	***No. of Cases***	***No. of Individuals***	***No. of Observable Elements***	***TPR***	***CPR (N=24)***
Cribra Orbitalia	6	4	22	27.3%	16.7%
Osteoporosis	3	3	12	25.0%	12.5%
Osteomalacia/Healed Rickets	2	2	12	16.7%	8.3%
Hyperostosis Frontalis Interna	1	1	10	10.0%	4.2%
Hypertrophic Osteoarthropathy	1	1	15	6.7%	4.2%

Table 8: Summary of Generalised and Disseminated Conditions

Cribra orbitalia was observed in four individuals from Upton (CPR 16.7%, TPR 27.3%). SK[8061] and SK[8078] exhibited lesions in both orbits. All the lesions observed were minor, being recorded as grade 1 or grade 2. A CPR of 5.3% and a TPR of 12.5% was recorded in the population from St Andrew's, Worcester, (Western 2006) while no cases of cribra orbitalia were recorded in the assemblage Tallow Hill (Ogden 2005). A CPR of 7.5% and TPR of 9.6% for cribra orbitalia was observed in the population from St Martin's-in-the-Bull Ring (Brickley, Berry and Western 2006) compared to the average CPR of 8.95% recorded by Roberts and Cox (2003) at a national level. The rates at Upton for cribra orbitalia are, therefore, comparatively higher than all the local populations and the national average, suggesting rates of parasitic infestations during childhood may have been greater in this rural settlement, though the small size of the sample should be borne in mind. Conditions associated with intestinal parasitic infestations that could lead to cribra orbitalia, such as giardiasis, have been consistently associated with house flooding in some populations (Molina et al 2011) and this may be an important contributory factor in the health of Upton residents, especially in childhood. Historic evidence for flooding in Upton is attested to by the presence of the mudstone and riverine alluvium layer described earlier, such deposits deriving from flooding episodes in the later medieval and post-medieval periods (Entec UK Ltd 2008).

Osteoporosis is frequently associated with spinal defects resulting from the compression fractures of the vertebrae. Vertebrae are high in cancellous (spongy) bone content and

following a rarefaction (thinning) of the bone are particularly susceptible to micro-fractures, caused by a failure to bear the compression from the normal weight of the spine. The collapse of the underlying bone structure may lead to the eventual fracturing of vertebral bodies resulting in compressed wedge-shaped vertebrae (Brickley and Ives 2008). Wedge-shaped vertebrae were observed in SK[8069] and SK[8083], both old adult males, as well as SK[8127], an adult male of indeterminate age (CPR = 12.5%, TPR = 25.0%; based on the total number of adult individuals with observable lower thoracic vertebral bodies). A loss of height in T7–T12 (thoracic vertebrae) with lateral and anterior wedging suggesting compression due to underlying osteoporosis was noted in SK[8069] with the presence of compensatory large osteophytes. Secondary kyphoscoliosis would have resulted in the spine. Similar changes were noted in SK[8083] and SK[8127], with a loss of height in the vertebral bodies of T7, T8 and T9 and lateral wedging on the right hand side in the former and reduced height in the T7–T11 vertebral bodies reduced in height with osteophyte formation right hand side resulting in anterior wedging in the latter (Figure 38).

No clear cases of osteoporosis were reported from Tallow Hill (Ogden 2005) or St Andrew's (Western 2006), though a CPR of 2.84% was reported from St Martin's-in-the-Bull Ring, Birmingham (Brickley, Berry and Western 2006). True rates of osteoporosis in past populations are likely to have been much higher than reported in the osteoarchaeological literature due to the lack of radiographic analysis undertaken, which is used to diagnose clinical cases of osteoporosis at a much earlier stage. The higher rates of osteoporosis in the assemblage from Upton are likely to be due to the significant number of old adults present in the sample.

One individual, SK[8016], a male adult of indeterminate age, were also observed to exhibit lateral bowing in the proximal thirds of the femora. The changes were bilateral. The cortices were noticeably thin and had taken on a 'pinched' appearance. The metric analysis of the left femur of SK[8016] also confirmed that the element was platymeric. Such bowing and remodelling have been noted as indicative of residual rickets and osteomalacia (Brickley and Ives 2008). Rickets occurs due to a lack of vitamin D during childhood and although the condition may heal in later life, residual defects can still be present in the skeleton. Osteomalacia is similarly caused by a lack of vitamin D, concentrations of which decrease with age and is noted specifically in elderly individuals with osteoporosis and post-menopausal females (Brickley and Ives 2008, 87, 154). It can, therefore, not only be difficult to differentiate residual rickets and osteomalacia manifested by long bones deformities in adults but also between osteomalacia and osteoporosis, particularly given that osteomalacia and osteoposis are both age-related conditions. Although pseudofractures are considered pathognomic of osteomalacia, these are rarely recorded and it is likely that in its earlier stages, changes resulting from osteomalacia are either non-specific or unobservable macroscopically. It is also probable, however, that such non-specific defects in the skeleton are multi-factorial in aetiology and that individuals suffering from osteoporosis may also have osteomalacia and vice versa to some extent. Unfortunately, the thoracic vertebral bodies were not observable for either of the individuals exhibiting the laterally bowed femora, so it was not possible to assess any co-occurring changes in the spine.

However, one further case of residual rickets or osteomalacia was observed in SK[8083], an old male adult who also exhibited wedging of the vertebrae indicative of osteoporosis (See Figure 39). The femora of this individual were platymeric and look pinched, particularly on the left side, which also exhibited severe osteoarthritis is located. Bilateral coxa vara was also noted in addition to lateral bowing of the proximal thirds of the tibiae. Only the right fibula was

present and did not appear to be affected. No evidence for pseudofractures, synonymous with osteomalacia (Brickley and Ives 2008), was present. The extensive bowing deformities throughout the skeleton may well indicate a case of healed rickets rather than osteomalacia.

The overall CPR for residual rickets/osteomalacia at Upton was 8.3%, with a TPR of 16.7% in those individuals with observable proximal femora. Osteomalacia was recorded in one elderly female from St Andrew's, Worcester (CPR = 5.3%) along with one case of juvenile rickets (CPR = 33.3%) (Western 2006). No cases of rickets or osteomalacia were noted at Tallow Hill (Ogden 2005). A high prevalence rate of rickets was found amongst the sub-adult population at St Martin's-in-the-Bull Ring, Birmingham, however (CPR 13.1%) and was also present in 8.9% (CPR) of adults as a residual condition, with an overall CPR of 7.5% for the whole population (Brickley, Berry and Western 2006). This relatively high level of rickets in Birmingham is attributed to the air pollution that was undoubtedly present in the industrial city that would have blocked out sunlight and created a higher risk to vitamin D deficiency. A CPR of 1.14% was calculated for those individuals exhibiting pathognomic pseudofractures of osteomalacia. The average CPR at the national level for rickets in post-medieval populations is reported as 3.65% (Roberts and Cox 2003). The higher rates of cases of residual rickets/osteomalacia at Upton may be related to the bias in older aged adults in the sample, if the cases are in fact osteomalacia, and also by its small size. It is interesting to note that no cases of rickets were observed in the sub-adults from Upton and points to the fact that lack of vitamin D from air pollution during childhood is unlikely for this area. If the cases observed among the population are residual rickets, it may be a possibility that these individuals migrated out of urban areas after childhood. It is also possibly that different cultural practices of child nurturing played a role, since the swaddling of infants also reduces their exposure to sunlight and thereby Vitamin D (Brickley and Ives 2008).

One additional condition was observed that is thought to be related to hormone regulation, though the specific aetiology is unclear. Hyperostosis frontalis interna (HFI) was present on the endocranial (inner) frontal bone surface in SK[8028], a possible female adult of indeterminate age (CPR = 4.2%, TPR 10%; based on those adult individuals with frontal bones but with no craniometric analysis data i.e. crania was incomplete and the endocranial surface was observable). Irregular but smooth lamellar bone deposits were located on the frontal bone fragments. The deposits were ill defined but overall the surface had an irregular, undulating appearance. More extensive involvement was noted in the supraorbital region. The frontal bone also had a thickened appearance. The presence of HFI is more frequently noted in older females and is often cited to be associated post-menopausal endocrine issues. However, more recent clinical evaluation of the lesions has found that the cause may be likely to be associated with an increased life-long exposure to oestrogen; the purported increase seen in modern populations has been linked to the 'industrialisation' of society and the concomitant reduction in numbers of offspring, reduced rates of breastfeeding, increased hormone treatments and longevity (Hershkovitz et al 1999). Unfortunately, rates of HFI in past populations are difficult to assess accurately due to the lack of radiographic analysis and macroscopic observability in complete skulls, which is particularly true of post-medieval populations where skeletons are relatively well preserved. No cases are recorded from St Andrew's (Western 2006), Tallow Hill (Ogden, 2005) nor St Martin's-in-the-Bull Ring, Birmingham (Brickley, Berry and Western 2006).

One case and one possible case of hypertrophic osteoarthropathy (HOA) were observed in SK[8019] (a young adult female) and SK[8134] (a middle aged male) respectively. This condition presents as bilateral periostitis or new bone formation that is symmetrical in the

skeleton and generally affects the areas of long bones in the region of the joints as well as peripheral bones in the hands and feet (El-Khoury 2013). It is a progressive condition whereby the new bone formation becomes increasingly thickened and multi-layered. In more progressive cases, axial elements such as the ribs, clavicles, scapulae and pelvis can also be involved; characteristic of the condition is the symmetrical involvement of elements (El-Khoury 2013). There are two types of HOA; the disease occurs either as a primary, idiopathic condition or secondary to an underlying disease, most commonly one affecting the lungs (pulmonary), such as cancers (i.e. non-small cell carcinomas and adenocarcinon accounting for 80% of all cases) (El-Khoury 2013) or more rarely, infections such as tuberculosis (Roberts and Buikstra 2003). Clinically, the condition is painful and is associated with clubbing of the fingers (El-Khoury 2013). Differential diagnosis includes thyroid acropachy, leukemia and hypervitaminosis A (El-Khoury 2013).

SK[8019] exhibited porotic woven bone formation on several long bones. The bone was disseminated but bilateral and symmetrical. It was generally located in the metaphyseal areas, superior to or inferior to the joints. The bones involved included the distal thirds of the left and right humerii, proximal thirds of the right and left ulnae and the distal third of the left radius in the upper extremities with the most extensive involvement of periostitis being located in the lower extremities, in the distal right and left tibiae and fibulae. In addition, the inferior surfaces of the right and left 5th metatarsals were also affected. Other lesions were observed in this individual, which are discussed in full below, including a lytic lesion in the lumbar spine as well as visceral surface rib lesions, indicating that HOA in this individual was secondary to a pulmonary condition. The expression of the condition was relatively minor with only single layers of periostitic woven bone formation but this is likely to be due to the fact that the individual was a young adult aged between 18 and 24 years at death. In this case it is likely that the individual did not live long enough to develop more extensive, chronic lesions.

A second possible case of HOA was identified in SK[8134], although this could not be diagnosed conclusively due to the lesions being less extensive in this skeleton. Plaque like lamellar bone formation was symmetrically present on the proximal tibiae with some woven bone formation as well as on the distal tibiae in the metaphyseal area. In addition, fine woven bone formation was also located on the inferior and anterior surfaces of the clavicles at the sternal ends. This individual also presented with fine woven bone periostitis on the visceral surfaces of the ribs, as discussed below. It is possible that the periostitis present on the tibiae and clavicles are the result of the HOA but the changes observed are not pathognomic and it is possible these lesions represent a separate inflammatory response. These lesions have, therefore, been recorded here as non-specific inflammation in the section below.

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 to the extent of the development of a draining sinus (cloaca), 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 inflammation does not necessarily indicate the presence of an infection; 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. The presence of woven bone deposits indicate that a lesion was active at the time of death whereas remodelling lamellar bone suggests the lesion had healed prior to death.

Periostitis, a non-specific inflammation affecting the outer surface of the bone, was likely to be well represented in the assemblage since the skeletal assemblage is well preserved. Nonetheless, prevalence rates of non-specific periostitis were low, with only one individual, SK[8134] exhibiting the periostitic lesions recorded in the tibiae and clavicles (Table 9). As discussed earlier, it is unclear if these lesions are related to the rib lesions also observed in this individual as part of secondary hypertrophic osteoarthropathy.

Pathology	No. of Cases	No. of Individuals	No. of Observable Elements	TPR	CPR (N=24)
Endocranial bone formation	1	1	14	7.1%	4.2%
Rib Lesions	15	3	228	6.6%	12.5%
Tuberculosis (Spine)	1	1	9	11.1%	4.2%
Maxillary Sinusitis	2	2	–	–	8.3%
Periostitis L. Tibia	1	1	16	6.3%	4.3%
Periostitis R. Tibia	1	1	15	6.6%	4.3%
Periostitis L. Clavicle	1	1	14	7.1%	4.3%
Periostitis R. Clavicle	1	1	12	8.3%	4.3%

Table 9: Summary of Inflammatory Pathology

Rib lesions were found in three individuals and are indicative of pulmonary inflammation in these individuals. Two individuals were adults; SK[8019], a young female and SK[8134], a middle adult male. The third individual, SK[8091] was a sub-adult aged between 6 and 8 years at death and in this individual only one rib was observed to be affected, though the ribs were poorly preserved. Porotic woven bone was present the visceral surface at the head of a left rib, indicating that pulmonary inflammation was active at the time of death. No other lesions were noted in the skeleton. Both the adults exhibited extensive involvement of several ribs; SK[8134] exhibited lesions involving four right rib heads and further eight diaphyseal fragments in addition to one sternal end fragment. The lesions consisted of a fine, porotic woven bone indicating that the inflammation was active at the time of death. No lesions were observed on the left side. Inflammatory lesions were also present on the tibiae and clavicles as described above but it was unclear if the pulmonary and extra-pulmonary lesions shared a common aetiology. Interestingly, this individual was one of several in the assemblage with pipe-smoking grooves in the dentition, indicating that he was a long term smoker. No correlation between the presence of pipe-smoking grooves and rib lesions was found in the population as a whole however (5.2.15 Dental Disease).

The second adult individual to have rib lesions, SK[8019], a young adult female, also showed multiple involvement of ribs, with active woven bone lesions being present on the visceral surfaces of the ribs 2–11 on the left side (Figure 40). Some of the lesions were quite thickened. The ribs and diaphyses were the most commonly affected sites but one sternal rib end was also involved. No ribs from the right hand side exhibited lesions. A lytic lesion in the superior surface of the second lumbar vertebra was also present in this individual (Figure 41). The lesion was located at the anterior aspect with reactive bone growth protruding out from the

body. The surface of the lesion was irregular and porotic, leaving a scallop like defect in the vertebra. No changes were observed to the inferior surface of L1. It is possible that this lesion in the spine was caused by tuberculosis, which can cause lesions in the spine in the lower thoracic and upper lumbar vertebrae (Roberts and Manchester 1997). A differential diagnosis of brucellosis and osteomyelitis, however, cannot be ruled out.

Also present in SK[8019], in addition to the rib and spine lesions, were endocranial lesions. Porotic and smooth woven bone formation was present along the sagittal sinus, extending along the inner surface of the parietals and occipital where it was also present in the transverse sinus, especially on the right hand side. Also small isolated area of smooth and porotic woven bone formation on the inner surface left parietal, superior area c 5cm lateral to the sinus, measuring c 1.5cm x 1cm. The bony changes are likely to represent inflammation to the sinus and/or veins, possibly through infection. Endocranial lesions such as these are non-specific and are usually associated with inflammation of the meninges or a reaction to adjacent soft tissue lesions in the literature (Ortner 2003, 250). Thus, lesions can arise from a number of causes, such as epidural haematoma, meningitis or meningoencephalitis (Ortner 2003, 93). These lesions can also be found in cases of tuberculosis (Roberts and Buikstra 2003) and with the co-occurring presence of rib and spinal lesions, a diagnosis of tuberculosis for this young adult individual is credible.

Tuberculosis was a common disease in the Victorian period, particularly in the newly expanding and overcrowded suburbs, and may be spread though either droplet inhalation (i.e. from person to person) or via the consumption of infected bovine milk or meat (Roberts and Manchester 1997; Roberts and Buikstra 2003). Its prevalence increases with population density and hence, prior to improved housing, working conditions and medical treatment, it was at its peak in England during the Industrial Revolution when during the early 19th century, pulmonary tuberculosis was the most common cause of death (Aufderhiede and Rodríguez-Martin 1998) though other respiratory diseases, possibly undiagnosed, may have been a contributory factor (Woods 2000). Tuberculosis is primarily an infectious disease of the lungs and may also be associated with hypertrophic osteoarthropathy, which was also diagnosed in this individual (see above), though the association is rare (Roberts and Buikstra 2003). Rib lesions, however, are most frequently associated with tuberculosis and tuberculosis co-occurring with other pulmonary conditions; Roberts and Buikstra (2003, p.106), from a study of known individuals, demonstrated that rib lesions were present in 62% of those that had died from tuberculosis and in 70% of those that had died with tuberculosis and a co-occurring pulmonary condition, in comparison to only 22% who had died of a pulmonary disease other than tuberculosis and 15% of those who had died of a condition not related to pulmonary diseases. Nonetheless, the presence of rib lesions is not pathgnomic of tuberculosis and differential diagnoses including other respiratory conditions should be considered.

The crude prevalence rate of 12.5% for rib lesions in the Upton population is lower than the contemporary urban assemblage from St Andrew's, Worcester (CPR = 26.3%, n=5) (Western 2006). This may reflect better housing and working conditions in Upton compared to the overcrowded, run down slums in St Andrew's. Interestingly, only one individual from the middle class vaults at Tallow Hill exhibited visceral surface rib lesions (CPR = 10%). The rates reported for rib lesions from St Martin's-in-the-Bull Ring, Birmingham (CPR = 8.5 %, n=43) are relatively low, probably due to the larger sample size rather than reflecting the surrounding environment of the population (Brickley, Berry and Western 2006). Tuberculosis diagnosed on the presence of spinal lesions is much less frequently reported, with a national average CPR of only 0.47% (Roberts and Cox 2003). Today, most cases of spinal tuberculosis are found

in countries or in people from countries where tuberculosis is endemic (Garg and Somvanshi 2011). Clearly, spinal lesions represent a chronic case of the disease and it is likely that many individuals at the time suffering this virulent infection would have died prior to developing such lesions.

Two cases of maxillary sinusitis were also observed in the Upton population, in SK[8028], a possible female adult, and SK[8138,] a possible male adult. Also reflecting lifestyle in some cases, maxillary sinusitis, is linked to smoke, environmental pollution, upper respiratory tract infections and house dust (Roberts and Manchester 1997, 131). The disease is likely to be underestimated in the population from Upton-upon-Severn since the sinuses of compete maxillae cannot be observed except through endoscopic analysis. Changes observed to the maxillary sinuses of SK[8138] consisted of extensive porotic lamellar bone remodelling in the right sinus with some bony spicules (Figure 42). The bone had a thickened and irregular appearance internally and externally in the posterior aspect. Porotic woven bone formation present across the surface of the left maxillary sinus but this was only partly observable. Similar changes were seen in SK[8028], where the maxillary border of the right zygomatic bone was thickened and irregular with porotic lamellar bone deposit in a plaque like mosaic appearance. Both cases of the condition appear, therefore, to have been chronic. The crude prevalence rate of 8.3% at Upton is slightly lower than that of 10.5% from St Andrew's (n=2) (Western 2006) but higher than the national average CPR reported by Roberts and Cox (2003) of 6.88% and the CPR of 2.8% at St Martin's-in-the-Bull Ring (Brickley, Berry and Western 2006). However, due to the aforementioned issues with the observability of the maxillary sinuses, the prevalence reports rated are only approximations, making it difficult to draw any firm conclusions.

Trauma

Trauma to the skeleton was frequent in the Upton-upon-Severn population (Table 10). In total, 20 cases of trauma were recorded, including three fractures present in adults that had occurred during childhood. No fractures were recorded in the sub-adults. The overall CPR for trauma in the whole population from Upton-upon-Severn is 33.3%, with a CPR of 47.1% in the adult sample.

This is higher than that reported for the urban population at St Martin's-in-the-Bull Ring, Birmingham, where an overall CPR of 21.4% and of 30.4% in adults was noted (Brickley, Berry and Western 2006) as well as that at St Andrew's, Worcester, where a CPR of 15.8% of trauma was recorded amongst the adults (Western 2006). Overall, males experienced more trauma than females, with a CPR of 72.7% (N=11) for trauma in males compared to a complete absence of trauma recorded in females (N=4). Six of the eight male adult individuals affected by trauma exhibited multiple fractures or traumata (Table 11).

It is difficult to assess whether this is an accurate reflection of trauma experienced by the whole population given the small sample size and the bias towards males in the sample; nonetheless, the relative absence of trauma in females given the high number of fractures is noteworthy and may relate to differences in lifestyles between males and females. Clinically, males are most commonly involved in trauma incidents (Salter 1999). At St Martin's, Birmingham, fractures were present in 17.9% of females compared to 41.4% of males (Brickley, Berry and Western 2006), reflecting a similar pattern to that at Upton-upon-Severn. At St Andrews, one female (14.3%, N=7) and one male (14.3%, N=7) in addition to one adult individual of unobservable sex were affected; interestingly, two of these individuals exhibited

multiple fractures, as was commonly the case at Upton-upon-Severn. 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).

