Gloucestershire
COUNTY COUNCIL

An Archaeological Watching Brief
during the

Gloucester Quays City Centre Linkages Scheme Gloucester

for Mr Nigel Edgeworth

Nathan Thomas

Gloucestershire County Council Archaeology Service

Site details

Report title:	An Archaeological Watching Brief during the Gloucester Quays City Centre Linkages Scheme
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Site type:	Watching Brief
Client:	Mr Nigel Edgeworth, Gloucestershire County Council
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Summary
Gloucestershire County Council Archaeology Service (GCCAS) was commissioned by Mr Nigel Edgeworth of Gloucestershire County Council to undertake an archaeological watching brief during the groundworks associated with the Gloucester Quays City Centre Linkages Scheme (OS NGR 382978 218358). The watching brief was undertaken at the request of the Senior Archaeological Officer of Gloucestershire County Council as the site lies within the archaeologically sensitive area of Gloucester city centre. The construction work being carried out consisted of the replacement of the existing road and pavement surfaces across the development area and the creation of two art features on Kimbrose Triangle. In general, the scope of the works had a limited impact on the archaeological resource present due to the shallow nature of the excavations. However, a number of significant archaeological finds and features were recorded during the more intrusive works for the Art Wall feature on Kimbrose Triangle. This included a previously unrecorded section of the Roman city wall and a medieval double inhumation. The remains of the Roman wall were represented by large limestone blocks. These were interpreted as the foundation of the third phase of the Roman city defences, the blocks having been reused from earlier phases of the wall. The primary interment (SK2) of the double medieval inhumation has been radiocarbon dated to 920 ± 30 BP, giving a calibrated date of between 1020 to 1190 AD at 95.4% probability. The date indicates that the burial probably took place within the burial ground of St Kyneburgh's Chapel, recorded as existing from the time of the Norman Conquest. A wall recorded during foundation piling for the Art Wall, may be a remnant structural element of the chapel itself. Evidence from the post-medieval period comprised a 19th century gravestone, disarticulated human remains, coffin furniture and a number of structural features. The gravestone fragment was found dumped in a disused well adjacent to the Dental Practice on Southgate Street and originated from the Independent Chapel. The historical background associated with the gravestone provides interesting insights into the personal history of a 19th century Gloucester couple. The disarticulated human remains and coffin furniture may also have come from the Independent Chapel. The structural features recorded comprised two wells, four walls and two surfaces and in most cases these were features which appeared on the historic mapping.

1 Introduction

1.1 Gloucestershire County Council Archaeology Service (GCCAS) was commissioned by Mr Nigel Edgeworth of Gloucestershire County Council to undertake an archaeological watching brief during the groundworks associated with the Gloucester Quays City Centre Linkages Scheme, hereafter referred to as "the Site".

1.2 Archaeological recording at the Site was carried out in accordance with the Institute for Archaeologists (IfA) *'Standard and Guidance for an Archaeological Watching Brief'* (IfA 2008). The work was also in line with the standard brief for archaeological monitoring issued by the Senior Archaeological Officer at Gloucestershire County Council (Parry 2010) and the written scheme of investigation (Williams 2010). GCCAS is a Registered Organisation of the IfA (IfA RO 42).

1.3 Paul Nichols, Edmund Stratford, Briege Williams, Andrew Walsh and Nathan Thomas (GCCAS) all participated in the archaeological monitoring that took place between March 2010 and February 2011. Paul Nichols (GCCAS Senior Project Officer) managed the project.

2 Site location (see Figure 1)

2.1 The Site lies within Gloucester city centre, immediately southwest of the central pedestrianised zone. The works focused on the highway surrounding Kimbrose Triangle and segments of the converging roads; this includes a c.270m section of Southgate Street, a c.150m section of Commercial Road and a c.30m section of Parliament Street and Kimbrose Way. The majority of the development area is located within the Blackfriars/Greyfriars Conservation Area with the southern extreme, along Southgate Street, within the Brunswick Square Conservation Area.

2.2 The Site is situated at a height of between 15m and 20m above Ordnance Datum (aOD). The geology consists of limestone and mudstone of the Blue Lias and Charmouth Formations (BGS 2011).