Pathology	No. of Cases	No. of Observable Elements	TPR	CPR (N=24)
Avulsion Medial Epicondyle: L. Humerus (childhood)	1	22	4.5%	4.2%
Avulsion Olecranon: R. Ulna (childhood)	1	20	5.0%	4.2%
Monteggia Fracture-Dislocation R. Ulna (childhood)	1	20	5.0%	4.2%
Osteochondritis Dissecans	2	27	7.4%	8.3%
Rotator Cuff Arthropathy with Dislocation of the Shoulder (1R + 1L)	2	26	7.8%	4.2%
Fracture 1st Metacarpal Diaphysis (1R + 1L)	2	22	9.1%	4.2%
Fracture 4th Metacarpal Diaphysis (R)	1	17	5.9%	4.2%
Fracture 5th Metacarpal Intra-articular (R)	1	18	5.6%	4.2%
Fracture Hand Phalangeal Intra-articular (Thumb)	2	102	2.0%	4.2%
Fracture Proximal Fibula (R)	1	28	3.6%	4.2%
Bimalleolar Fracture (L Ankle)	1	25	4.0%	4.2%
Fracture Talus Intra-articular (R)	1	20	5.0%	4.2%
Toe Fracture	1	151	0.7%	4.2%
Fracture of the Ribs	3	15	20.0%	12.5%
Enthesophytes Distal Tibia L	1	25	4.0%	4.2%

Table 10: Summary of Trauma Prevalence (TPR calculated for total adult elements)

The most commonly affected area of the body by trauma at Upton-upon-Severn was the hands, with four of the six fractures occurring to the thumb (Figure 43). Clinically, fractures to the metacarpals and hand phalanges are the most common type in the upper extremity (Berger and Weiss 2004). Fractures of the metacarpals represent 30–40% of all hand fractures; of those, 25% are fractures to the 1st metacarpal while the next most common involve the 5th metacarpal (Askenaze and Ruby 1992). Today, thumb fractures occur most commonly in children and the elderly (over 65 years old) (Askenaze and Ruby 1992). Three of the hand fractures recorded in the Upton assemblage, one of a 5th metacarpal and two of thumb phalanges, are likely to have occurred as a result of impaction with evidence of this manifest by intra-articular fractures across the joint surfaces. No such fracture lines were present in the remaining 3 fractures; two were Winterstein fractures of the 1st metacarpal (a proximal transverse or oblique extra-articular fracture close to the base of the metacarpal with palmar angulation; Castro, Jerosch and Grossman 2001; Marincek and Dondelinger 2007) and the third was a fracture to the diaphysis of the 4th metacarpal. These fractures are also most commonly the result of direct impaction; although crushing cannot be ruled out, severe crush injuries to the hand often involve multiple metacarpals (Salter 1999). Fractures to the first and fifth metacarpals are often associated with longitudinal forces along the axis of the bone and can occur as the result of falling onto a clenched fist as well as interpersonal violence.

Dislocation co-occurring with these types of fractures is common and evidence of this was noted in SK[8069], where lateral and posterior displacement of the distal hand phalanx had resulted in severe secondary osteoarthritis.

Skeleton	Sex	Age	Trauma
8010	Male	OA	1) Avulsion fracture to medial epicondyle of humerus (childhood); 2) Bimalleolar fracture left ankle 3) Intra-articular fracture right talus (ankle) Winterstein fracture left 1st metacarpal (thumb)
8016	Male	U	1) Winterstein fracture right 1st metacarpal (thumb)
8037	Poss. Male	Adult	1) Fracture proximal third right fibula (Greenstick?)
8039	Male	MA	1) Rib fracture 2) Fracture 4th metacarpal 3) Fracture proximal toe phalanx– 5th?
8069	Male	OA	1) Intra-articular fracture 1st hand phalanx (thumb)
8078	Male	MA	1) Fracture right 5th metacarpal 2) Intra-articular fracture left 1st proximal phalanx (thumb)
8083	Male	OA	1) Avulsion fracture olecranon process ulna (childhood); 2) Bilateral rotator cuff arthropathy with superior subluxation of the humerii 3) Two rib fractures 4) Bilateral Osteochondritis dissecans tibiae
8134	Male	MA	1) Monteggia fracture-dislocation right ulna/radius (childhood); 2) Three rib fractures 3) Enthespohytes distal left tibia

Table 11: Trauma prevalence At Upton-upon-Severn according to individual

Three cases of rib fractures were noted in the assemblage (CPR = 12.5%). This is higher than reported average reported rates of 4.2% from this period (Roberts and Cox 2003) and of that at St Martin's, Birmingham, where the CPR was 2.3% (Brickley, Berry and Western 2006) though the same as at St Andrew's, Worcester (Western 2006). Rib fractures occur when they strike or are struck by a hard object (Salter 1999). The fractures were well healed in all cases denoted by the presence of smooth lamellar bone callus. In all three cases, the ribs affected were located on the left hand side. All three individuals affected also suffered trauma to other elements of the skeleton. In SK[8039] there was evidence of an additional fracture to the 4th metacarpal, enthesophytes (bony outgrowths) were located along the line of the distal capsular attachment on the left tibia of SK[8134] and SK[8083], an old adult male, exhibited an unusual bilateral rotator cuff arthropathy (superior dislocation of the humeral heads). In this individual, bilateral ossification of the coraco-acromial ligament was present forming a substantial bony outgrowth projecting over the humeral head from the acromion (Figure 44). Both the scapulae, acromial ends of the clavicles and the superior and lateral aspects of the humeral heads exhibited extensive eburnation. This eburnation were the result of osteoarthritis secondary to rotator cuff arthropathy, where there had been a complete tear of the rotator cuff in both shoulder joints allowing proximal migration of the humeral heads. As a result, the humeral heads would have struck the inferior surface of the acromion (http://radiopaedia.org/cases/rotator-cuff-arthropathy-1). The development of the substantial osteaoarthritic changes indicated that the heads of the humerii were chronically subluxated.

A recent study of rotator cuff disease suggests that the condition is highly correlated with age, with an average age of 48.7 years for individuals with no tear, 58.7 years for individuals with a unilateral tear compared to 67.8 years for bilateral tears (Yamaguchi et al 2006). Patients frequently experience pain on only one side, though those presenting with a full thickness tear on the painful side had a 35.5% chance of having a full thickness tear on the other, asymptomatic side (Yamaguchi et al 2006). In younger individuals, rotator cuff tears can be caused by trauma to the shoulder whereas in older individuals the tears can be secondary to rotator cuff degeneration or impingement, whereby the tendon become impinged and trapped, with the continued use of the shoulder leading to fraying of the tendon and its eventual shearing (Maher and Bear-Lehman 2008).

Trauma was also observed in the lower limb, the most serious of which was a bimalleolar fracture to the left ankle in SK[8010], an old male adult. In this individual, fractures through the tibial malleolus and distal fibula were observed concomitant with an impact fracture to the calcaneus and talus; in the latter, the whole ankle bone was flattened and remodelled (Figure 45). Extensive remodelling to the distal tibial joint surface had occurred, consisting of macro- and micro porosity with osteophytic lipping. The surface was highly irregular and showing signs of disuse. Some impact damage to the superior calcaneus was also noted with reduction in height of the bone, flattening of superior articular surface and osteophytic lipping. The contiguous articular surface of navicular exhibited osteophyte formation. The left metatarsals were hypoplastic and rarefied compared to the right hand side and this was particularly noticeable in the 4th and 5th elements. This indicates the foot was not fully functional as a result of the fracture to the ankle and that the metatarsals had atrophied from disuse. The right tibia and femur were more robust than left side but left side was not particularly atrophied.

Such a bimalleolar fracture, particularly when involving the calcaneus and talus, is commonly the result of an impact fracture, also known as a vertical compression fracture incurred through an individual falling from a considerable height and landing directly on their feet/heels (Salter 1999). Severe comminuted fractures such as these (where the bone is shattered into several pieces) generally render the ankle irreparably damaged. Avascular necrosis of the ankle bones may follow and malunion of the fragments is common, resulting in secondary joint disease (Salter 1999) such as observed in SK[8010]. This individual also suffered an intra-articular fracture to the right talus involving the inferior joint surface with secondary joint disease also present. It is possible that both fractures were sustained at the same time, with the left foot bearing the brunt of the fall.

Two further fractures were observed to the lower limb. One fracture to the toe bones was present in the distal third of a proximal phalanx of SK[8039], a middle aged adult male, resulting in angulation of the proximal interphalangeal joint and secondary remodelling. A well healed fracture to the proximal third of the right fibula was also present in SK[8037]. Evidence of lamellar bone callus was only present on the postero-lateral aspect where the diaphysis was slightly enlarged and a small lamellar bone exostosis (outgrowth) was located. Very slight anterior bowing was noted but otherwise the element was well aligned. No secondary joint disease was observed. The healing at the site of the fracture and the bowing indicated that it was an old fracture had been sustained some time prior to death, possibly occurring as a greenstick fracture during childhood. One further case of trauma to the lower limb was present in SK[8083], consisting of bilateral osteochondritits dissecans, a condition that amongst adults is more common in males and though to be traumatic in aetiology (Salter 1999). Large sub-circular defects were present on the surfaces of the lateral condyles of the tibiae. They were well defined and consisted of an area of smooth lamellar bone. Both the lesions were healed.

Usually, such defects are associated with pressure epiphyses, convex in profile, such as the humeral or femoral condyles (Salter 1999). This individual exhibited lateral bowing in the tibiae however, attributed to residual rickets, and this change in the morphology of the tibiae and resulting stresses to the knee joints might have resulted in this unusual location of the osteochondritic lesions.

Three fractures sustained during childhood but present as healed conditions in adult individuals consisted of an avulsion fracture to the olecranon process of the right ulna in SK[8083], an old adult male, and an avulsion fracture to the medial epidondyle of the left humerus of SK[8010], an old adult male and a Monteggia fracture-dislocation to the right ulna of SK[8134], a middle aged male adult (Figure 46). A Monteggia fracture-dislocation consists of a fracture to the shaft of the ulna combined with dislocation of the radiohumeral joint (Salter 1999). Dislocation of the radial head was manifest by the remodelling of the proximal radius, where the head was dome shaped with a very thin neck. No articular facet present for the head on the contiguous ulna. The ulna was shortened (241mm v 259mm) with anterior bowing of the diaphysis present. The capitellum of right humerus was also hyoplastic. Secondary osteoarthritis was present with formation of a supra-articular pseudoarthrosis on the distal metaphysis of the humerus, testifying to the long-standing nature of the condition. In situ, it was evident that the arm was lying in a straightened position, so it appears that full extension was possible at the elbow joint. The fracture is usually caused by an injury involving hyperextension and pronation, although it can also be caused by a direct blow over the ulnae border of the forearm (Salter 1999).

Joint Disease

Primary osteoarthritis and degenerative joint disease (DJD) are an inevitable consequence of old age when the body's tissues begin to break down and are unable to repair themselves adequately (Salter 1999). 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). Joint disease can be extra-spinal (i.e. affecting long bones and joints) or spinal. The latter 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. In the most severe cases, eburnation of the articulating surfaces created as the bones' surfaces abrade each other is present and this is feature is pathgnomic of osteoarthritis.

Primary extra spinal joint disease occurs without associated trauma or underlying pathological conditions and is associated mainly with abnormal stress on the joint or age. When associated with trauma or pathological conditions, the joint disease is said to be 'secondary'. Degenerative joint disease is characterised by the presence of macro- or microporosity to the joint and osteophyte formation around the joint surface. Osteoarthritis has only been diagnosed if eburnation was present. This is the result of the complete destruction of the cartilage lining the joint, allowing the bone surfaces to abrade against each other. It is difficult to assess which conditions would have had the greatest impact on the individual, as in some clinical cases patients present with joint pains where little bony change has occurred, yet others exhibit quite advanced skeletal changes and experience little discomfort (Rogers and Waldron 1995). Joint diseases such as osteoarthritis, however, can be a debilitating disorder.

Observations of spinal joint disease, including osteoarthritis, for the population per element are recorded in Table 12. Pathological changes in the spine are recorded separately for the

anterior body and for the posterior arch at the zygapophyseal joints. Overall, the highest levels of degenerative joint disease (DJD) and osteoarthritis occurred in the upper and lower thoracic vertebrae, with moderate levels of osteoarthritis being seen in the cervical vertebrae of the neck. This degenerative disease in the neck led to 5 cases of fusion of the cervical vertebrae, which in all cases was associated with moderate DJD or osteoarthritis. Clinically, degeneration in these joints is quite common in the elderly (Salter 1999). Few changes were observed in the lumbar region. The comparatively high levels of DJD observed within the population are undoubtedly related to the age structure of the population, particularly when considering that three old adult individuals exhibited changes in the vertebrae associated with osteoporosis, which in turn would lead to degenerative joint disease in the spine.

	Zyg. Joints Affected	Body Affected	Fusion	Zyg. Joints Present	Body Present	TPR Zyg. Joints %	TPR Bodies %	CPR (N=18) Zyg. Joints %	CPR (N=18) Bodies %
C1–C2	0	0	0	13	13	0.0	0.0	0.0	0.0
C2–C3	1	1	1	11	11	9.1	9.0	5.6	5.6
C3–C4	1	1	0	12	12	8.3	8.3	5.6	5.6
C4–C5	1	2	1	13	12	7.7	16.7	5.6	11.1
C5–C6	1	0	1	12	11	8.3	0.0	5.6	0.0
C6–C7	1	1	1	12	13	8.3	7.7	5.6	5.6
C7–T1	4	1	1	14	13	28.6	7.7	22.2	5.6
T1–T2	3	0	0	11	13	27.3	0.0	16.7	0.0
T2–T3	3	0	0	10	12	30.0	0.0	16.7	0.0
T3–T4	1	1	0	12	13	8.3	7.7	5.6	5.6
T4–T5	2	0	0	11	13	18.2	0.0	11.1	0.0
T5–T6	1	0	1	10	13	10.0	7.7	5.6	0.0
T6–T7	4	0	0	14	13	28.6	0.0	22.2	0.0
T7–T8	2	0	0	13	12	15.4	0.0	11.1	0.0
T8–T9	0	0	0	12	12	0.0	0.0	0.0	0.0
T9–T10	1	1	1	12	12	8.3	8.3	5.6	5.6
T10–T11	1	1	1	11	12	9.1	8.3	5.6	5.6
T11–T12	1	1	0	10	10	10.0	10.0	5.6	5.6
T12–L1	0	0	1	10	10	0.0	0.0	0.0	0.0
L1–L2	0	1	0	11	9	0.0	11.1	0.0	5.6
L2–L3	0	1	0	11	8	0.0	9.1	0.0	5.6
L3–L4	1	0	0	11	9	9.1	0.0	5.6	0.0
L4–L5	1	1	0	11	9	9.1	11.1	5.6	5.6
L5–S1	0	1	0	9	10	0.0	10.0	0.0	5.6

Table 12: Summary of Spinal Joint Disease

Overall, 13 of the 17 adult individuals present in the Upton-upon-Severn population exhibited some degenerative change to their spine (CPR = 76.5%, TPR adults = 92.9%), reflecting to some degree the absence of young adults in the assemblage; the rate is much higher than that reported for St Martin's, Birmingham (TPR adults = 19.59%) and at St Andrew's, Worcester (CPR Adults = 26.3%). Male and females were both affected; though males/possible males

exhibited comparatively more DJD/OA in the cervical vertebrae (TPR =80.0% n=8, N=10) than females/possible females (TPR = 25.0%, n=1, N=4). Females/possible females (TPR = 75% n=3, N=4) and males/possible males (TPR = 70%, n=7, N=10) were affected equally by DJD/osteoarthritis in the thoracic vertebrae while it was not possible to make any comparison in the lumbar vertebrae due to only one female individual with the lumbar vertebrae being observable. Of the observable males/possible males (N=9), however, 44.4% (n=4) were affected. No changes were observed in the one observable young adult, though middle (n=5, N=5) and old adults (n= 5, N=5) were affected equally. All of those individuals noted above as having osteoporosis also showed changes of joint degeneration in the spine.

Also manifest as vertebral joint disease amongst the population at Upton were Schmorl's nodes. These are rounded lesions occurring in the surfaces of vertebral bodies and occur as a result degenerative changes to the intervertebral disc and soft tissues. With age, the annulus fibrosis of the intervertebral disc loses its elasticity and the thin cartilage lining the end plate (body surface) deteriorates. This allows the nucleus pulposis of the intervertebral disc to protrude through the cartilage forming a depression in the surface of the body (Salter 1999, 274). Schmorl's nodes are frequently seen radiographically but they are of little clinical significance. They are, however, a clear indication of degeneration of the spine in archaeological populations.

	SN	OBS	TPR %
C2–C3	0	11	0.0
C3–C4	0	12	0.0
C4–C5	0	12	0.0
C5–C6	0	11	0.0
C6–C7	0	13	0.0
C7–T1	0	13	0.0
T1–T2	0	13	0.0
T2–T3	0	12	0.0
T3–T4	1	13	7.7
T4–T5	1	13	7.7
T5–T6	0	13	0.0
T6–T7	0	13	0.0
T7–T8	2	12	16.7
T8–T9	2	12	16.7
T9–T10	5	12	41.7
T10–T11	4	12	33.3
T11–T12	3	10	30.0
T12–L1	0	10	0.0
L1–L2	1	9	11.1
L2–L3	0	8	0.0
L3–L4	1	9	11.1
L4–L5	0	9	0.0
L5–S1	0	10	0.0

Table 13: Presence of Schmorl's nodes

As can be seen from Table 13, Schmorl's nodes were present throughout the lower thoracic and lumbar vertebrae, as would be expected with a condition that is in part related to weight bearing in its aetiology, with a greater prevalence in the mid and lower thoracic areas. In total, seven of the 17 adult individuals exhibited Schmorl's nodes (CPR = 41.2%), two being female/possible female (CPR 50.0%, N=4) and 5 being male/possible male (CPR 45.4%, N=11). As with the degenerative disease, it appears that males and females were affected in approximately equal numbers. All age groups were affected, although the sample is of females in very small and may not be representative.

Pathology	No. of Cases	No. of Observable Elements	TPR	CPR Total Population (N=24)	CPR Adults (N=17)
Primary DJD TMJ (1R)	1	26	3.8%	4.2%	5.9%
Primary OA Acromio-Clavicular Joint (1L +1R)	2	23	8.7%	8.3%	11.8%
Primary DJD Acromio-Clavicular Joint (1L)	1	23	4.3%	4.2%	5.9%
Primary DJD Sterno-Clavicular Joint (2R +2L)	4	23	17.4%	16.7%	23.5%
Primary DJD Shoulder (1L +1R)	2	24	8.3%	8.3%	11.8%
Primary OA Elbow (1L)	1	21	4.8%	4.2%	5.9%
Primary DJD Elbow (2R + 1L)	3	21	14.3%	14.3%	17.6%
Primary OA Hand (1R)	1 (2 el.)	102	2.0%	4.2%	5.9%
Primary DJD Sacro-Iliac Joint (1L)	1	16	6.3%	4.2%	5.9%
Primary OA Hip (2R)	2	24	8.3%	8.3%	11.8%
Primary DJD Hip (2R +2L)	4	24	16.7%	16.7%	23.5%
Primary OA Knee (2R +1L)	3	25	12.0%	14.3%	17.6%
Primary DJD Knee (3L +3R)	6	25	24.0%	25.0%	35.3%
Primary DJD Foot (1R + 1L)	2 (4 el.)	141	2.8%	8.3%	11.8%
Secondary OA Acromio-Clavicular (1R + 1L)	2	23	8.7%	8.3%	11.8%
Secondary OA Shoulder (1R + 1L)	2	24	8.3%	8.3%	11.8%
Secondary OA Elbow (1R)	1	21	4.8%	4.2%	5.9%
Secondary DJD Wrist (1R)	1 (2 el.)	94	2.1%	4.2%	5.9%
Secondary OA Hand (1R)	1 (2 el.)	102	2.0%	4.2%	5.9%
Secondary DJD Hand (1R)	1 (2 el.)	102	2.0%	4.2%	5.9%
Secondary OA Hip (1L)	1	24	4.2%	4.2%	5.9%
Secondary DJD Foot (1L)	1 (2 el.)	141	1.4%	4.2%	5.9%

Table 14: Extra-Spinal Joint Disease according to Element

Forty three cases of extra-spinal joint disease were recorded (Table 14). The high number of cases is in part due to the older age of the population but also due to the high level of trauma, where secondary degenerative joint disease has developed due to the extra stresses placed on the joints by uneven load produced by mal-aligned and subluxated fractured elements. In total, 11 individuals were affected by extra-spinal joint disease (CPR = 45.8% total population, 64.7% adult population), again reflecting the older age of many individuals in the assemblage.

In comparison, the national CPR for osteoarthritis in post-medieval populations is 24.53% and for DJD, 11.02% (Roberts and Cox 2003). Of these, eight were male/possible male and two were female, with 72.7% (N = 11) of all males and 50% (N=4) of all the females affected. Nine individuals exhibited degeneration in more than one joint (Table 15). In total, 33 cases were classed as primary joint disease whereas ten were secondary.

	Sex	Age	Total	Primary	Secondary
8010	Male	OA	1	0	1
8016	Unobservable	Adult	3	2	1
8028	Poss. Female	OA	2	2	0
8039	Male	MA	2	2	0
8069	Poss. Male	OA	5	4	1
8078	Poss. Male	MA	4	4	0
8083	Male	OA	9	4	5
8086	Male	MA	2	2	0
8127	Poss. Male	Adult	10	10	0
8131	Female	Adult	1	1	0
8134	Male	MA	4	2	2
81332	Unobservable	Adult	1	1	0
Total	–	–	**44**	**34**	**10**

Table 15: Cases of Extra-Spinal Joint Disease according to individual

The most commonly affected joint was the knee, with 36.0% of all observable knee joints in adults exhibiting either DJD or OA, followed by the hip (25.0%, n=6) and the elbow (19%, n = 4). In modern populations it has been estimated that more than 80% of men and women are affected by primary degeneration of the joints after the age of 75 (Salter 1999).

Secondary changes following trauma to the joints are more common in males and is not age related (Salter 1999) and this pattern was also observed in the Upton population; however, some cases of secondary DJD or OA were associated with long-standing pathological conditions, such as in the case of secondary osteoarthritis of the hip in SK[8083]. This individual was also noted to have bilateral coxa vara, possible due to healed rickets or osteomalacia (see above), where the angle of femoral neck was decreased to approximately 90º, placing extra stress on the hip joints. The left hip was more severely affected than the right and exhibited extensive eburnation in addition to macroporosity over the entire surface of the femoral head. There was also substantial peri-articular osteophyte formation around the acetabulum, forming a collar of bone around the whole articular surface up to 3cm in depth, obliterating the acetabular notch. The head of the femur in flattened with a mushroom shaped appearance and appears to have undergone avascular necrosis. It is not clear if the more extensive nature of the osteoarthritis in the left hip was perhaps at least partly attributable to other conditions, such as Legg-Perthes' disease (osteochondrosis of the femoral head), slipped upper femoral epipysis, non-traumatic osteonecrosis of the femoral head (Chandler's disease) or trauma.

Neoplastic Disease and Fibrous Lesions

Neoplastic disease and fibrous lesions are rarely observed in the archaeological record, mainly due to the fact that few neoplastic and fibrous lesions diseases result in pathgnomic changes

in the skeleton that are easily diagnosed macroscopically (Roberts and Manchester 1997). Three neoplastic conditions or possible neoplastic conditions were observed in the Upton-upon-Severn population, however (Table 16).

Pathology	No. of Cases	No. of Observable Elements	TPR	CPR (N=24)
Multiple Hereditary Exostosis	1	12	8.3%	4.2%
Blastic Long Bone Lesion (Femur)	1	26	3.8%	4.2%
Mixed Blastic/Lytic Scapular Lesion – metastatic?	1	26	3.8%	4.2%

Table 16: Summary of Neoplastic and Fibrous Disease

Multiple Hereditary Exostosis was present as a symmetrical and bilateral condition in SK[8010], an old adult male. Small pedunculated osteochondromata were present on the distal third of the diaphyses of both humerii on the medial side. They were located c 5cm superior to the distal articular surface edge and measured c 5mm in length. In many cases, these growths are symptomatic but they can cause pain in some individuals if they impinge on muscle or nerve function (Bovée 2008; Vigorita 2008). They are frequently located on the long bones in the per-articular areas and arise when epiphyseal cartilage separates from the growth plate during development (Vigorita 2008). Males are more frequently affected and the condition is an autosomal dominant disorder with a strong genetic/familial link (Bovée 2008; Vigorita 2008).

Another possible neoplastic lesion was noted in this individual and was located on the inferior aspect of the acromion/neck area of the right scapula (Figure 48). The lesion was macroscopically a blastic lesion (bone growth), measuring approximately 2.5cm A–P x 3cm S–I, with a well defined lytic lesions (appearing a holes in the growth). The lesion was fairly well defined and localised, though no obvious sclerosis of the margins was present, and consisted of a fibrous-like bone surrounded by sponge-like smooth bone. Some lysis was present in addition to a small amount of spiculation, with woven bone present around the edges. Another separate area of woven bone present on the superior aspect of the acromion, consisting of a porotic layer measuring approx 1cm S–I x 1.5cm M–L. No other lesions were noted about the skeleton with the exception of the osteochondromata described above. Although osteochondromas can transform into malignant growths such as chondrosarcomas in the case of multiple hereditary exostosis (Vigorita 2008), this occurs within the previously benign osteochondroma and given the unilateral expression of this lesion, it is likely that this lesion and the osteochondromata represent separate conditions. Mixed blastic and lytic lesions can occur as metastases in bone, having spread from other primary tumours, such as carcinoma; the location of the lesion might suggest a primary site in the lung or breast, though prostate might also be a possibility. Given the solitary nature of the lesion, it may be that the cancer was in an early stage; the associated woven bone reaction suggests that the lesion was active at the time of death.

One further suspected neoplastic lesion of fibrous defect was noted in SK[8019], a young adult female. A possible intracortical lesion was observed at the diaphysis of the left femur. An ill defined localised raised area was noted in the mid third, postero-medial aspect, with a porotic surface but no periostitis. The affected area measured c. 1.5cm M–L x 1cm A–P. A diagnosis could not be made without radiographic assessment but the lesion is likely to be a localised neoplastic (i.e. osteoid osteoma) or a fibrous defect (i.e. benign fibrous histiocytoma of bone, fibrous dysplasia).

Dental Disease

Dental diseases include conditions that not only directly affect the teeth but also the soft tissue surrounding them, sometimes observable in changes to the underlying alveolar bone. Each condition can give an indication of different aspects of lifestyle and health of the individual. For example, caries is associated with diets high in sucrose content. The presence of calculus can inform us about dental hygiene whilst enamel hypoplastic defects testify to developmental stresses that an individual has undergone in childhood. The analysis of dental disease, therefore, not only informs us of specific oral conditions but provides complimentary data regarding overall health status and cultural practices.

Prevalence rates of dental diseases are presented here as a percentage of the number of observable teeth present or number of observable sockets. In total, 171 teeth were recorded as observable, 130 of which were permanent dentition and 41 of which were deciduous. Amongst the sub-adults, a further 15 permanent teeth were recorded as present but erupting in addition to 20 permanent unerupted teeth, 12 erupting deciduous teeth and 1 unerupted deciduous tooth. These teeth were not considered as 'observable' for the purposes of calculating dental pathology. The prevalence rates of ante-mortem loss, periodontal disease and abscesses were calculated according to total number of observable tooth sockets for each condition. The total number of observable sockets associated with permanent dentition was 311 and the total number of observable sockets associated with deciduous dentition was 47, giving a total of 358 observable sockets.

True and crude prevalence rates for dental diseases present are shown in Table 17.

Dental Disease	Adult (n)	Adult Obs. Elements (N)	Adult TPR	Subadult (n)	Subadult Obs. Elements (N)	Subadult TPR	Whole Pop. TPR	No. of Affected Individuals	Whole Pop. CPR (N=24)
Caries	35	126	27.8%	4	45	8.9%	22.8%	10	41.7%
Calculus	107	126	84.9%	36	45	80.0%	88.9%	12	50.0%
Ante-Mortem Loss	113	297	38.0%	0	61	0.0%	31.6%	11	45.8%
Abscess	9	297	3.0%	0	61	0.0%	2.6%	5	20.8%
Enamel Hypoplasia	29	98	29.6%	2	18	11.1%	26.7%	8	33.3%
Periodontal Disease	90	297	30.3%	1	61	1.6%	25.4%	10	41.7%

Table 17: Prevalence rates of Dental Disease

The 22.8% TPR for caries, linked to diets high in sucrose and poor oral hygiene, is twice that of the national average TPR of 11.2% for post-medieval sites (Roberts and Cox, 2003) (Figure 42). The rate from the Upton population may be elevated in part due to the small sample size but is also likely to be high due to the number of middle and old age adults in the assemblage, who are more likely to have carious teeth than younger individuals as was noted at St Martin's, Birmingham (Brickley, Berry and Western 2006). The overall TPR is higher than that recorded at St Andrew's Worcester (16.7%) (Western 2006) and at St Martin's, Birmingham (9.88%) (Brickley, Berry and Western 2006). The TPR is the same as that recorded for Tallow Hill, Worcester, however (22.9%) (Ogden 2005). It is also interesting to note the presence of caries

(TPR = 8.8%) in two sub-adult individuals, SK[8061] and SK[8091], who were only 4–5 years old and 6–8 years old. Seemingly, a diet sufficient in sugar to cause caries (cariogenic) was also accessible to children at Upton. Again, the rate is higher than the 2.81% recorded for sub-adults at St Martin's, Birmingham (Brickley, Berry and Western 2006). Roberts and Cox (2003) report an increase in caries from the medieval period to the post-medieval when considering true prevalence rates; crucially, during the 19th and 20th centuries, the development of beet sugar and high fructose corn syrup, concomitant with the mechanisation of cane sugar processing and the lifting of import duties on refined sugars (Hillson 1996), allowed a wide-spread adoption of sugar into the mainstream diet. During the medieval period, honey is likely to have been the only source of sweetening foodstuffs (Roberts and Manchester 1997). The high TPR rate could also reflect poor dental hygiene routines in general; interproximal caries were frequently observed and may have developed from food particles lodged between neighbouring teeth.

Evidence of whether dental care was employed regularly can be inferred from the relative presence of calculus or mineralised plaque in an archaeological population. The analysis of calculus presence at Upton-upon-Severn indicates that 88.9% of observable teeth present exhibited calculus deposits. As with caries, the prevalence rate of calculus is much higher than the national average of 21.43% (Roberts and Cox 2003, 194) and higher than the comparable rate reported from St Martin's, Birmingham (TPR = 63.0%) (Brickley, Berry and Western 2006) though is slightly lower than that at St Andrew's, Worcester (TPR = 92.5%) (Western 2006). A higher amount of plaque and mineralised calculus, like caries, is found in those individuals with greater sucrose in their diets (Roberts and Manchester 1997) and is also associated with a diet high in protein (Roberts and Cox 2003); however, it is generally assumed that high levels of calculus relate to poor oral hygiene. Deposits were mainly minor, consisting of flecking (Figure 33) but a few deposits were noted to be extensive.

As calculus builds up as a deposit on the teeth along the lines of the gums it eventually causes irritation to the neighbouring gums. This irritation is known as gingivitis, or gum disease, which can lead to changes observed in the underlying alveolar bone, known as periodontal disease. Of all the observable teeth with tooth sockets, 25.4% exhibited some of the changes associated with alveolar inflammation and resorption. These rates are much lower than that reported at St Andrew's, Worcester (TPR = 73.1%) and the 50.14% TPR reported for St Martin's, Birmingham (Brickley, Berry and Western 2006).

Eventually, as periodontal disease progresses, the gum and the underlying bone may recede causing teeth to become loose. In this assemblage, it was noted however, that ante-mortem loss was high with 31.6% or almost a third of teeth having been lost during life, with some individuals being edentulous, having lost all their teeth. Ante-mortem loss amongst the Upton population was higher than at St Martin's, Birmingham (TPR = 26.65%) (Brickley, Berry and Western 2006) and at St Andrew's, Worcester (TPR=22.2%) (Western 2006). Once the tooth is lost the alveolar bone is resorbed and remodelled, leaving little evidence of any periodontal disease present during life. The high proportion of individuals with ante-mortem tooth loss within the assemblage suggests that the rate of periodontal disease observed is likely to be lower than that in populations also comprising of younger individuals with more teeth present. It may also be the case that some teeth had been extracted; when full removal of the tooth has been successfully achieved, however, there are no means of differentiating between natural or artificial tooth loss.

Ante-mortem tooth loss can also be associated with abscesses, where the infective process leads to a loss of alveolar bone around the tooth root (Figure 33). Severe caries and attrition are both linked to abscess formation, where bacteria from the tooth infection spread through the pulp to the jaw. The TPR of dental abscess at Upton of 2.6% approximates the national average of 2.8%, reported by Roberts and Cox (2003, 192) and also the rates of 2.63% and 2.3% reported for St Martin's, Birmingham (Brickley, Berry and Western 2006) and St Andrew's (Western 2006). The data suggests a consistency in rates of abscess between all the populations and that no particular population was exposed to dental infections via their dental health or diet etc.

Caries and abscesses would have caused individuals great discomfort. Great improvements in dental treatment had been made during this period but overall treatment was fairly crude; fillings and extractions could be undertaken but the lack of antibiotics meant that chronic infections could still be a serious issue. The first professional dental training in Britain began in 1856 (Roberts and Cox 2003) and access was restricted to those who could afford it from privately trained practitioners. For example, fillings could be made from a variety of substances including gold, silver and mercury pastes as well as some cheaper materials lead, pitch and a variety of amalgams (Roberts and Cox 2003). The two examples of fillings at St Martin's, Birmingham were found in individuals of higher socio-economic status interred in vaults (Brickley, Berry and Western 2006); no examples of fillings were found at Upton, at St Andrew's, Worcester (Western 2006), nor at Tallow Hill (Ogden 2005). Crude prosthetics (dentures) were also in use during this period but no evidence of these was found at Upton-upon-Severn. The toothbrush was in mass production from about 1840, although its widespread uptake may have been later. Prior to this innovation, people commonly employed a variety of abrasive substances such as soot, salt, brick dust, cuttlefish and later bicarbonate of soda, applied with rags or just with the fingers to clean their teeth (Roberts and Cox 2003, http://www.bbc.co.uk/dna/place-london/A2818686) in addition to using chewing sticks and picks. Toothpaste was only first mass-produced in 1873 (http://www.bbc.co.uk/dna/place-london/A2818686). The high rates of ante-mortem tooth loss, caries and calculus suggest that teeth-cleaning was not a regular habit for most of the Upton population during this period, particularly as caries, calculus and periodontal disease were all also seen in children.

Enamel hypoplasia was also present in the dentition in the Upton population and is interpreted in many archaeological analyses to indicate physiological stress during development. Hypoplastic defects in the teeth, usually more common in the anterior dentition, are caused by bouts of childhood illness or severe malnutrition and are often used as an indicator of stress to health in childhood (Goodman and Armelagos 1985). These defects appear to occur most often around the age of three years (Dobney and Goodman 1991) and it is believed that only one person in 14,000 is affected by a hereditary hypoplastic condition (Hillson 1986). Many ethnographic studies have found correlations between low socio-economic status and a higher rate of hypoplastic defects (eg Dobney and Goodman 1991) and diachronic increases in observations of such defects have also been observed in archaeological populations thought to be related to lifestyle changes and increased stress following colonisation (Hutchinson and Larsen 1988). It should be borne in mind, however, that many of the people who are subjects in ethnographic studies live in conditions of the extreme poverty where there is little scope for social mobility and that we should expect to see more variance and less of a clear-cut picture in populations where the nutritional standard is over the critical nutritional threshold and where social mobility is more likely.

At Upton-upon-Severn, enamel hypoplastic defects were found in 26.7% of the anterior dentition, in 8 individuals, slightly lower than of the 30.1% TPR observed at St Andrew's (Western 2006) and 31.0% TPR recorded at St Martin's, Birmingham. The defects were typically manifest as horizontal linear grooves in the anterior teeth. In all cases the lesions were minor. Only one sub-adult exhibited hypoplastic defect, yielding a TPR of 11.1% compared to 40.0% of sub-adults from St Martin's Birmingham. Although this appears to indicate that the sub-adults from rural Upton enjoyed a comparatively healthy childhood compared to the suburban population at St Martin's, Birmingham, perhaps suffering from less febrile diseases and enjoying a better diet, the prevalence rate amongst adults from the two populations is the same (29.6% at Upton v 29.7% at St Martin's), suggesting that the rural environment offered little in the way of protection from childhood diseases amongst its older residents.

One further interesting feature was noted in the dentition from Upton. Seven individuals (CPR=29.1%, CPR Adults = 41.2%, TPR = 77.8%) had pipe-smoking grooves, a round circular defect worn into the dentition from habitual use of the teeth to bite down on to a clay pipe stem (Table 18). Usually the anterior dentition is affected, involving canines and premolars most frequently (Figure 33). Six of the individuals were male/possible male and one was a possible female (Table 19), with prevalence rates of 85.7% amongst the males, suggesting that pipe-smoking was a popular activity with males in Upton.

The female sample is too small to draw any inferences from. Comparative data from a study undertaken in a contemporary population from St Mary and St Michael, London, however, suggests that pipe-smoking was much more common amongst males than females and that it was a habit predominantly associated with the poorer classes in the City (Walker and Henderson 2010). Here, 39.6% of males with dentition exhibited pipe grooves compared to only 2.9% of females. Pipe grooves were often noted occurring in tandem with lingual stains from tobacco tar (55.2%) (Walker and Henderson 2010). Only two individuals from Upton were found to exhibit both facets with staining and in these cases the staining was minor. However, as noted above, the Upton population had high rates of ante-mortem tooth loss and it is possible that at least some of the molar teeth that may have been stained were no longer present. At least four of the individuals exhibited two or more grooves and in seven individuals, grooves were seen on both sides of the jaw.

Skeleton No.	Sex	Age	Age Category	Total Number of Grooves	Groove Left	Groove Right
8010	Male	50+	OA	3	1	2
8023	Poss. Male	40–44	MA	2	1	1
8039	Male	40–60	OA	2?	1?	1
8078	Male	35–45	MA	2	1	1
8086	Male	35–49	MA	2	1	1
8122	Poss. Female	Adult	Adult (OA?)	1	1	0
8134	Male	30–40	MA	1	1	0

Table 18: Individuals with Pipe-Smoking Grooves from Upton-upon-Severn

Total Males with Pipe-Smoking Groove	Total Males with Observable Anterior Dentition	Prevalence	Total Females with Pipe-Smoking Groove	Total Females with Observable Anterior Dentition	Prevalence
6	7	85.7%	1	2	50.0%

Table 19: Prevalence rates of Pipe-Smoking Grooves according to Sex

The population at St Mary and St Michael, London, also had a high prevalence rate of visceral surface rib lesions (indicating inflammation of the lungs) and a higher rate of these lesions was noted amongst pipe-smokers compared to non-smokers (Walker and Henderson 2010). No such pattern was found at Upton, however, with only one of the seven individuals with pipe-smoking grooves also having evidence of rib lesions (TPR = 14.3%), despite the presence of observable ribs in all the smokers. It appears then, at Upton, that pulmonary inflammation was not directly linked to smoking. Smokers were also noted at St Martin's-in-the-Bull Ring, Birmingham but the prevalence rate there was much lower, with only 11 individuals (3.6% of those individuals with dentitions) displaying grooves. All of these individuals were interred in earth-cut graves and were assumed to be of lower socio-economic status. Two individuals, both male/possible male, from St Andrew's, Worcester (CPR = 8.3%, CPR Adults = 10%) and one male from Tallow Hill, Worcester (CPR = 10%, CPR Adults = 12.5%) were also recorded as displaying pipe-smoking grooves. It is interesting to note that pipe smoking grooves are present in both the lower and higher socio-economic populations in Worcestershire. Given the duration of time taken to wear a pipe-smoking groove into the teeth and the fact that smoking was probably a chronic habit in these individuals, it is possible that the presence of evidence for pipe-smoking in individuals of higher economic means reflects a certain amount of opportunity for social mobility in the smaller cities or that social stratification was less rigidly defined or more cross-cutting than that in the metropolitan centres.

Post-Mortem Treatment of the Body

Post-mortem treatment of the body in preparation for burial was observed in the form of green staining from shroud pins and in some cases, the in situ presence of the pins themselves (Figure 51). Figure 19 illustrates the location of pins and stains about the skull in the seven adults exhibiting such stains.

It is possible that other adults also had shroud pins present but that these did not remain in situ after deposition and therefore left no staining on the bone. The diagram illustrates that although there is some variation in the location of the pins, they cluster around locations that are in the midline of each view of the skull i.e. lateral (from the sides), anterior and posterior. This suggests that the method for pinning the shroud was well practiced and followed a pre-conceived approach, though it was also individual to each body or each person undertaking the shroud wrapping. Most frequent locations were about the ears, usually above or behind, and also at the crown of the head, in the area of the bregma. Pins appear to have been rarely placed on the back of the head, perhaps indicating that the body was supine (lying on its back) when the pinning of the shroud took place. Pins may have been placed on the back of the head by turning the body onto its side but presumably this would have required two persons.

Shroud pin stains were also present on the remains of two sub-adult individuals (Table 20). The distribution of these stains was slightly different. The shroud of SK[8049], only 8–14 months old at the time of death, was pinned on both temples (left and right frontal/parietals)

and on the left cheek (zygomatic bone). Staining was found on the left gonion of the mandible (corner of the jaw) on SK[8091], a child of 6–8 years. Two further copper stains were observed on sub-adult elements from the disarticulated assemblage; one on the mid-frontal area on the forehead and the second on the zygomatic root, above the mandibular fossa (at the ear).

Of the total 18 crania present, shroud pin staining was present on 10 (55.6%). Fifty percent of observable female crania (n=2) had shroud pin stains compared to 40% of observable males (n=4). In contrast, all of the sub-adult crania were stained (n=4). There was, therefore, little difference in the treatment of body regarding the use of shroud pins between males and females but age seems to have been an influential factor. When examining the age of all the individuals and elements with shroud pin stains, including those from the disarticulated assemblage, 50.0% of those individuals with shroud pin staining are sub-adults. Only two of the individuals are middle adults and only two are old adults, despite these age groups being the most represented in the assemblage. It seems, therefore, that the death of the young was particularly resonant in Victorian conscience as expressed through grief, despite the high rates of infant mortality prevalent at this time.

Similar copper stainings on the post-cranial skeleton were also observed but these were much fewer in number. SK[8049], the infant with shroud pins stainings around the sides of the face, also had staining on the left scapula around the glenoid cavity, at the shoulder joint, as well as on the posterior aspect of the body on the right hand side in the area of the shoulder blade but affecting some of the upper thoracic vertebrae in the spine and contiguous ribs. Unfortunately, the skeletal remains were truncated at the level of the lower thoracic vertebrae so it was not possible to see if staining was present on the lower part of the skeleton. Fragments of a copper shroud pin were also present around the vertebrae of SK[8138], a male adult.

Skeleton No.	Sex	Age	Skull	Post-Cranial
8019	Female	18–24 years	✓	X
8049	Unobservable	8–14 months	✓	✓
8061	Unobservable	4–5 years	✓	X
8069	Male	50+ years	✓	X
8091	Unobservable	6–8 years	✓	X
8127	Male	Adult (Old?)	✓	✓
8131	Female	30+ years	✓	X
8134	Male	30–40 years	✓	X
8138	Male	Adult (Old?)	✓	✓
8046	Unobservable	5–7 years	Coins in Eyes	X
Disarticulated				
22	Unobservable	Sub-adult	✓	–
63	Unobservable	Adolescent	✓	–
12	Unobservable	Indeterminate	✓	–

Table 20: Shroud Pin Stainings according to Individual

Additional copper stainings were noted on the posterior side of a middle hand phalanx, possibly the fourth, of SK[8086], a middle adult male, and one further individual, [SK8127], an adult male, exhibited green copper staining to the upper torso area; staining was observed on the sternoclavicular joints and the acromial ends of the clavicles, along with staining to the

superior aspect of the mid diaphyseal area of the right clavicle, 1st right rib and an upper rib on the left hand side. SK [8086] was also found with numerous associated artefacts, including spectacle lenses, a brass button and two bone buttons in the torso area. Two bone buttons were also found in the region of the torso with SK[8039], a middle adult male and two porcelain buttons were located between the knees of SK[8010], an old adult male. The presence of the buttons suggests that the incumbents may well have been dressed in shroud garments or shifts. Shroud pins were also noted in a number of the burials from St Martin's-in-the-Bullring, Birmingham, though they appear in a minority of burials (Bevan 2006). Shrouds by this period consisted of a full length gown with long sleeves and a high neck and was used for both males and females (Walton-Rogers 2006). Additionally, face cloths and head gear were also common (Walton-Rogers 2006), probably requiring the use with shroud pins. The range of dress and accessories available during this period reflect the care and attention paid to the preparation processes of the body for burial.

One burial, that of SK[8046], a child aged between 5 and 7 years, was notable for the presence of coins that had been placed over the eyes as well as 19 small white porcelain buttons forming a rectangular outline over the torso area, presumably once attached to cloth laid out over the body or coffin (Figures 32–33).

Although the practice of placing coins is a commonly alluded to in folk lore, the discovery of the coins over the eyes in situ in burials is rare. One contemporary example was found at the Baptist burial ground at the King's Fee, Hereford where a coin had been placed over one eye of an adult (Archenfield Archaeology 2001) and another from St Marylebone, London where halfpennies of George III, dating to 1799 and 1806–7, had been placed over the eyes of a young child (Miles et al 2008). Several further examples of coins, being placed in burials have been found at post-medieval burial grounds in London, usually located about the skull, with over half (56.3%) associated with infants and children; this was particularly notable at Bow Baptist church and New Bunhill Fields burial ground (Henderson et al 2013). Several of these coins date very closely to 1790's-1810. Unfortunately, the corrosion of the coins found at Upton prevented any date from being legible, though they are the same dimensions as Victorian pennies.

Coins were traditionally placed over the eyes during the process of 'laying out' a body in preparation for burial, which was undertaken prior to rigor mortis setting in. Coins were placed over the eyes to fix the eyelids shut and similarly a binder was tied around the chin to keep the jaw shut (Roberts 1989). Once the eyelids were fixed, the coins were usually removed and hence the rarity of their recovery from burial contexts. The task of 'laying out' was carried out by women, very often an older female resident in the town or village who was sometimes also played the role of midwife (Roberts 1989, Lane 2001). These women were very often neighbours and friends with close ties to the family of the deceased, particularly in small or close-knit communities, and were seldom remunerated for the task. (Roberts 1989). The tradition of 'laying out' carried on in some areas until the early 20th century but the practice diminished as the more formal role of the professional undertaker became more popular.

The Articulated Assemblage: Conclusions

The articulated remains of a total of 24 individuals were excavated from the new graveyard at the Old Church of St Peter and St Paul. The assemblage consisted of both sub-adults and adults of a range of ages, with the largest group of individuals represented being middle and

old adults. The majority of adults were male and females were undoubtedly under-represented in the sample. The overall estimated stature for males/possible males was 1.70m whereas for females the average was 1.58m, very similar to the average height for this period.

Due to the presence of a high proportion of middle and old age adults, a high number of skeletal pathological lesions were observed. Figure 20 illustrates the relative frequency of diseases in the Upton population in comparison to St Andrew's, Worcester and St Martin's- in-the-Bull-Ring, Birmingham.

Trauma and joint disease, some of the latter secondary to the traumatic conditions, were frequently present. Trauma, exclusively affecting more males, was most prevalent in the hands and ribs, though other fractures affected the long bones of the arms and legs, some of which occurred during childhood. In addition, evidence for dislocation of the shoulders was found in the both the articulated and the disarticulated assemblages. No trauma was observed to the skull. A comparatively high prevalence rate of metabolic diseases, in particular osteoporosis and osteomalacia/healed rickets, were also noted and in part is due to the age structure of the population, with both osteoporosis and osteomalacia occurring in old age. Rickets, however, is a condition most commonly, although not exclusively, associated with the air pollution of industrial urban centres and it is possible that some of the affected individuals with residual deformities spent their childhood outside of Upton. The burial record sample from 1851–1866 consists of more males than females (particularly in the young and middle aged groups); there is a possibility that the population of Upton consisted of some itinerant males, though further research would be needed to clarify this. Congenital conditions were comparatively less frequent than at St Andrew's or St Martin's as were inflammatory diseases. The lower prevalence of inflammatory diseases may reflect the less crowded and healthier conditions of the Upton housing and settlement compared the urban sites, although documentary evidence suggests that infectious diseases, such as the endemic tuberculosis, still caused a significant number of deaths in the town, particularly in the younger adults and children. The documented high rate of infant mortality may have been exacerbated by the periodic flooding of the town leading to the intermittent contamination of water supplies and possibly intestinal parasitic infections.

The overall healthier rural environment of Upton may also be reflected in the slightly lower rates of enamel hypoplasic defects in the teeth, often associated with bouts of febrile disease or poor nutrition during childhood, as well as by the taller stature attained than in urban localities. Dental health amongst the Upton population, however, on the whole was poor with high levels of caries, which was also present in children, suggesting a cariogenic, sugary diet from an early age. Calculus, though generally only slight in severity, was very frequently observed as was ante-mortem loss of teeth. Abscesses, caused by infection, however, were present at the same rate as that observed at St Andrew's and St Martin's. Interestingly, pipe-smoking grooves were frequently observed in the sample and were present in 85.7% of those males with observable anterior dentition. One female also had a groove. Multiple grooves were present in several individuals and it is evident that tobacco smoking was a chronic habit in the Upton population. There was no association with inflammatory conditions of the lung (as indicated in the skeleton by visceral surface rib lesions) as has been found at other sites (Walker and Henderson 2011).

The Disarticulated Assemblage

Observations

A total number of 194 identifiable bone fragments in addition to 22 permanent and 8 deciduous teeth were recovered as disarticulated elements from 13 contexts. Some fragments were not recorded due to being unidentifiable, mainly due to their very small size. Fragments excavated and recovered in discrete contexts that could be re-associated or reconstructed were recorded as whole elements. It was not possible to re-associate any skeletal elements that were recovered from separate contexts. As a result, 191 bone elements were recorded and analysed for condition, age, sex and pathology.

The majority of the bone present was observed to be of ‘good’ condition (n = 152, 79.6%), allowing elements complete with the epiphyseal ends of bone to be assessed for age, fused epiphyses being classified as ‘adult’ and unfused as ‘sub-adult’. Those elements containing dentition were also assessed for age according to dental development, eruption and attrition. A further 26 (13.6%) fragments were assessed as being of ‘fair condition in addition to 13 fragments being in ‘poor’ (7.0%) condition.

Some contexts appear to have contained discrete deposits of associated remains, in particular context [8132] and [8071], whereas other contexts clearly contained the remains of more than one individual.

Results

The number of fragments according to context and age are presented in Table 21 along with the minimum number of individuals represented in each context. A total of 71 disarticulated elements could be classified as adult. Thirty eight elements belonged to the sub-adult classification in total, one being identified as ‘infant’, and 8 being categorised as ‘adolescent’, all from context [8071]. A total of 82 fragments were unobservable for age. Although there was a bias towards more robust adult elements being recovered, the data suggests that the preservation conditions did not entirely preclude the recovery of sub-adults as disarticulated remains. Of the 19 elements that could be assessed for sex, 3 were ‘male’, 2 were ‘possible male’, 7 were ‘indeterminate’, 2 were ‘female’ and 3 were ‘possible female’, suggesting there was no sex-related bias in the sample. Overall, however, only 10.2% of the elements could be assessed for sex.

Given the truncated nature of some of the burials on site, it is a possibility that the skeletal remains of one individual may be spread over several contexts. Given this scenario, it is necessary to calculate the minimum number of individuals for the collated assemblage as well as by context. Taking all the recorded disarticulated elements into account as one sample, a minimum of six individuals are represented, three adults (left humerus) and three sub-adults (right femur). If contexts are considered separately and as representing unassociated deposits of individuals, a minimum number of 21 individuals may be present, represented by 14 adults and seven sub-adults. It is not possible to assess the extent to which these latter figures are an artefact of the context system of recording, although it is likely that at least context [8071] represents a discrete deposit of remains from the same adolescent individual. A collection of long bones SK[81332] was also deposited in the backfill [8133] of grave containing an articulated individual SK[8134]. A similar collection of re-deposited long bones was noted in the

grave of an unrelated individual at St Andrew's, Worcester (Western 2006). The re-deposition of disturbed remains in discrete contexts, sometimes in the backfill of a new grave, appears then to have been a common practice in the management of the burial grounds. Nonetheless, some admixture of elements may have occurred between contexts; for example, one left and one right tibia were found displaying the same pathological changes but were recovered from contexts [8003] and [8001] respectively.

Context	Total Element Count	Adult	Sub-adult	Unobs.	MNI
8001	51	10	15	26	**2**
8002	5	2	0	3	**1**
8003	34	18	4	12	**3**
8015	24	8	1	15	**2**
8031	7	4	0	3	**1**
8033	11	5	0	6	**1**
8036	7	4	3	0	**2**
8038	13	6	2	5	**2**
8055	5	5	0	0	**1**
8067	4	2	0	2	**1**
8071	12	1	10	1	**2**
8082	10	4	0	6	**1**
81332	5	2	0	3	**1**
8145	3	0	3	0	**1**
Total	**191**	**71**	**38**	**82**	**21**

Table 21: Summary of the MNI by context

Pathological changes were recorded for 19 fragments. Inflammatory lesions were observed on three fragments, including the two adult tibiae from separate contexts described above. Reactive inflammatory bone formation was noted along the diaphyses with enlargement of the bone. The anterior aspects consisted of smooth lamellar bone with vascular grooves present, whilst on the lateral aspects a mix of porotic, sclerosing striated bone with some spiculations was present, giving an irregular appearance. The posterior aspects were similar but with less extensive bone deposits. The medial aspects were largely uninvolved. There were no specific inflammatory changes noted and the remodelling could represent extensive periostitis, osteitis or a sclerosing osteomyelitis. An additional sub-adult frontal element exhibited a smooth and porotic woven bone deposit along the frontal crest on the endocranial surface, measuring c 2.5cm S–I x 0.5cm, representing inflammation to the meninges.

Four cases of trauma were noted, including three well healed rib fractures all from context [8015]. Age could not be ascertained but it is likely that the ribs were adolescent or adult. The fourth element affected by trauma was a left adult humerus from context [8001] that exhibited a Hill-Sachs lesion on the posterior-lateral aspect of the head (Figure 52). The lesion consisted of a sub-circular depression on the margin of the articular surface with a porotic base and measured c 1.5 cm in diameter. These are recorded in the clinical literature as indicative of a forceful anterior dislocation with postero-lateral compression (Salter 1999) and have been rarely recorded in archaeological populations.

Joint disease was noted in ten elements, two unobservable for age but eight recorded as adult. The affected elements consisted of a left ulna, right ischium, right talus, left scapula, right femur, left and right tibia, left radius, a right humerus and one unsided humerus. Pathological changes were generally minor and consisted of enthesophytes, osteophyte formation and microporosity.

One case of moderate cribra orbitalia representing a metabolic condition was observed in an adolescent frontal bone from context [8071]. The condition was present bilaterally and consisted of large and fine foramina (grade 3). SK[81332] exhibited anterior bowing of the right proximal femur and the cortex was notable thin. A left femur, interred alongside this right femur and thought to be associated, also exhibited similar changes but was damaged. It is likely that the changes represent osteomalacia or healed rickets. Osteoarthritic changes were noted on the right femoral head in the form of subchondral erosion, eburnation, macroporosity and osteophytic lipping. The bowing of the femoral diaphysis may well have placed extra stress on the hip joint and at least in part contributed to the degenerative joint disease observed.

One undiagnosed lesion was present on a right parietal bone fragment from context [8001]. The lesion consisted of a sclerotic lamellar bone deposit on the endocranial surface and was ill-defined but localised, protruding c 3–4mm. The lesion measured c 0.5cm diameter and no associated bony reaction was noted. This is likely to be a neoplastic pathology but no specific diagnosis could be made.

Discussion

Analysis of the disarticulated skeletal material revealed the remains of at least six additional individuals based upon assessment of the whole assemblage. By context, the remains of least 21 individuals were recovered. The majority of the remains were adult though sub-adult remains were also present. The data from the disarticulated confirms the demographic profile obtained for the articulated assemblage, with males and females both present. The disarticulated assemblage also reflects the articulated assemblage in terms of the range of pathological conditions observed, such as trauma, joint disease, inflammatory and metabolic conditions and, furthermore, some elements exhibited evidence of pathologies not recorded in the articulated assemblage that are generally rarely observed in archaeological populations.

Artefact analysis

Dennis Williams

The artefactual assemblage recovered is summarised in Table 22. The key elements of the assemblage comprised finds directly related to the burials revealed in Trench 8, i.e. coffin furniture and personal items, and ceramic finds from the grave fills. The level of preservation of iron finds from coffins varied from poor to fair, depending on the extent of corrosion, but pottery and ceramic building materials were generally in good condition, with the majority of sherds displaying only moderate levels of abrasion.

Period	Material class	Material subtype	Object specific type	Count	Weight (g)
late med/early post-medieval	ceramic	–	pot	2	208
late medieval	ceramic	–	pot	3	20
medieval	ceramic	–	pot	5	58
medieval	ceramic	–	roof tile(flat)	6	270
post-medieval	bone	–	button	2	2
post-medieval	ceramic	–	brick	9	4876
post-medieval	ceramic	–	button	26	14
post-medieval	ceramic	–	clay pipe	14	40
post-medieval	ceramic	–	mortar	3	480
post-medieval	ceramic	–	pot	91	1065
post-medieval	ceramic	–	roof tile	3	300
post-medieval	ceramic	–	roof tile(flat)	10	862
post-medieval	glass	–	lenses	2	4
post-medieval	metal	brass	button	1	1
post-medieval	metal	iron	fitting (coffin)	14	132
post-medieval	metal	iron	handle (coffin)	70	2115
post-medieval	metal	iron	nail (coffin)	470	2064
post-medieval	metal	iron	name plate	142	564
post-medieval	metal	iron	sheet	103	774
post-medieval	metal	–	unident	9	103
post-medieval	metal	iron	buckle	1	31
post-medieval	metal	copper alloy	pin	1	1
post-medieval	organic	wood	coffin	32	380
post-medieval	organic	textile	burial	1	2
undated	mineral	coal	–	2	23
undated	organic	shell	–	3	18
undated	stone	–	–	1	62
			Totals	1026	14469

Table 22: Quantification of the assemblage

Coffin furniture and personal items

Coffin handles were recovered from contexts 8001, 8003, 8012 (associated with burial 8010), 8022 (burial 8023), 8033 (burials 8016 and 8019), 8030 (burial 8013), 8040 (burial 8039), 8045 (burial 8046), 8068 (burial 8069), 8079 (burial 8080), 8085 (burial 8086), 8123 (burial 8122), 8126 (burial 8127), 8129 and 8030 (burial 8131), and 8135 (truncating fill 8137), and 8137 (burial 8138). Most of these handles were heavily rusted, but with the exception of two fixed handles from context 8123, they appeared to be hinged drop handles, manufactured in cast iron. The corroded remains of handle backplates, some with raised decorative designs, were retrieved from various grave contexts, along with numerous coffin nails. Coffin plates were found on the lids of coffins (8044, 8123 and 8126, associated with burials 8046, 8122 and 8127, respectively), but all were very corroded and fragmentary when examined, and no engravings could be distinguished. Fill 8036, above burial 8037, contained an unidentifiable iron fitting that included part of a stud, securing the remains of a thin leather covering.

Other metalwork included an iron belt buckle found with burial 8028, and a pressed brass button found in context 8085, the fill of grave 8086. This fill, 8085, also yielded two buttons, turned and drilled from bone, and a pair of small, oval spectacle lenses (these were probably 19th century in date, but unlikely to have been earlier than late 18th century). Small white porcelain buttons, probably 19th century in date and from a burial gown, were found in the fill 8038 above burial 8039. Similar buttons were found in fill 8036, between the knees of burial 8037, on top of burial 8046, and in the vicinity of burial 8131. A single textile fragment was found with wooden coffin remains 8130, containing burial 8131.

Corroded fragments of a copper alloy object were identified in a sample of human hair from fill 8085, covering burial 8086. A very corroded copper alloy pin was recovered from 8137, the fill of the north to south orientated burial 8138, although it was noted that a post-medieval coffin handle was also found in 8137.

Pottery

All pottery sherds were grouped and quantified according to fabric type (Table 23). None of the pottery was datable in terms of form, but the majority of sherds were dated by fabric type to their general periods or production spans.

Both medieval and post-medieval pottery was represented in subsoil layers 201 and 301, investigated during the earlier stage of the watching brief. These contained small body sherds of oxidized Malvernian ware (fabric 69). With both brown and green unspeckled glazes, these were made locally, probably during the 15th to early 17th centuries.

Layer 201 produced post-medieval pottery sherds from a range of dates: 17th–18th century black-glazed red wares (fabric 78), 18th century buff ware with slip-trailed decoration (fabric 91), late 18th–early 19th century creamware (fabric 84), 19th century blue and white decorated china (fabric 85), and earthenware with a pale yellow glaze (fabric 100), probably late 18th–19th century in date. Similar black-glazed red wares (fabric 78), and buff wares (fabric 91) were found in context 301, as well as 17th century Midlands yellow ware (fabric 77) and 19th century decorated stoneware (fabric 81).

Black-glazed red wares, buff wares and Midlands yellow ware were found in layer 401 (similar to 201 and 301) during the earlier watching brief. This layer also produced two abraded sherds

of an oxidised, very micaceous pottery (fabric 100). One of these was the base of a jar or jug, and though unglazed, this bore white slip-trailed decoration on its exterior. The other example was from the base of a bowl or dish, green-glazed over white slip-trailed and spotted decoration, internally, and with a reduced, grey fabric immediately underneath the glaze. Although micaceous, the fabric of this pottery was otherwise very fine, being reminiscent of the products of the late 16th–17th century kilns at Lingen in Herefordshire.

Period	Fabric code	Fabric common name	Count	Weight (g)
medieval	69	Oxidized glazed Malvernian ware	8	78
post-medieval	78	Post-medieval red wares	21	486
post-medieval	81	Stonewares	5	104
post-medieval	82	Tin-glazed ware	2	14
post-medieval	83	Porcelain	2	5
post-medieval	84	Creamware	15	56
post-medieval	85	China	12	77
post-medieval	77	Midlands yellow ware	2	12
post-medieval	91	Post-medieval buff wares	17	164
post-medieval	100	Miscellaneous post-medieval wares	17	350
		Totals	**101**	**1351**

Table 23: Quantification of the pottery by period and fabric-type

A single sherd of oxidised, glazed Malvernian ware, of 15th–early 17th century date, was found in grave fill 8038, but otherwise the pottery found in the graves in Trench 8 was all post-medieval. By sherd count, the post-medieval red wares (fabric 78) and buff wares (fabric 91) were the most prolific. The red wares were found in fills 8001, 8003, 8009 and 8121, and the buff ware in fills 8009, 8129 and 8064. The more precisely dated, late 18th-early 19th century creamware (fabric 84) was found in fills 8003, 8009, 8015, 8064, 8129 and 8133, and pearlware (fabric 100), from a similar date range, in fills 8064, 8129 and 8121. A single sherd of tin-glazed ware (fabric 82), found in fill 8038, dated from the early 18th century. Two sherds of porcelain, found in fills 8003 and 8130, were very fragmentary and could not be dated other than to a broad late 18th to 19th century production span.

China (fabric 85), dating from the early 19th century onwards (some of it bearing a blue willow pattern) was found in grave fills 8001, 8003, 8009 and 8064. Stoneware (fabric 81) found in fills 8064, 8129 and 8133, and an earthenware, with a pale yellow glaze (fabric 100), in fills 8003, 8009 and 8067, could not be precisely dated, but were probably also from the 19th century.

Clay tobacco pipes

Two clay pipe bowls recovered from layer 8153 were of the Broseley type, with distinct spurs, produced during 1720–1770 (Oswald 1975). Other small stem fragments, found in grave fills 8003, 8009, 8064 and 8153, and layers 301 and 401, were undiagnostic.

Ceramic building material

Fragments of flat medieval roof tile, with Malvernian inclusions indicating local manufacture, were recovered from layers 201, 301 and 401.

Roof tile fragments found in grave fills 8006, 8009, 8024 and 8036 all appeared to be post-medieval, though the examples from 8009, 8024 and 8129 were probably mechanically formed, and therefore 19th century in date.

One complete brick was recovered from context 8072, part of the graveyard wall structure. This brick was machine-made but unfrogged, with dimensions of 9 x 4½ x 3 inches, i.e. the Imperial size adopted from 1840 onwards. A fragment of 3 inch thick brick was also found in modern pit fill 8055. Those found in grave fills 8036, 8064, 8082, 8085 and 8125 were all small and undiagnostic.

Other material

Three fragments of oyster shell were found in grave fill 8064, and pieces of coal in grave fills 8006 and 8038. Small fragments of coffin wood were recovered from coffins 8045, 8068 and 8123.

Overview of artefactual evidence

Terminus post quem date ranges determined from the artefactual assemblage are shown in Table 24. The early stage of the watching brief (contexts 201, 301 and 401) produced pottery that provided evidence of both medieval and post-medieval activity in the vicinity of the site, but the ceramic finds from the graves generally indicated dates from the early 19th century onwards, and certainly no earlier than the late 18th century. In graves lacking ceramic evidence, the presence of hinged iron coffin handles was probably also consistent with this conclusion. Nevertheless, the red, buff and yellow wares indicated earlier post-medieval occupation nearby, as might be expected for a burial site so close to the centre of the town.

Context	Material class	Object specific type	Fabric code	Count	Weight (g)	Start date	End date	*tpq* date range
201	ceramic	roof tile(flat)	–	2	80	1200	1625	1800–1900
	ceramic	roof tile(flat)	–	2	98	1600	1850	
	ceramic	pot	69	4	54	1200	1625	
	ceramic	pot	69	2	10	1400	1625	
	ceramic	pot	78	2	84	1600	1800	
	ceramic	pot	78	2	24	1600	1800	
	ceramic	pot	91	2	34	1700	1800	
	ceramic	pot	84	1	6	1760	1840	
	ceramic	pot	100	3	28	1750	1900	
	ceramic	pot	85	3	12	1800	1900	
301	ceramic	roof tile(flat)	–	1	46	1200	1625	1800–1900
	ceramic	roof tile(flat)	–	1	44	1600	1900	
	ceramic	pot	78	3	72	1600	1800	
	ceramic	pot	91	1	12	1650	1800	
	ceramic	pot	91	1	4	1700	1800	
	ceramic	pot	77	1	6	1600	1700	
	ceramic	pot	81	1	8	1800	1900	
	ceramic	pot	69	1	4	1200	1625	
	ceramic	clay pipe	–	1	6	1600	1900	
401	ceramic	roof tile(flat)	–	2	102	1200	1625	1700–1800
	ceramic	pot	78	3	58	1600	1800	
	ceramic	pot	78	2	20	1600	1700	
1002	ceramic	pot	91	6	60	1700	1800	1780–1830
	ceramic	pot	91	2	12	1700	1800	
	ceramic	pot	90	1	6	1700	1800	
	ceramic	clay pipe	–	1	1	1600	1900	
	ceramic	pot	100	1	166	1550	1700	
	ceramic	pot	100	1	42	1550	1700	

Context	Material class	Object specific type	Fabric code	Count	Weight (g)	Start date	End date	*tpq* date range
1002	ceramic	pot	100	1	2	1780	1830	1780–1830
	ceramic	pot	81	1	14	1650	1800	
	ceramic	pot	78	1	26	1650	1800	
3002	ceramic	pot	91	1	8	1700	1800	1700–1800
8001	metal	handle (coffin)	–	2	58	–	–	1800–1900
	metal	unident	–	1	12	–	–	
	ceramic	pot	78	1	36	1600	1800	
	ceramic	pot	84	1	4	1760	1840	
	ceramic	pot	84	1	8	1760	1840	
	ceramic	pot	78	1	20	1600	1800	
	ceramic	pot	78	1	2	1600	1800	
	ceramic	pot	85	1	14	1800	1900	
	ceramic	pot	85	1	4	1800	1900	
8003	ceramic	clay pipe	–	1	1	1600	1900	1800–1900
	metal	handle (coffin)	–	1	20	–	–	
	metal	nail	–	6	38	–	–	
	metal	handle (coffin)	–	2	20	–	–	
	ceramic	pot	83	1	4	1750	1900	
	ceramic	pot	100	1	6	1750	1900	
	ceramic	pot	78	1	8	1600	1700	
	ceramic	pot	84	1	1	1760	1840	
	ceramic	pot	85	1	2	1800	1900	
8006	ceramic	roof tile(flat)	–	1	28	1600	1800	1600–1800
	metal	unident	–	1	8	–	–	
	mineral	coal	–	1	1	–	–	

Context	Material class	Object specific type	Fabric code	Count	Weight (g)	Start date	End date	*tpq* date range
8009	ceramic	roof tile(flat)	–	1	40	1600	1800	1800–1900
	ceramic	roof tile(flat)	–	1	36	1800	1900	
	ceramic	clay pipe	–	2	6	1600	1900	
	ceramic	pot	100	1	8	1800	1900	
	ceramic	pot	91	1	14	1700	1800	
	ceramic	pot	91	1	4	1700	1800	
	ceramic	pot	78	1	2	1600	1700	
	ceramic	pot	85	1	1	1800	1900	
	ceramic	pot	84	1	4	1760	1840	
8012	metal	handle (coffin)	–	1	46	–	–	–
	metal	handle (coffin)	–	7	54	–	–	
	metal	handle (coffin)	–	1	46	–	–	
	metal	handle (coffin)	–	2	12	–	–	
	metal	handle (coffin)	–	1	58	–	–	
8012	metal	handle (coffin)	–	10	24	–	–	–
	metal	handle (coffin)	–	1	78	–	–	
	metal	sheet metal	–	103	774	–	–	
	metal	nail	–	21	48	–	–	
	metal	fittings	–	4	56	–	–	
8015	metal	nail	–	3	10	–	–	1760–1840
	ceramic	pot	84	1	4	1760	1840	
8022	metal	handle (coffin)	–	2	76	–	–	–
	metal	nail	–	70	238	–	–	
	metal	unident	–	1	38	–	–	
8024	ceramic	roof tile	–	2	106	1600	1800	1800–1900
	ceramic	roof tile(flat)	–	1	156	1800	1900	
8027	metal	nail	–	12	44	–	–	–
	metal	unident	–	1	42	–	–	

Context	Material class	Object specific type	Fabric code	Count	Weight (g)	Start date	End date	*tpq* date range
8028	metal	buckle	–	1	31	–	–	–
8030	metal	handle (coffin)	–	1	30	–	–	–
	metal	handle (coffin)	–	1	44	–	–	
	metal	handle (coffin)	–	5	12	–	–	
8033	metal	handle (coffin)	–	1	24	–	–	–
	metal	nail	–	5	24	–	–	
8036	ceramic	roof tile(flat)	–	1	34	1600	1800	1800–1900
	metal	nail	–	14	74	–	–	
	metal	fitting (coffin)	–	1	8	–	–	
	metal	fitting (coffin)	–	8	48	–	–	
	metal	nail	–	9	20	–	–	
	ceramic	brick	–	1	112	1800	1900	
	ceramic	button	–	2	2	1800	1900	
8038	ceramic	pot	69	1	10	1400	1625	1800–1900
	ceramic	pot	82	1	10	1590	1730	
	mineral	coal	–	1	22	–	–	
	ceramic	button	–	2	2	1800	1900	
	ceramic	button	–	1	1	1800	1900	
8040	metal	handle (coffin)	–	1	68	–	–	–
	metal	handle (coffin)	–	1	54	–	–	
	metal	handle (coffin)	–	1	54	–	–	
	metal	handle (coffin)	–	1	34	–	–	
	metal	nail	–	15	40	–	–	
	metal	handle (coffin)	–	1	10	–	–	
8043	ceramic	roof tile	–	1	194	1600	1850	1600–1850
8044	metal	plate	–	9	140	–	–	–

Context	Material class	Object specific type	Fabric code	Count	Weight (g)	Start date	End date	*tpq* date range
8045	metal	fitting (coffin)	–	1	20	–	–	–
	metal	handle (coffin)	–	1	30	–	–	
	metal	plate	–	11	18	–	–	
	metal	unident	–	1	2	–	–	
	organic	coffin	–	1	2	–	–	
8046	ceramic	button	–	20	8	1800	1900	1800–1900
8052	metal	nail	–	17	56	–	–	–
8055	ceramic	brick	–	1	404	1800	1900	1800–1900
8062	metal	nail	–	16	36	–	–	–
8064	ceramic	pot	85	2	14	1800	1900	1800–1900
	ceramic	pot	91	1	4	1650	1800	
	ceramic	pot	84	4	8	1760	1840	
	ceramic	pot	100	1	4	1780	1830	
	ceramic	pot	81	1	2	1700	1900	
	ceramic	pot	85	2	6	1800	1900	
	ceramic	brick	–	1	166	1600	1900	
	shell	oyster	–	3	18	–	–	
	ceramic	clay pipe	–	3	8	1600	1900	
8067	metal	nail	–	5	22	–	–	1800–1900
	ceramic	pot	100	1	4	1800	1900	
8068	metal	handle (coffin)	–	1	54	–	–	–
	metal	handle (coffin)	–	1	2	–	–	
	metal	nail	–	2	94	–	–	
	organic	coffin	–	25	126	–	–	
	metal	nail	–	11	62	–	–	
	metal	nail	–	2	94	–	–	
8068	metal	plate	–	2	12	–	–	–
8069	metal	handle (coffin)	–	1	56	–	–	–

Context	Material class	Object specific type	Fabric code	Count	Weight (g)	Start date	End date	*tpq* date range
8072	ceramic	brick	–	1	3590	1800	1900	1800–1900
8079	metal	handle (coffin)	–	1	38	–	–	1800–1900
	metal	nail	–	10	26	–	–	
	metal	handle (coffin)	–	1	48	–	–	
	metal	handle (coffin)	–	1	32	–	–	
	metal	nail	–	16	44	–	–	
	metal	handle (coffin)	–	1	42	–	–	
	metal	nail	–	15	46	–	–	
	metal	handle (coffin)	–	1	46	–	–	
	metal	nail	–	8	24	–	–	
	ceramic	pot	100	1	4	1800	1900	
8082	ceramic	brick	–	1	26	1600	1900	1600–1900
8085	ceramic	brick	–	3	508	1600	1900	1800–1900
8085	bone	button	–	1	1	–	–	
	metal	button	–	1	1	1800	1900	
	glass	lenses	–	2	4	–	–	
	metal	handle (coffin)	–	1	43	–	–	
	metal	handle (coffin)	–	1	55	–	–	
	metal	handle (coffin)	–	1	44	–	–	
	metal	nail	–	12	48	–	–	
	bone	button	–	1	1	–	–	
8092	metal	unident	–	4	1	–	–	
8121	ceramic	pot	78	1	22	1600	1800	1780–1830
	ceramic	pot	100	2	18	1780	1830	

Context	Material class	Object specific type	Fabric code	Count	Weight (g)	Start date	End date	*tpq* date range
8123	metal	handle (coffin)	–	1	100	–	–	–
	metal	handle (coffin)	–	1	104	–	–	
	metal	handle (coffin)	–	1	74	–	–	
	metal	plate	–	40	54	–	–	
	metal	nail	–	163	798	–	–	
	metal	plate	–	30	104	–	–	
	organic	coffin	–	6	252	–	–	
8125	ceramic	brick	–	1	70	1600	1900	1600–1900
	stone	–	–	1	62	–	–	
8126	metal	handle (coffin)	–	1	51	–	–	–
	metal	handle (coffin)	–	1	60	–	–	
	metal	handle (coffin)	–	1	48	–	–	
	metal	plate	–	50	236	–	–	
	metal	nail	–	2	16	–	–	
8129	metal	handle (coffin)	–	1	20	–	–	1800–1900
	ceramic	roof tile(flat)	–	1	160	1800	1900	
	ceramic	pot	91	1	12	1700	1800	
	ceramic	pot	81	1	74	1700	1900	
	ceramic	pot	84	1	2	1790	1840	
	ceramic	pot	100	1	1	1780	1830	
8130	metal	handle (coffin)	–	1	52	–	–	1800–1900
	metal	handle (coffin)	–	1	48	–	–	
	metal	handle (coffin)	–	1	40	–	–	
	metal	handle (coffin)	–	2	42	–	–	
	metal	handle (coffin)	–	1	44	–	–	
	metal	nail	–	10	34	–	–	
	metal	nail	–	12	50	–	–	
	ceramic	button	–	1	1	1800	1900	

Context	Material class	Object specific type	Fabric code	Count	Weight (g)	Start date	End date	*tpq* date range
8130	ceramic	pot	83	1	1	–	–	1800–1900
	organic	textile	–	1	2	–	–	
8133	ceramic	pot	84	1	1	1760	1840	
	ceramic	pot	81	1	6	1700	1900	
8135	metal	handle (coffin)	–	1	66	–	–	–
	metal	nail	–	14	78	–	–	
8137	metal	handle (coffin)	–	1	54	–	–	–
	metal	pin	–	1	1	–	–	
8146	ceramic	roof tile(flat)	–	1	266	1600	1800	1600–1800
8150	ceramic	roof tile(flat)	–	1	42	1300	1600	1300–1600
8153	ceramic	clay pipe	–	1	4	1720	1770	1720–1770
	ceramic	clay pipe	–	2	4	1600	1900	
	ceramic	clay pipe	–	1	8	1720	1770	
	ceramic	pot	82	1	4	1590	1730	
8157	ceramic	mortar	0	3	480	1600	1900	1600–1900
8162	ceramic	pot	78	1	64	1600	1800	1800–1900
	ceramic	pot	100	1	52	1750	1900	
	ceramic	pot	85	1	24	1800	1900	
8167	ceramic	pot	100	1	16	1750	1900	1780–1830
	ceramic	pot	78	1	48	1600	1800	
	ceramic	pot	84	1	6	1760	1840	
	ceramic	pot	84	2	12	1760	1840	
	ceramic	pot	100	1	4	1780	1830	
8170	ceramic	clay pipe	–	2	2	1600	1900	1600–1900

Table 24: Summary of context dating based on artefacts

Environmental analysis

Elizabeth Pearson

The environmental evidence recovered is summarised in Tables 25 to 27.

Human bone was recovered from soil samples from all burials, but was particularly abundant in contexts 8048, 8060 and 8085. These were mostly hand or foot bones with some rib fragments and other small unidentifiable fragments. Wood fragments, presumed to be coffin remains, were recovered from context 8077. These probably survived as a result of waterlogging as the graveyard was close to the river bank. Worked bone in the form of a button (context 8085) is likely to have been part of clothing within the burial.

Other environmental remains included a small amount of fish bone and small mammal mandible (probably large rodent) from context 8085, while occasional waterlogged plant remains such as elderberry seed (Sambucus nigra), willow bud (Salix sp) and possible lichen filaments were also recovered (Table 27). These remains are likely to have been originally present in the topsoil at the time of burial and subsequently incorporated into the grave, with the exception of the lichen which may have been growing on the coffin wood.

Artefacts recovered from the samples are discussed in the Finds report (Coffin furniture and personal items).

Context	Sample	Feature type	Fill of	Period	Volume of sample (L)	Volume processed (L)	Residue assessed	Flot assessed
8048	115	Grave fill	8050	Post-medieval	5	5	Yes	Yes
8060	117	Grave fill	8063	Post-medieval	5	5	Yes	Yes
8077	118	Burial	8080	Post-medieval	5	5	Yes	Yes
8077	119	Burial	8080	Post-medieval	5	5	Yes	Yes
8077	120	Burial	8080	Post-medieval	5	5	Yes	Yes
8085	123	Grave fill	8088	Post-medieval	5	5	Yes	Yes
8085	124	Grave fill	8088	Post-medieval	5	5	Yes	Yes

Table 25: List of assessed samples

Context	Sample	small mammal	human bone	fish	charcoal	waterlogged plant	Comment
8048	115		mod				occ coal
8060	117	occ	mod/abt		occ		occ Fe obj, coal
8077	118		occ			abt*	occ Fe obj, coal,* abt wood
8077	119		occ			abt*	occ brick, coal, *abt wood
8077	120		occ			abt*	occ Fe obj, coal, *abt wood
8085	123	occ	occ	occ		occ?	occ bone button, tile, Fe obj, coal
8085	124		abt	occ		occ	occ brick, Fe obj, coal

Table 26: Summary of environmental remains (Occ = occasional, mod = moderate,

abt = abundant)

	Family	Common name	Habitat	8077	8077	8077	8085	8085
Sample				**118**	**119**	**120**	**123**	**124**
Latin name								
Waterlogged plant remains								
Salix sp bud	Salicaceae	willow	C					+
Sambucus nigra	Caprifoliaceae	elderberry	BC		+			
Unidentified ?lichen fragments	unidentified						+	
unidentified wood fragments	unidentified			+++	+++	+++		

Table 27: Plant remains from selected contexts

Synthesis

The post-medieval bridge

The first bridge over the river at Upton-upon-Severn was built of timber in the 15th century to replace a ferry. No remains of this bridge were uncovered during the excavations and it is likely that any sub surface features associated would have been destroyed during the construction of subsequent phases. Excavation of Trench 8 revealed the remains of the stone bridge (8106, 8157) which was completed in 1609 after an earlier stone structure had collapsed. The exposed remains comprised a north to south aligned wall (8106), made with well-dressed red sandstone blocks forming a well-faced west-facing upstream edge. One of the stones on the outer face contained a well-defined mason's mark. Adjoining the north to south wall to the east was a wall running east to west (8157), parallel to the flow of the river. Both walls were keyed in, indicating that they were contemporary and both formed part of the original bridge structure. The new structure, of red sandstone, consisted of five high arches and massive buttresses.

The bridge saw action in the early years of the Civil War when two arches were broken and then repaired, only for the bridge to be slighted again in 1651.

The stone bridge survived until the mid 19th century (Figures 2 and 3) when it was hit by a barge and further damaged during flooding. The extent of the damage is represented in a contemporary painting (Figure 4). It was replaced with a drawbridge which was designed to allow the passage of shipping on the river between Worcester and Gloucester. The mechanism of the drawbridge, of which part was exposed during the excavations, proved to be too slow and the bridge was soon adapted to take a swinging section which pivoted on the abutment on the south bank (Figure 5).

The swing bridge itself was replaced at a cost of £50,000 by the present riveted iron bridge in 1940, approximately 80m upstream to the north-west. The viaduct over the floodplain on the north bank has been recently raised and modified, and the bridge is still in use today, carrying the A4104.

The graveyard

The southern ramp of the 1940 bridge was built across the graveyard extension of the Old Church of St Peter and St Paul. This graveyard was established in 1836, and used until 1865–6, when land for a new cemetery was allocated off Rectory Road as part of the Enclosure Award. The graveyard occupied a roughly triangular portion of land, between the more north-westerly previous alignment of Church Street and Church Cottages, set back approximately 15m from the river bank. There is no known record of the disturbance of burials during the construction of the 1940 bridge, nor is it known where any remains were re-interred, although a pit exposed during the present project may represent reburial of some of the disturbed remains. The graveyard is indicated on the 1st edition Ordnance Survey map of 1885 and as a triangular plot on the tithe plan of 1841. It was probably extended into this patch of land as a result of the growth of population of Upton-upon-Severn in the early-mid 19th century.

A total of 31 human burials were observed in the graveyard extension of which 24 were recorded and exhumed. 22 of the burials were aligned roughly east to west, with the head to the west, as is the norm within the Western Christian tradition. However, two of the burials were found to be orientated north to south, with the head to the south. These may represent

the graves of dissenters (later known as non-conformists) and may relate to funerals recorded in the parish records as being carried out by ministers, as opposed to the more commonly referred to reverends. These two graves lay adjacent, to the north-eastern edge of the excavated area, just inside the graveyard boundary. The foundation for the curving north-eastern boundary wall of the graveyard was exposed, built from red machine-made bricks, common from *c*1840.

Burial and census records from the parish of Upton-upon-Severn during this period show that although people frequently survived into old age, there was a high rate of mortality of infants and young children, with the highest proportion of deaths occurring between the ages of 0–1 year. Of the 24 individuals examined, 17 were found to be adult and 7 to be sub-adult. The sex of 15 adults could be determined; 11 were male; 4 were female. The over-representation of males might be explained by the existence of a harbour for barges at Upton, which would have encouraged a transient male population not represented in the census records. Census records from 1841 show the vast majority of men at Upton employed in some form of manual labour. Trauma to the skeleton was frequent in the Upton-upon-Severn population which may have been due, in part, to engaging in manual labour.

A condition called cribra orbitalia was observed in 4 individuals characterised by lesions around the eye orbits. Conditions associated with intestinal parasitic infections that lead to cribra orbitalia have been consistently associated with house flooding in some populations which is consistent with historic accounts and modern instances of flooding at Upton-upon-Severn.

It is also noted that no cases of rickets were observed in the sub-adults suggesting that a lack of vitamin D due to air pollution during childhood is unlikely for this area. If the cases observed among the population are residual rickets, it may be a possibility that these individuals migrated out of urban areas after childhood.

The recorded level of house occupancy, at 4–5 people per house, indicates that overcrowding was not an issue in the town at the time, and the population may have enjoyed a relatively better health status than their counterparts in a city for example. The majority of the burials excavated were typical of the desired ‘decent burial’ of the period and followed the predominant Christian practice of aligning the body east to west. Pennies were noted in the eye orbits of a child aged between 5 and 7 years. This is a rare discovery; only one other example of this practice has been identified in the archaeological record for the post-medieval period in Britain. 19 small white porcelain buttons were also recorded, forming a rectangular outline over the torso area, presumably once attached to cloth laid out over the body or coffin.

Intercutting of burials was rarely seen, suggesting that though the graveyard became full and was subsequently closed only 30 years after it was opened, there was little issue with restrictions on space for burials in the town.

Prior to the inception of the flood alleviation scheme, there was no ground marker to suggest that the triangular ground had been used for burial. This may, in part, be due to the redundancy and partial demolition of the Old Church of St Peter and St Paul, the remaining tower of which is now know as the ‘Pepper Pot’.

Research frameworks

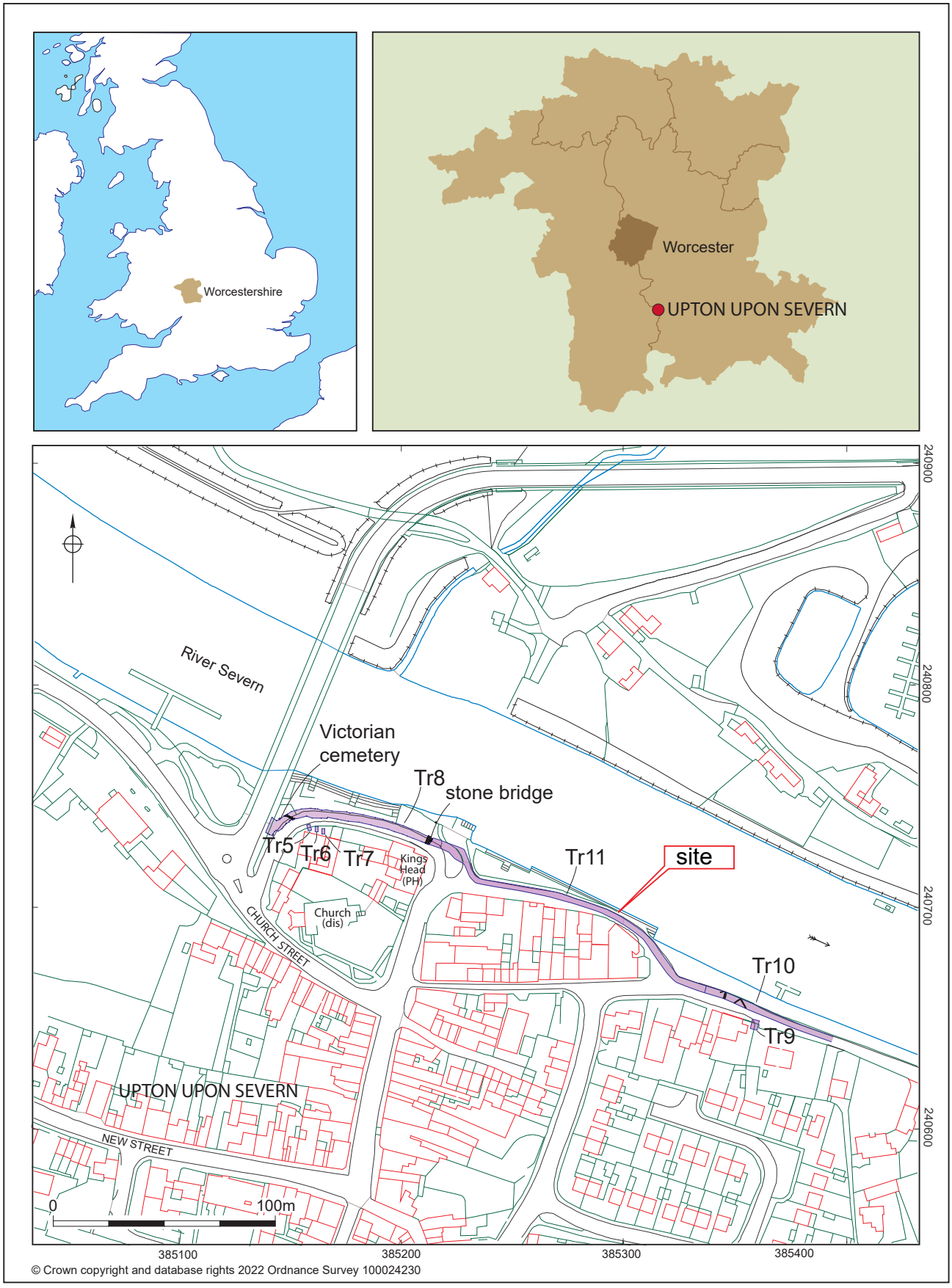
Seminar 7 of the West Midlands Regional Research Framework Strategy identified the aim (period-specific aim iii) of improving understanding of the 'transport revolution', (http://www.birmingham.ac.uk/schools/historycultures/departments/caha/research/arch-research/wmrrfa/seminar7.aspx) most notably the Severn in the West Midlands. The excavation has added to our understanding of the sequence of the town's bridges; the relatively small area opened provides a good illustration of development of the crossing in the post-medieval period which itself reflects the increasing use of the river for transport in this period of regional industrialisation. The excavation has shown that despite rebuilding and re-use of material over time, the buried remains of bridges can survive well.

In a paper given as a part of this seminar, James Dinn (2003) noted that 'urban burial grounds are now acknowledged to be a significant reservoir of information on the physical anthropology of post-medieval populations'. This has proved to be the case at Upton-upon-Severn where valuable information about the age demographic, health and socio-economic status of the population of this expanding town has been obtained from a relatively small sample of a short-lived burial ground. The excavation has also highlighted the way in which burial grounds can be 'lost' both from public consciousness and records rendering them vulnerable to development without appropriate mitigation.

The Central Marches Historic Towns Survey for Upton-upon-Severn (Dalwood 1996) noted the potential for the survival of archaeological remains of the various phases of the bridging point and the excavation described in this document fulfilled this expectation. The survival of well-preserved deposits in this small area of the river frontage indicates the potential for survival of well-stratified deposits on other stretches of the river frontage.

Acknowledgements

Worcestershire Archaeology would like to thank the following for their kind assistance in the successful conclusion of this project, Ed Wilson (Senior Archaeologist, Environment Agency), Alisha Lewis (Project Manager, Environment Agency), Ashley Tolley and Mark Woods (Galliford Try), and Mike Glyde (Worcestershire County Council Historic Environment Planning Officer).



Location of the site

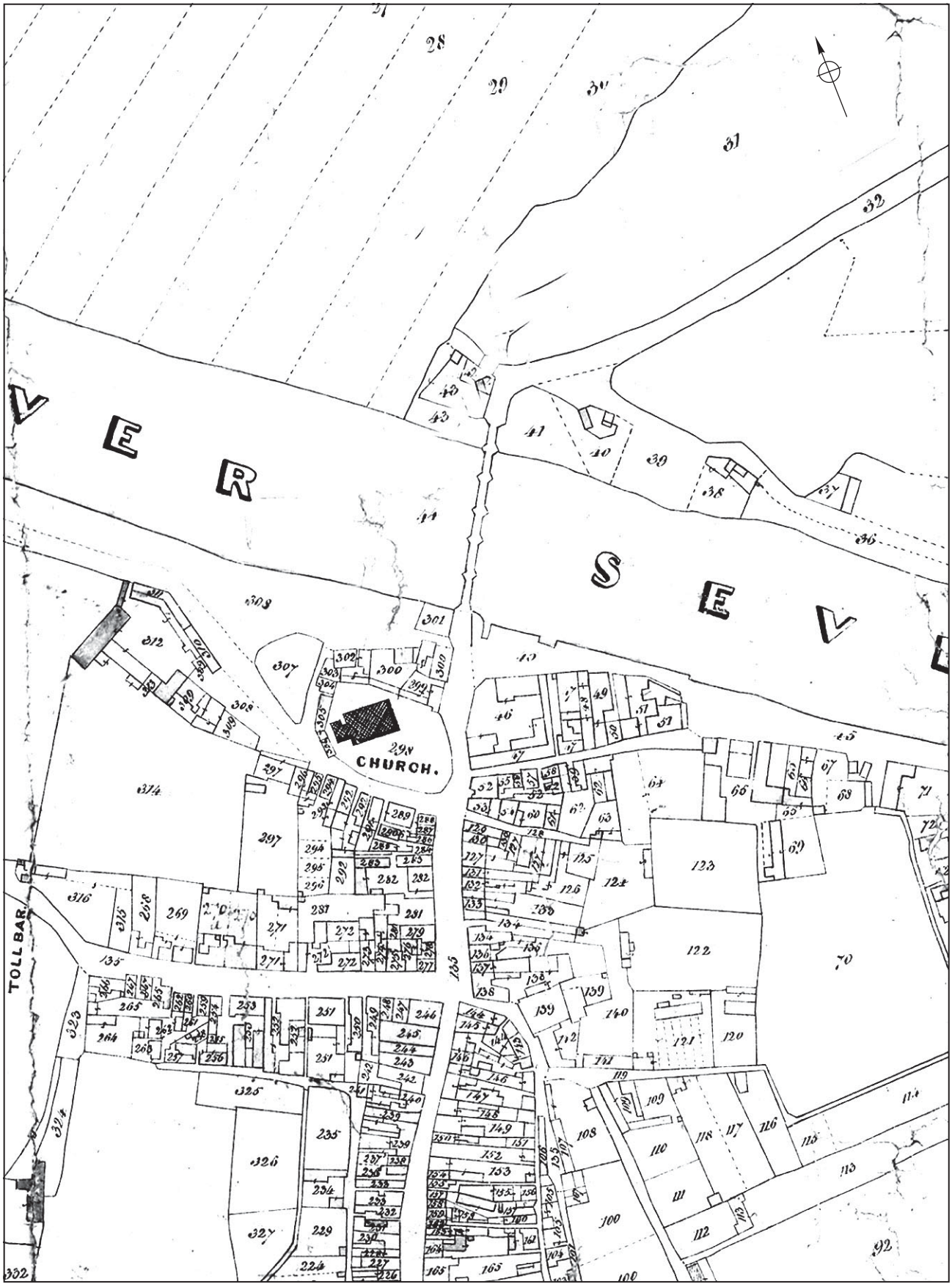


Figure 2: Extract of 1841 tithe
showing location of Upton Bridge and the triangular field subsequently used as a graveyard

Figure 3: Mid 19th century map of bridge

Figure 4: Painting of Upton bridge,1852.
Painting by Mrs Lechmere, wife of the then Vicar of Hanley Castle.
Showing damage by the barge Blaina and flooding in 1851/2

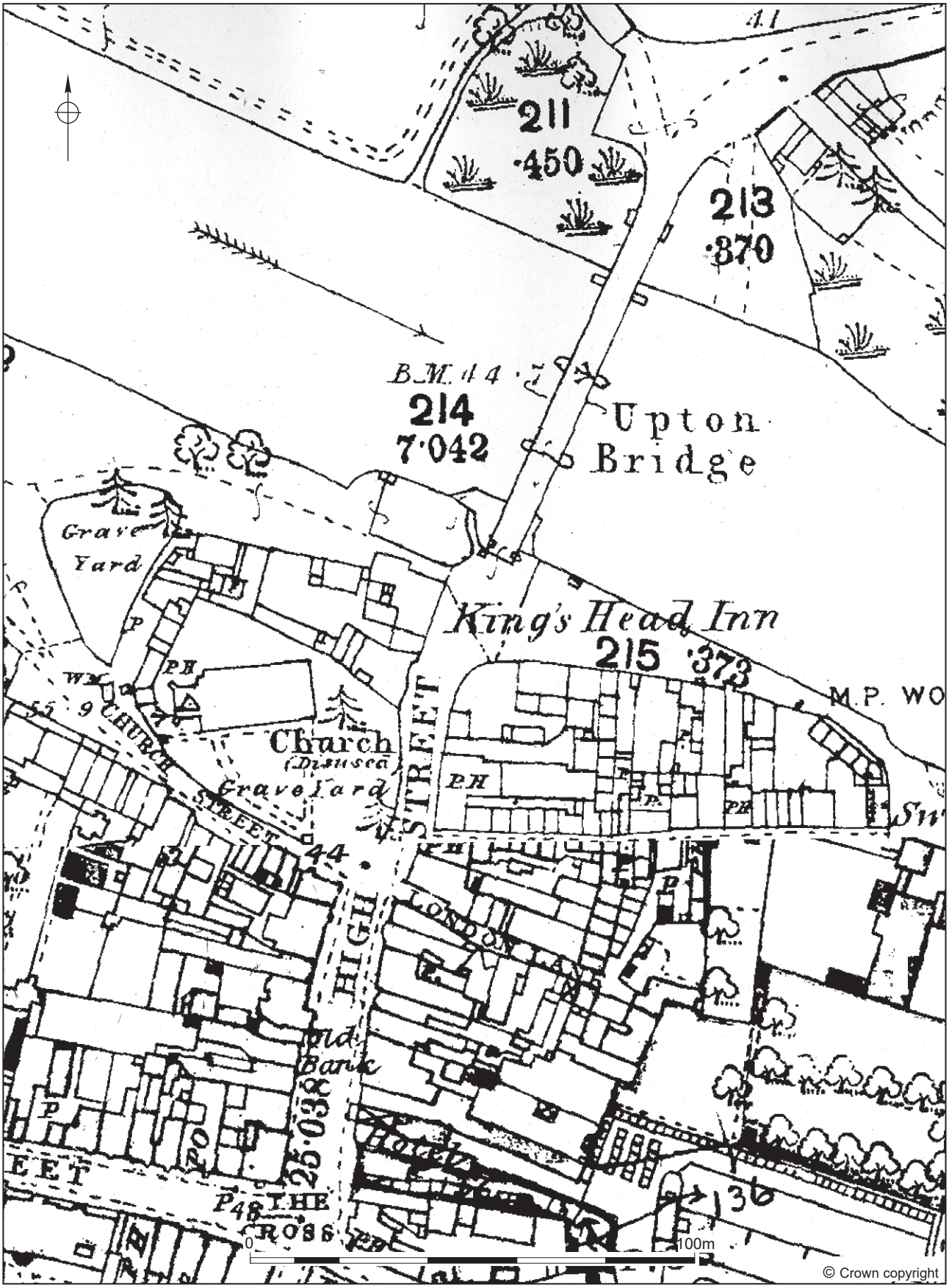


Figure 5: Extract of Ordnance Survey map, 1886

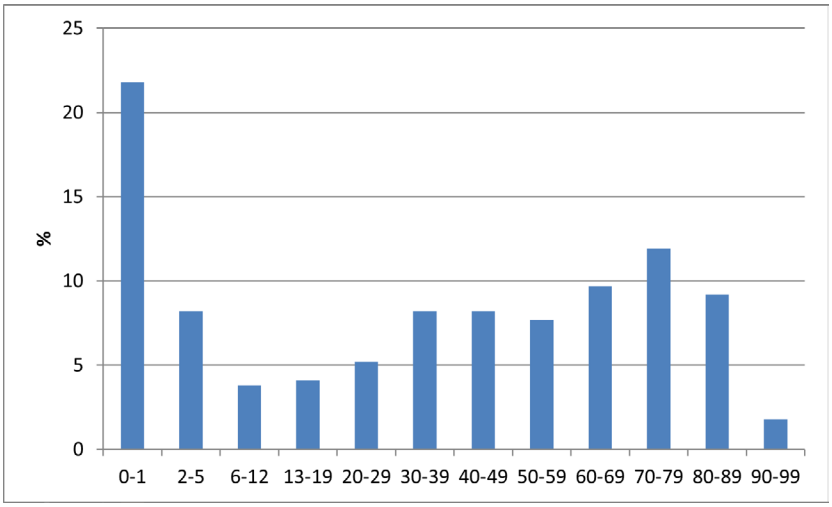


Figure 6: Mortality profile of the population of Upton-upon-Severn between 1851 and 1866 from the parish burial records

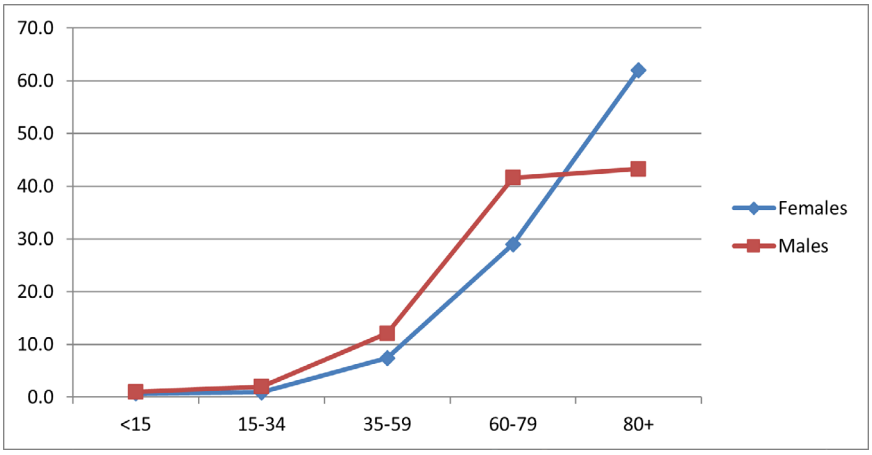


Figure 7: Mortality profile UK population 2010 (Office for National Statistics)

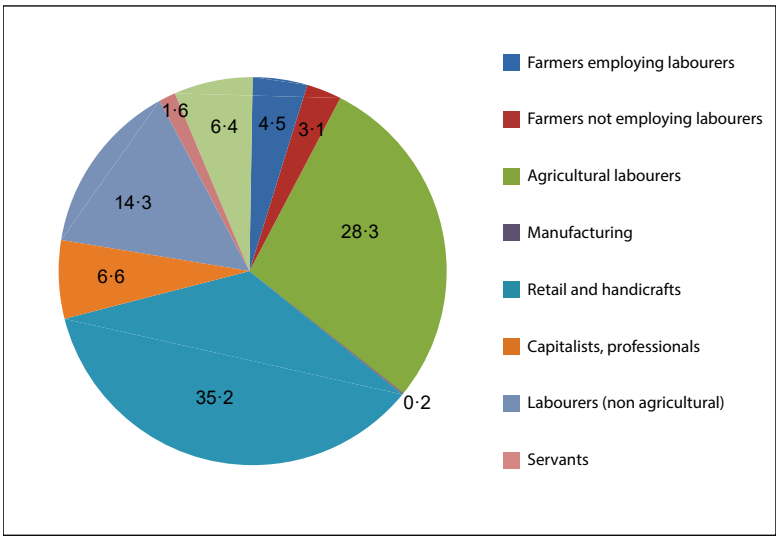


Figure 8: Professions recorded for the Upton-upon-Severn population in the 1831 census (%)

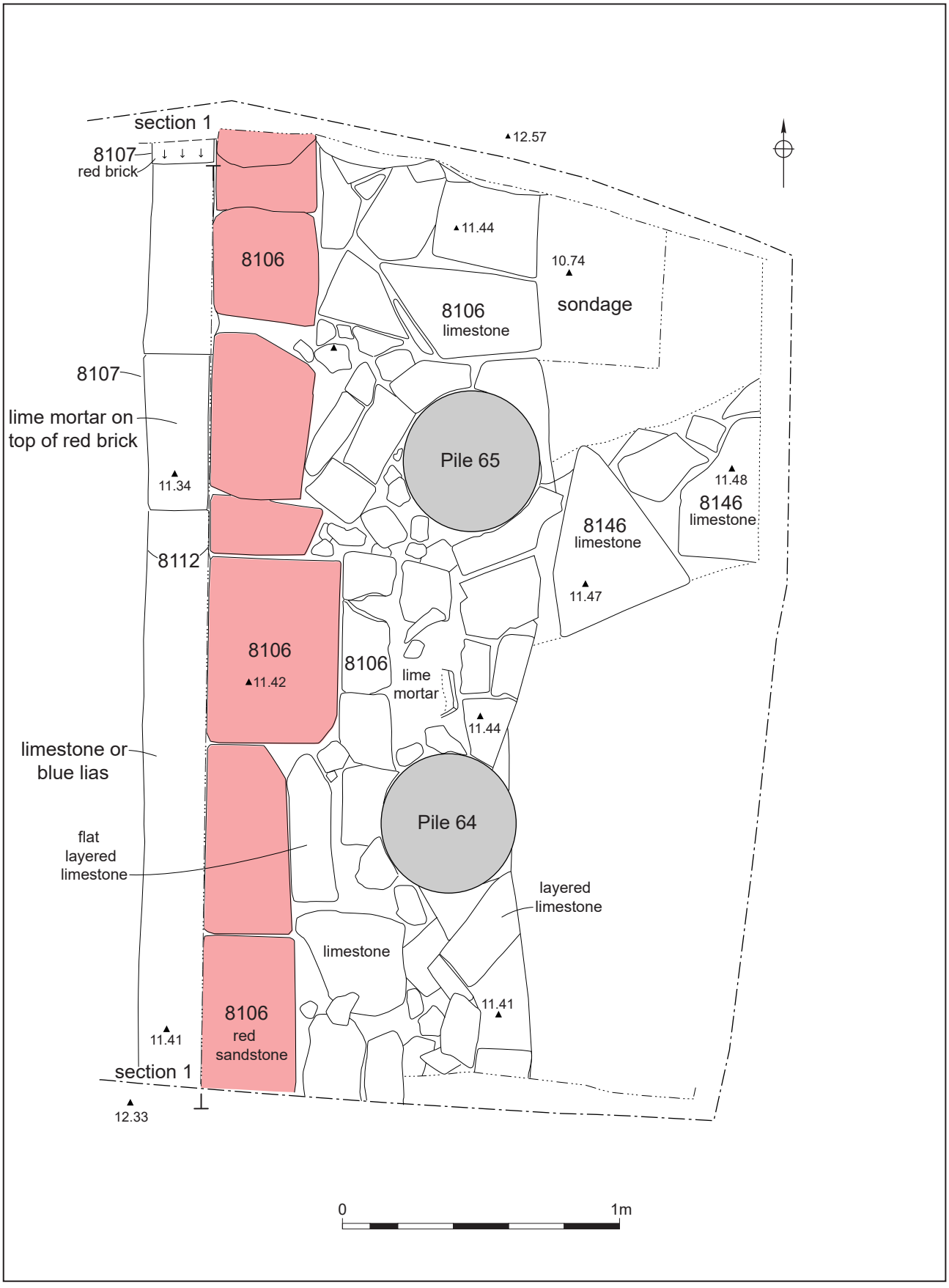


Figure 9: Plan of western side of post-medieval bridge

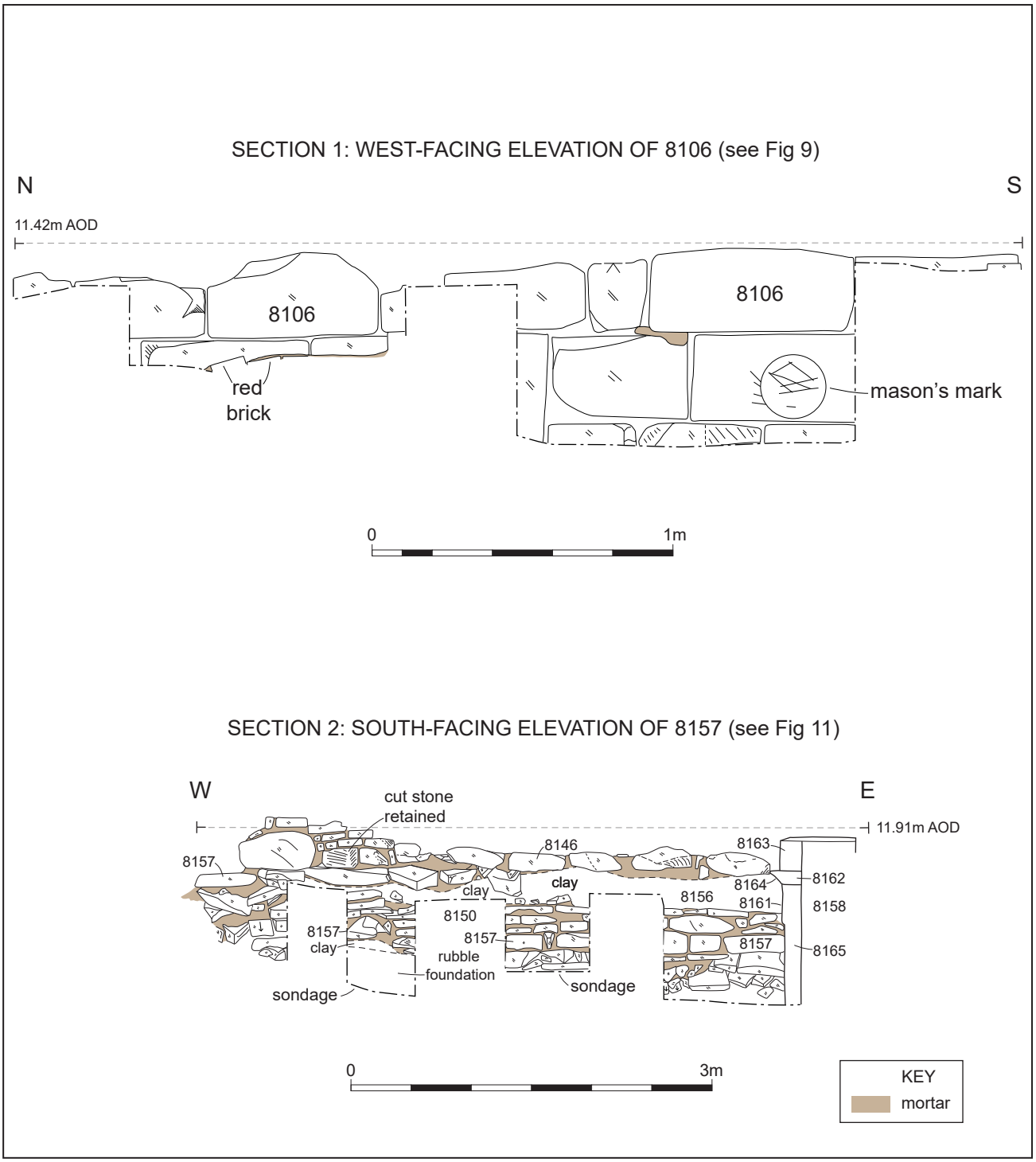


Figure 10: Post-medieval bridge elevations

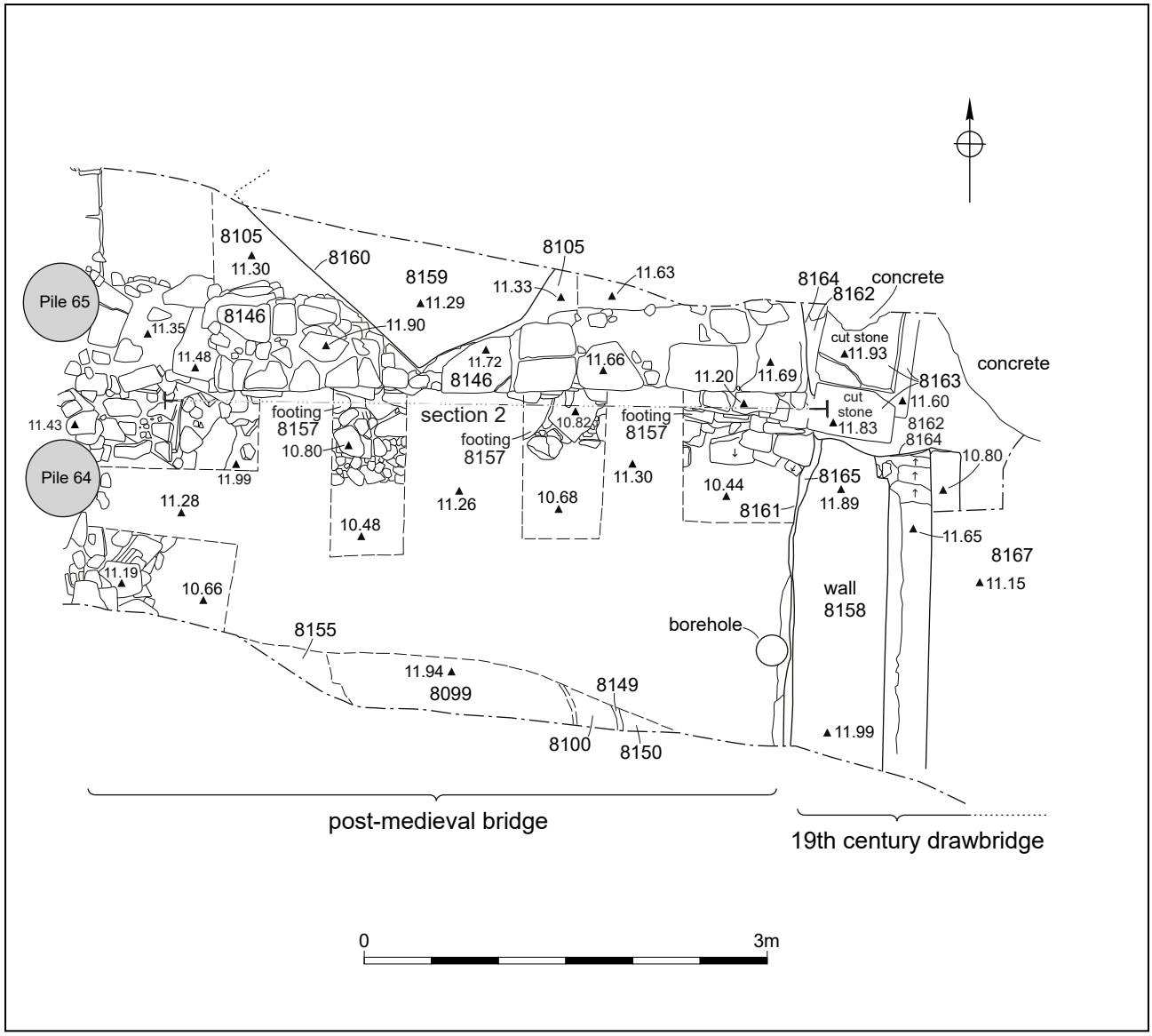


Figure 11: Plan of post-medieval bridge and 19th century drawbridge

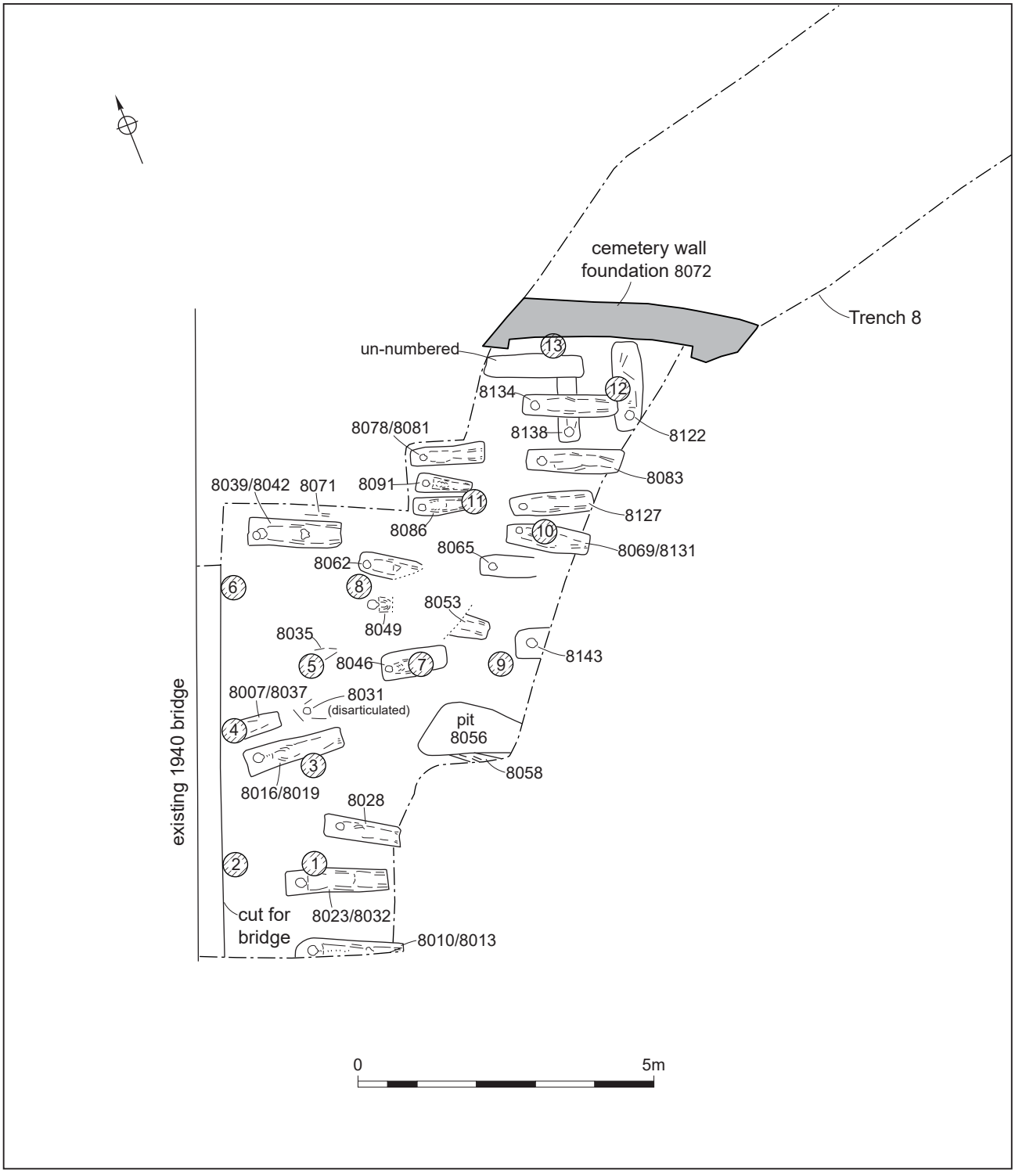


Figure 12: Plan of burials in Trench 8

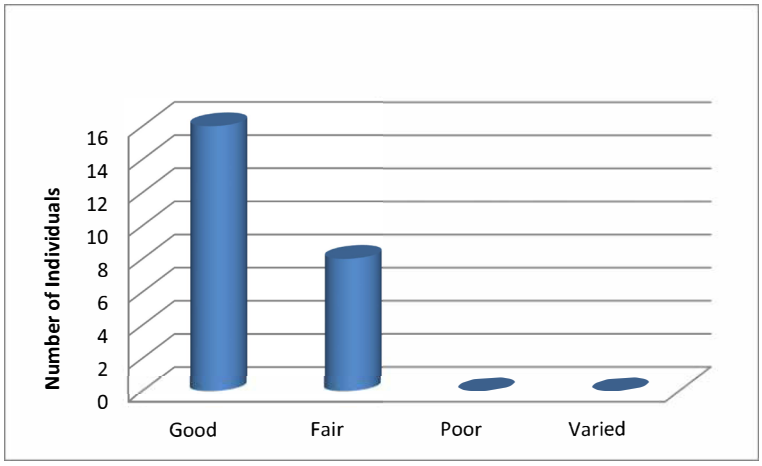


Figure 13: Condition of skeletal remains from the Old Church of St Peter and St Paul

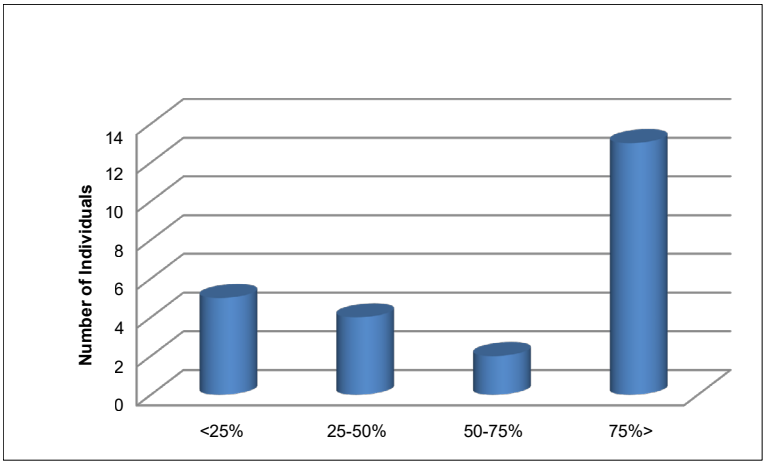


Figure 14: Completeness of skeletons from the Old Church of St Peter and St Paul

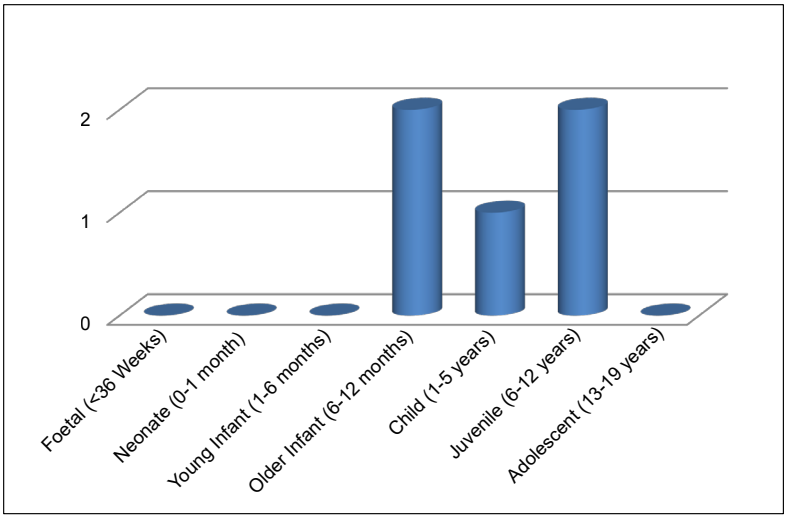


Figure 15: Age categories represented in the sub-adult sample from the Old Church of St Peter and St Paul

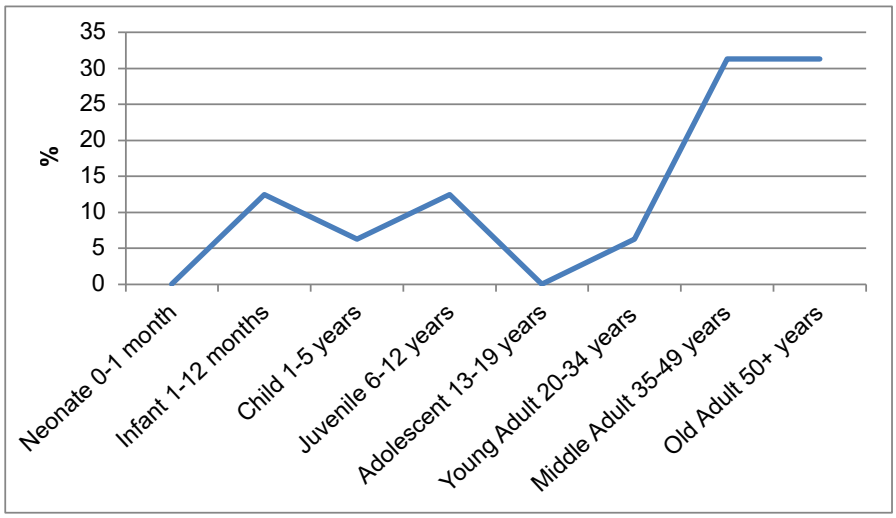


Figure 16: Age profile of the archaeological sample

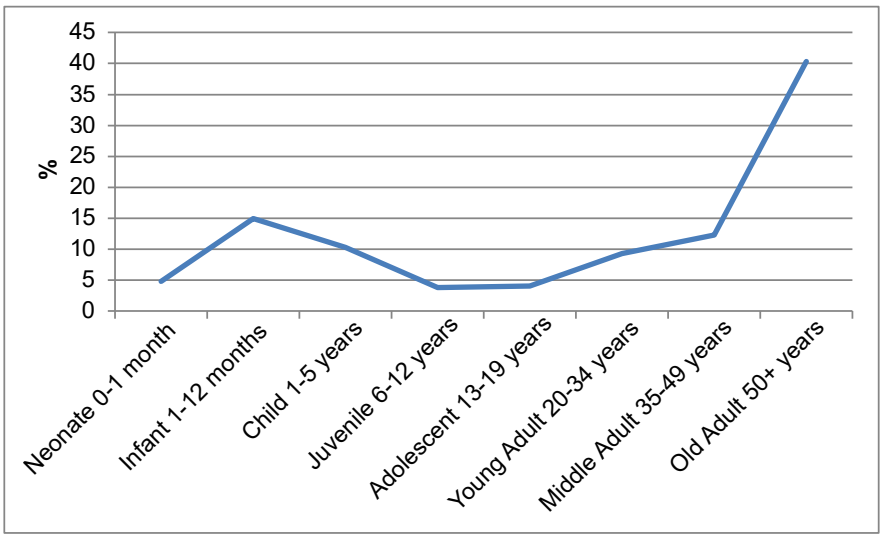


Figure 17: Age Profile from the burials records of the Upton-upon-Severn population 1851-1866

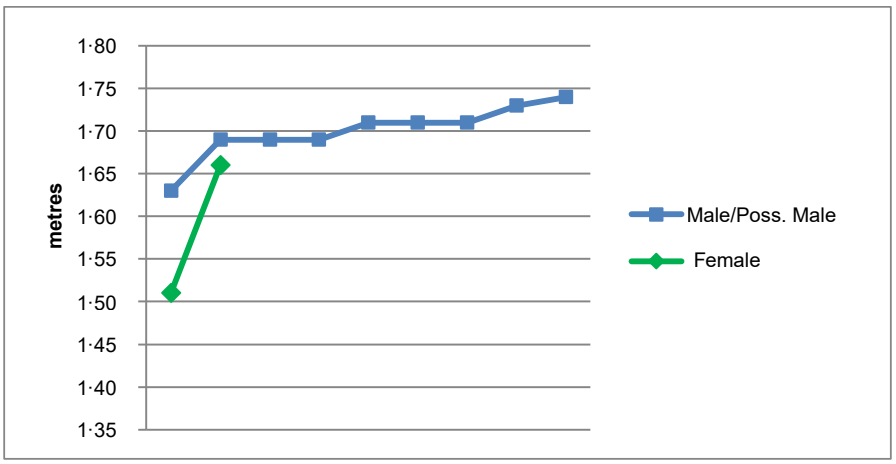


Figure 18: Stature estimation for males and females from the Old Church of St Peter and St Paul

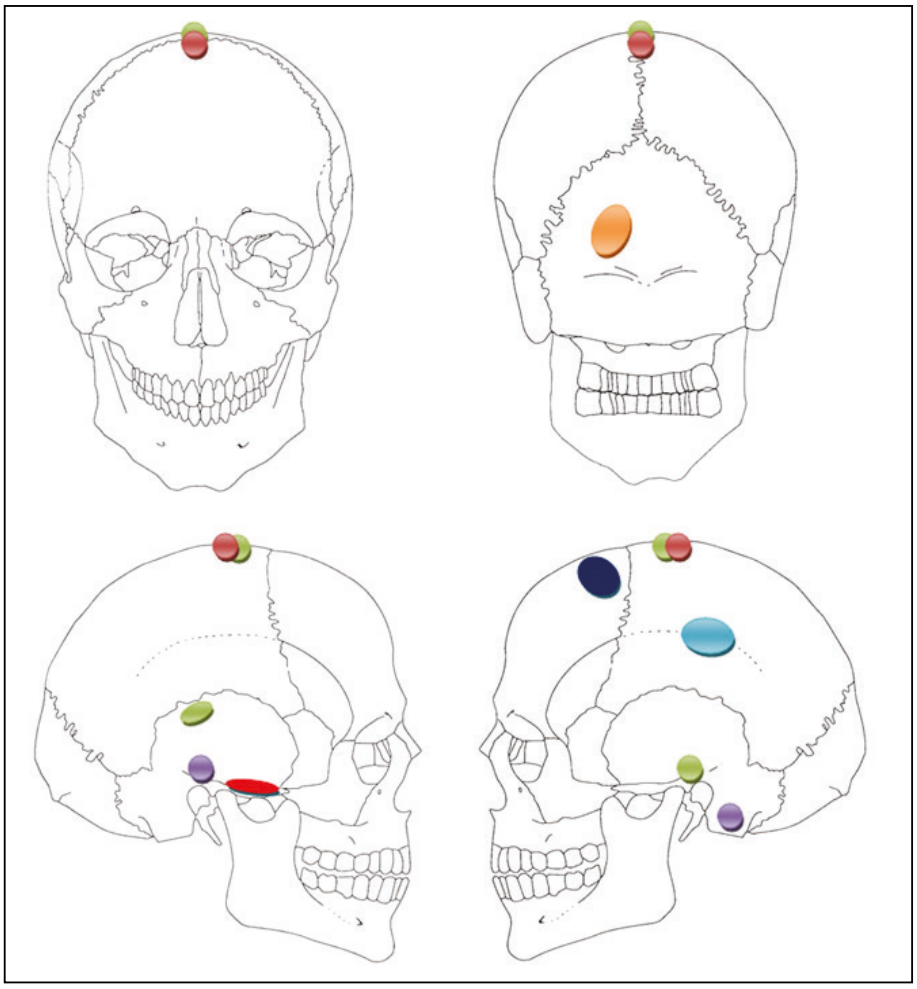


Figure 19: Composite plan showing the distribution of shroud pins around the adult skulls (colours represent sets of stainings for each individual).

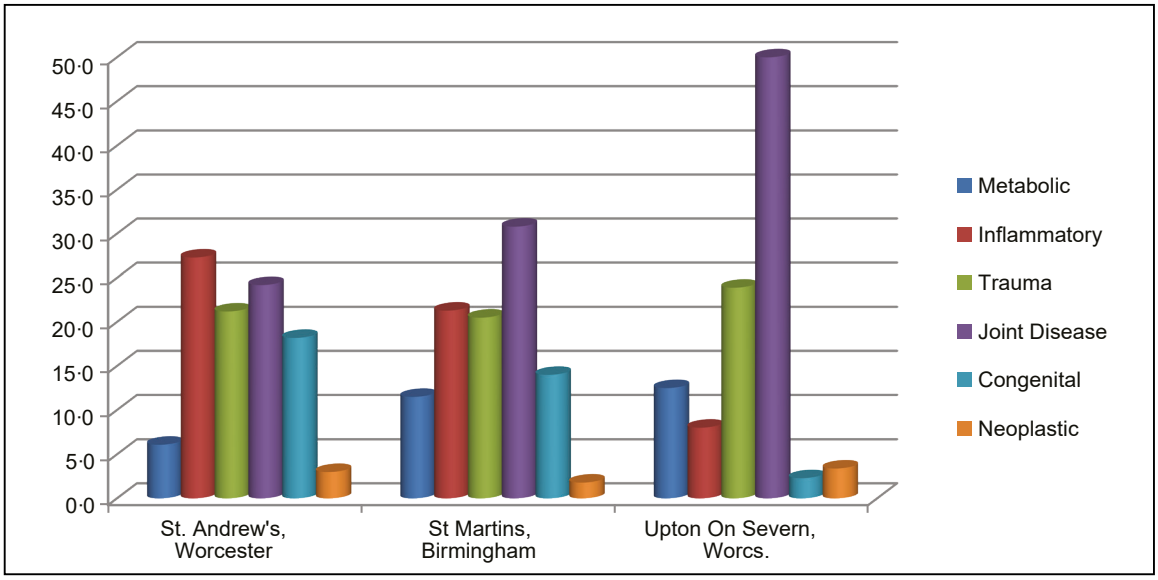


Figure 20: Comparative proportion of diseases present according to number of cases by category

Figure 21:
General view of the waterfront from the road bridge, with the curved graveyard wall in the foreground, and the bridges located to the top left, below the working machines; 2m scales; view south-east

Figure 22:
Post-medieval stone bridge with wall 8106 in the foreground;
1m scales; view east

Figure 23:
Detail of the mason's mark on the outer face of wall 8106;
0·30m scale; view east

Figure 24:
The post-medieval bridge; wall 8106 to the left, wall footing 8157 to the centre; later wall 8146 above; drawbridge wall 8158 to the right; the curved wall for the swing bridge still upstanding above; 1m scales; view north

Figure 25:
Deposit sequence above the post-medieval bridge; 1m scale, view north

Figure 26:
Granite running block (8171) capping the eastern, downstream drawbridge wall; 1m scale; view north-east

Figure 27:
The western drawbridge wall (8158) in the foreground, with the later truncation for the swing bridge to the right; the re-used square granite blocks supporting the back of the curved retaining wall for the swing bridge;
1m scale, view west

Figure 28:
Burial 8010 overlying burial 8013;
1m scale; view south

Figure 29:
Burial 8023 truncated by Pile 1,
1m scale; view west

Figure 30:
Burial 8028 with coffin traces below;
1m scale; view south

Figure 31:
heavily disturbed burial 8037; cut by pile 4;
0·30m scale; view south

Figure 32:
Burial 8046 with pennies within the eye orbits;
0·30m scale; view west

Figure 33:
Burial 8046 truncated by pile 7, with pennies within the eye orbits and porcelain buttons across the torso; 0·30m scale; view south

Figure 34:
Burial 8122 truncated by pile 12 and grave cut for burial 8138;
1m scale; view west

Figure 35:
Burial 8134, truncated by grave cut for burial 8138; view south

Figure 36:
Curved graveyard wall (8072).
1m scales; view west

Figure 37:
Culvert 10009 in Trench 10,
1m scales; view south

Figure 38: SK 8127
Loss of height and lateral wedging with osteophyte formation in the lower thoracic vertebrae

Figure 39: SK 8083
Bilateral coxa vara with secondary osteoarthritis on the left side

Figure 40: SK 8019
Pleural inflammatory lesions on the visceral surfaces of the ribs. The porotic nature of the lesions indicate that the inflammation was active at the time of death.

Figure 41: SK 8019
Scalloped lytic lesion on the superior surface of the second lumbar vertebra

Figure 42: SK 8138
Gross remodelling of the maxilla due to chronic sinusitis

Figure 43: SK 8069
Intra-articular fracture-dislocation to the thumb with secondary osteoarthritis

Figure 44: SK 8083
Bilateral rotator cuff arthropathy with secondary pseudoarthroses and osteoarthritis

Figure 45: SK 8010
Impact fracture to the left ankle (calcaneus and talus). Note the secondary disuse atrophy of the left metatarsals

Figure 46: SK 8134
Childhood monteggia fracture-dislocation of the right ulna with remodelling of the contiguous radial neck and head.Left side pictured for comparison

Figure 47: SK 8069
Primary osteoarthritis of the right hip with extensive eburnation and Macroporosity

Figure 48: SK 8010
Mixed blastic and lytic lesion at the acromion

Figure 49: SK 8131
caries present

Figure 50: SK 8134
Circular wear facets on the anterior dentition representing a pipe smoking groove. Note the calculus and abscess

Figure 51: SK 8131
Shroud pin in situ at the left ear. Note the associated preservation of textile and hair.

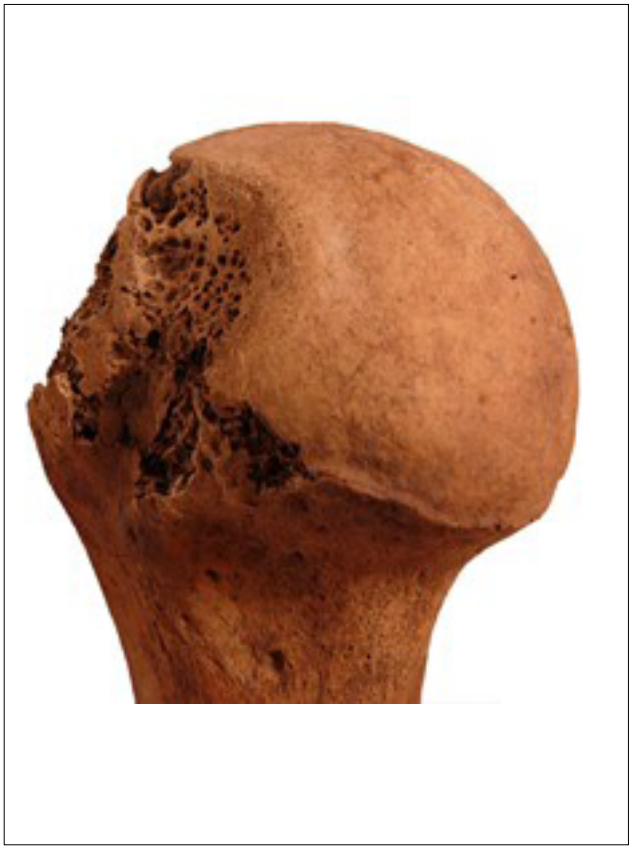


Figure 52: SK 55
Hill-Sachs lesion indicating an anterior dislocation of the left shoulder

Figure 53: Dole stone from ash rich deposit 8153

Bibliography

Askenaze, D M and Ruby, L K, 1992 Metacarpal fractures and dislocations, *Orthop Clin North Am:* 23:19

Atkin, M, 1995 *The Civil War In Worcestershire*, Alan Sutton Publishing Ltd, Hereford and Worcester Libraries and Arts

Aufderheide, A C, and Rodriguez-Martin, C, 1998 *The Cambridge Encyclopedia of Human Palaeopathology,* Cambridge University Press. Cambridge

Barnes, E, 2008 Congenital Anomalies, in Pinhasi, R and Mays, S (eds) *Advances in Human Palaeopathology,* 329-362, Wiley and Sons Ltd., Chichester, England

Bass, W M, 1995 *Human Osteology; A Laboratory and Field Manual*, Missouri Archaeological Society, Inc., Columbia, USA

Berger, R, and Weiss, A P, 2004 *Hand Surgery, Volume 1,* Lippincott, Williams and Wikins, Philadelphia, USA

Bevan, L, 2006 The Impedimenta of Death: Jewellery and Other Personal items. in Brickley, M, Buteux, S, Adams, J and Cherrington, R (eds) *St Martin's Uncovered: Investigations in the churchyard of St Martin's-in-the-Bullring, Birmingham, 2001*: 179-184, Oxbow Books, Oxford, England

Bovée, J V, 2008 Multiple Osteochondromas, *Orphanet Journal of Rare Diseases,* 3:3 doi:10.1186/1750-1172-3-3

Brickley, M, and Ives, R, 2008 *The Bioarchaeology of Metabolic Bone Disease.* Elsevier Ltd, Oxford

Brickley, M, Berry, H, and Western, G, 2006 The People: Physical Anthropology, in Brickley, M, Buteux, S, Adams, J and Cherrington, R (eds) *St Martin's Uncovered: Investigations in the churchyard of St Martin's-in-the-Bullring, Birmingham, 2001*: 90-151, Oxbow Books, Oxford

Brickley, M, and McKinley, J I, 2004 Guidelines to Recording Human Remains, *IFA Paper,* **7**, Institute of Field Archaeologists, in association with BABAO

Brooks, S T, and Suchey, J M, 1990 Skeletal Age Determination Based on the Os Pubis: A Comparison of the Acsadi-Nemeskeri and Suchey-Brooks Methods, in *Human Evolution* **5**, 227-238

Buikstra, J E, and Ubelaker, D H, 1994 *Standards for Data Collection from Human Skeletal Remains,* Arkansas Archaeological Survey Research Series, **44**

Castro, W, Jerosch, J, and Grossman, T, 2001 *Examination and Diagnosis of Musculoskeletal Disorders: Clinical Examination, Imaging Modalities,* Stuttgart, Germany: Georg Thieme Verlag

Chamberlain, A, 2006 *Demography in Archaeology*, Cambridge University Press, Cambridge

Chenoweth, J, 2009 Social Identity, Material Culture and the Archaeology of Religion: Quaker practices in context, in *Journal of Social Archaeology* **9**: 319-339

Cox, M, 2000 Ageing adults from the skeleton, in *Human Osteology in Archaeology and Forensic Science,* M Cox and S Mays (eds), 289-305, Greenwich Medical Media

Curtis, H, n.d. *An Account of the Development of a Public Utility, in this case Burial Grounds and Cemeteries, in Worcester City,* Worcestershire Archives and Archaeology Service

Dalwood, H, 1996 *Archaeological Assessment of Upton-upon-Severn, Hereford and Worcester,* County Archaeological Service, Hereford and Worcester County Council, unpublished report, **349**

Dinn, J, 2003 *Worcestershire from 1750,* paper given for Seminar 7 of the West Midlands Regional Research Framework for Archaeology accessed March 2014, http://www.birmingham.ac.uk/schools/historycultures/departments/caha/research/arch-research/wmrrfa/seminar7.aspx

Dobney, K, and Goodman, A, 1991 Epidemiological Studies of Dental Enamel Hypoplasia in Mexico and Bradford; Their Relevance to Archaeological Skeletal Studies, in Bush, H and Zvelebil, M, (eds) *Health in Past Societies, Biocultural interpretations of human remains in archaeological contexts.* Oxford, Tempus Reparatum, British Archaeological Reports. International Series **567**: 101-13

El-Khoury, G Y, 2013 Section 12: Tumors/Miscellaneous, in Bennett, D L and El-Khoury, G Y, (eds) *Pearls and Pitfalls in Musculoskeletal Imaging: Variants and Other Difficult Diagnoses*. Cambridge: Cambridge University Press, 163-249

English Heritage 2002 *Human Bones from Archaeological Sites: Guidelines for producing assessment documents and analytical reports,* English Heritage, Centre for Archaeology guidelines

Entec UK Ltd, 2008 *Environment Agency - Upton upon Severn Flood Alleviation Project - Cultural Heritage Desk Study Report,* unpublished report, draft dated June 2008

Floud, R, Wachter, K, and Gregory A, 1990 *Health, Height and History: Nutritional Status in the United Kingdom 1750-1980,* Cambridge University Press, Cambridge

Freyschmidt, J, 2003 The Lower Extremity in (eds) Freyschmidt, J, Brossman, J, *Freyschmidt's "Koehler/Zimmer" Borderlands of Normal and Early Pathological Findings in Skeletal Radiology,* 5th revised edition, 859-1104, Thieme, Stuttgart, New York.

Garg, K, And Somvanshi, D S, 2011 Spinal Tuberculosis: A review, in *Journal of Spinal Cord Medicine*: Sep **34**(5): 440-454

Goodman, A, and Armelagos, G, 1985 Factors Affecting the Distribution of Enamel Hypoplasias Within the Human Permanent Dentition, in *Am. J. Phys. Anth.* **68**: 479-493

Gowland, R, and Western, A G, 2012 Morbidity in the Marshes: Using Spatial Epidemiology to Investigate Skeletal Evidence for Malaria in Anglo-Saxon England (AD410-1050), in *American Journal of Physical Anthropology **147** (2)*, 301-311

The Happy Pontist website *Worcestershire Bridges: 7. Upton-upon-Severn Bridge*, accessed September 2012, http://www.happypontist.blogspot.co.uk/2011/05/worcestershire-bridges-7-upton-upon.html

HEAS 2010 *Standards and guidelines for archaeological projects in Worcestershire,* Worcestershire County Council, Historic Environment and Archaeology Service

Henderson, J, 1987 Factors Determining the State of Preservation of Human Remains, in Boddington, A, Garland, A N and Janaway, R C (Eds), *Death, Decay and Reconstruction*, 43-54. Manchester University Press, Manchester

Henderson, M, Miles, A, and Walker, D, with Connell, B, and Wroe-Brown, R, 2013 '*He being dead yet speaketh': Excavations at three post-medieval burial grounds in Tower Hamlets, east London, 2004-10*, MoLA Monograph Series **64**, London

Hershkovitz, I, Greenwald, C, Rothschild, B, Latimer, B, Dutour, O, Jellema, L, and Wish-Baratz, S, 1999 Hyperostosis Frontalis Interna: An Anthropological Perspective, in *American Journal of Physical Anthropology* **109**: 303-235

Higginbotham, P, 2014 *Upton-upon-Severn, Worcestershire,* accessed 4 March 2014. http://www.workhouses.org.uk/UptonUponSevern/

Hillson, S, 1986 *Teeth,* Cambridge University Press, Cambridge

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

Hughes, J, 2008 *Archaeological investigations at Upton Marina and adjacent to New Street, Upton-upon-Severn, Worcestershire*, Historic Environment and Archaeology Service, Worcestershire County Council, report **1659**, dated 12 December 2008, P3245, WSM 39863, 39890 and 39891

Hurle, P, 1988 *Upton - Portrait of a Severnside Town,* 2nd edition

Hurst, J D, and Miller, D, 2008 *River Severn bank-side survey, Worcester to Tewkesbury*, Historic Environment and Archaeology Service, Worcestershire County Council, report dated 21 July 2008, **P3039**, English Heritage 5301 PD

Hurst, J D, and Rees, H, 1992 Pottery fabrics; a multi-period series for the County of Hereford and Worcester, in Woodiwiss, S G (ed), *Iron Age and Roman salt production and the medieval town of Droitwich*, CBA Res Rep, **81**, 200-9

Hutchinson, D, L, and Larsen, C S, 1988 Determination of Stress Episode Duration from Linear Enamel Hypoplasias: A Case Study from St Catherines Island, Georgia, in *Human Biology* **60**, 93-110

IfA 2008a *Standard and guidance for archaeological excavation,* Institute for Archaeologists

IfA 2008b *Standard and guidance for an archaeological watching brief,* Institute for Archaeologists

The Illustrated London News, 1854 *New Bridge over the Severn, at Upton*, accessed September 2012, http://www.upton.uk.net/history/bridge/draw_bridge.html

Kausmally, T, 2004 *Report on the Human Remains from St Johns, Ousebridge, York,* On-Site Archaeology, unpublished

Lee, A, 2011 *Archaeological watching brief of Upton-upon-Severn flood alleviation scheme, Upton-upon-Severn, Worcestershire,* Historic Environment and Archaeology Service, Worcestershire County Council, unpublished report **1848**, dated 4 July 2011, WSM 43246, P3639

Lovejoy, C, Meindl, T, Pryzbeck, T, and Mensforth, R, 1985 Chronological Metamorphosis of the Auricular Surface of the Ilium: A New Method for the Determination of Age at Death, in *American Journal of Physical Anthropology*, **68**, 15-28

Maher, C, and Bear-Lehman, J, 2008 Orthopaedic Conditions, in Radomski, M, And Latham, C, (eds) *Occupational Therapy for Physical Dysfunction,* Baltimore, Philadelphia: Lippincott, Williams and Wilkins, 1106-1130

Malvern Hills District Council 2008 *Upton upon Severn Conservation Area – Appraisal and Management Strategy*, Planning Services, April 2008

Marincek, B, and Dondelinger, R F, 2007 *Emergency Radiology: Imaging and Intervention,* Heidleberg, Berlin: Springer Verlag

Miles, A, Powers, N, Wroe-Brown, R, with Walker, D, 2008 *St Marylebone Church and Burial Ground in the 18th to 19th Centuries: Excavations at St Marylebone School, 1992 and 2004-6*, MoLAS Monograph Series **46**, London

Miles, A E W, 1963 The Dentition in the Assessment of Individual Age in Skeletal Material, in Brothwell, D R (ed) *Dental Anthropology*, 191-209, Oxford: Pergamon

Molina, N, Pezzani, B, Ciarmela, M, Orden, A, Rosa D, Apezteguia, M, Basualdo, J, and Minivielle, M, 2011 Intestinal parasites and genotypes of Giardia intestinalis in school children from Berisso, Argentina, in *J Infect Dev Ctries* 5(7): 527-534

Ogden, A, 2005 Skeletal Report for the Tallow Hill Excavation, Department of Archaeological Sciences, University of Bradford, Appendix 4 in T M Vaughan, *Archaeological watching brief at Tallow Hill, St Martins, Worcester,* Worcestershire County Council, Historic Environment and Archaeology Service, report **982**, P2215, WCM 100879, revised 5 April 2005

Ortner, D J, 2003 *Identification of Pathological Conditions in Human Skeletal Remains,* Academic Press, Smithsonian Institution, Washington DC

Oswald, A, 1975 Clay pipes for the archaeologist, *BAR Brit Ser **14***

Roberts, C, and Buikstra, J, 2003 *The Bioarchaeology of Tuberculosis: A Global View on a Re-Emerging Disease,* Florida: University of Florida Press

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

Roberts, C, and Manchester, K, 1997 *The Archaeology of Disease,* Sutton Publishing Ltd, Stroud

Roberts, E, 1989 The Lancashire Way of Death, in Houlbrouke, R (ed), *Death, Ritual and Bereavement,* Routledge, London

Rogers, J, and Waldron T, 1995 *A Field Guide to Joint Disease in Archaeology,* Wiley and Sons, Chichester

Scheuer, L, and Black, S, 2004 *The Juvenile Skeleton,* Elsevier Academic Press, London

Salter, R, 1999 *Textbook of Disorders and Injuries of the Musculoskeletal System*. 3rd ed. Williams and Wilkins, Maryland

Schaefer, M, Black, S and Scheuer, L, 2009 *Juvenile Osteology: A Laboratory and Field Manual,* Academic Press, London

Scheuer, L, and Black, S, 2004 *The Juvenile Skeleton.* Elsevier Academic Press, London

Archenfield Archaeology Ltd Sherlock, H, and Pikes, P, 2001 *49-53 Commercial Road, Hereford: An Archaeological and Historical Assessment,* unpublished report

Smith, B H, 1991 Standards of Human Tooth Formation and Dental Age Assessment, in Kelley, M, and Larsen, C S, (eds) *Advances in Dental Anthropology.* Wiley-Liss, New York, 143-168

Stuart-Macadam, P,1991 Anaemia in Roman Britain, in H Bush and M Zvelebil (eds) *Health in Past Societies, Biocultural interpretations of human remains in archaeological contexts,* Oxford, Tempus Reparatum, British Archaeological Reports, International Series **567**, 101-13

Stace, C, 2010 *New Flora of the British Isles*, Cambridge University Press, 3rd edition

Tarlow, S, 2011 *Ritual, Belief and the Dead in Early Modern Britain and Ireland, Cambridge University Press*, Cambridge

Thorn, F, and Thorn, C (eds), 1982 *Domesday Book: Worcestershire*, **16**, Chichester

Trotter, M, 1970 Estimation of Stature from Intact Limb Bones, in Stewart, T D (ed.) *Personal Identification in Mass Disasters*, 71-83, Washington DC, Smithsonian Institution

Tyrell, A, 2000 Skeletal non-metric traits and the assessment of inter- and intra-population diversity: Past problems and future potential, in *Human Osteology in Archaeology and Forensic Science,* M Cox and S Mays (eds), 289-305, Greenwich Medical Media

Ubelaker, D, 1989 *Human Skeletal Remains,* 2nd edition, Taraxacum Press, Washington DC

VCH IV, Page, W (ed), 1924 Victoria County History - Worcestershire***,* IV**

Vigorita, V J, 2008 *Orthopaedic Pathology,* 2nd ed, Wolters Luwer/Lippincott Williams and Wilkins, London

A Vision of Britain Through Time website *Upton upon Severn CP/AP*, accessed March 2014, www.visionofbritain.org.uk/unit/10348031/cube

WA 2012 *Manual of Service Practice: Recording Manual*, Worcestershire Archive and Archaeology Service, Worcestershire County Council internal report, **1842**

WA 2013 *Written Scheme of Investigationl for Archaeological Excavation,* Worcestershire Archive and Archaeology Service, Worcestershire County Council internal report

Walker, D, and Henderson, M, 2010 Smoking and health in London's East End in the first half of the 19th century, in *Post-Medieval Archaeology*, **44/1**, 209–222

Walker, P, Bathurst, R, Richman, R, Gjerdrum, T, and Andrushko, V, 2009 The Causes or Porotic Hyperostosis and Cribra Orbitalia: A Reappraisal of the Iron-Deficiency-Anemia Hypothesis, in *Am. J. Phys. Anth.* **139**, 109-125

Walton-Rogers, P, 2006 Textiles, in *St Martin's Uncovered: Investigations in the churchyard of St Martin's-In-The-Bullring*, Birmingham, 2001, Oxbow Books, Oxford, 163-179

WCC 2010 *Standards and guidelines for archaeological projects in Worcestershire*, Planning Advisory Section, Worcestershire Archive and Archaeology Service, Worcestershire County Council unpublished report **604**, amended July 2012

Western, A G, 2006 *Osteological Analysis of the Human Remains from St Andrew's Burial Ground, Worcester*, Ossafreelance, OGW1011, Appendix 4 in S J Sworn, *Archaeological watching brief at All Saint's Building, Worcester College of Technology, Worcester,* Worcestershire County Council, Historic Environment and Archaeology Service, report **1403**, P2741, WCM 101369, dated 12 April 2007

Wilkinson, S C, *c* 2007 The Bridge at Upton, http://www.upton.uk.net/ accessed September 2012

Wood, J W , Milner G R , Harpending, H C, and Weiss K M, 1992 The Osteological Paradox, Problems of inferring health from skeletal samples, in *Current Anthropology* **33**, 4, 343-70

Woods, R, 2000 *The Demography of Victorian England and Wales,* Cambridge University Press, Cambridge

Published by

Worcestershire
Archive & Archaeology Service

www.explorethepast.co.uk/

worcestershire
county council