3 Archaeological background

3.1 Information regarding the archaeological background of the Site and its wider surroundings has been reported in the desk-based assessment (DBA) (GHER 32973) conducted in the early stages of this project (Stratford 2008). The following information presents a summary of the most recent archaeological work within the immediate area of the development. Sites are discussed with reference to Gloucester Urban Archaeological Database (GUAD) numbers and Gloucestershire Historic Environment Record (GHER) numbers.

3.2 An archaeological evaluation (GHER 33352) conducted by GCCAS within the raised flower bed of Kimbrose Triangle identified significant archaeological deposits. A Roman mortar floor surface was recorded at a depth of 1.55m below ground level (BGL), at a height of 16.79m aOD. From the limited evidence available, it was not possible to ascertain the exact form or function of this feature, although the mortar composition of the surface, combined with its location to the north of the supposed line of the Roman city wall, suggested that it may be the internal floor of a Roman building. A series of stratified Roman deposits and a possible pit or ditch feature were also recorded beneath the floor surface.

3.3 Monitoring of works to install utility pipes within the carriageway along Southgate Street, Commercial Road and Kimbrose Way. The trenches were excavated to a maximum depth of 1.40m BGL within the highway, typically revealing layers of made ground with evidence of significant reworking since the post-medieval period. Roman deposits including two small walls and a possible floor surface were recorded opposite the Custom House on Commercial Road and a possible medieval road layer was recorded opposite the Baptist Church in Southgate Street (Arcus forthcoming).

3.4 During excavations of a gas pipe trench (GUAD 436; GHER 14425) opposite the frontage of 40 Southgate Street, a wooden conduit measuring 0.4m in diameter was found. The conduit is thought to relate to 17th century water systems.

3.5 Monitoring was undertaken during construction works to the rear of 47 Southgate Street (GUAD 925; GHER 14682). Archaeological deposits were identified from a depth of approximately 0.60m BGL. The deposits measured over 2m in thickness and comprised a Roman clay and timber building, a Saxon undercroft, road surfaces of possible Saxon and Norman date and early post-medieval pits and occupation debris.

3.6 A series of large-scale excavations have been undertaken immediately to the southwest of the Site. In 1983, an area directly south of Commercial Road was excavated (GUAD 788; GHER 27268) and a further excavation (GUAD 887; GHER 27268) was carried out in 1989 on the west side of Southgate Street between Kimbrose Way and the entrance to the Docks (approximately on the line of medieval Severn Street). Evidence was found for extensive Roman activity including a row of timber buildings dating to the 1st/2nd century, possibly associated with iron-working. Further masonry buildings were recorded and the extent of the Roman suburbs was defined, 70m from the south gate. A series of Saxon timber buildings were recorded in association with metalled surfaces and further settlement evidence. Extensive medieval features and deposits were also recorded and included a series of stone built houses and over 300 burials.

3.7 Monitoring was undertaken during excavation of a BT trench at the Parliament Street and Southgate Street junction in 1984 (GUAD 800; GHER 5573). The natural clay was encountered at a depth of 2m BGL. A metalled surface of Roman date was recorded at a depth of 1.2m BGL.

3.8 Observations were made during the excavation of a shaft (GUAD 1811), at the junction of Southgate Street and Parliament Street. Roman and medieval deposits were recorded at a depth of 2.6m BGL. The remains of a brick cellar, associated with the early 19th century gaol were also recorded.

3.9 A watching brief (GUAD 797), during construction work at 6 Commercial Road, recorded a portion of a metalled surface of Roman date sealed by deposits thought to be parts of the Roman rampart. A medieval building with a clay floor was also recorded.

3.10 A watching brief (GUAD 799), at the junction of Parliament Street and Southgate Street, recorded a Roman metalled street frontage, immediately outside the south gate.

3.11 Three walls of the medieval and 17th century south gate were recorded in a 0.35m wide gas main trench, outside 71-3 Southgate Street (GUAD 745; GHER 14537)**.** One wall was aligned on what is thought to be the location of the city wall at c.0.45m BGL. Two further walls, recorded further to the south, were thought to represent the footings of the 17th century south gate.

3.12 A portion of the Roman city wall was recorded in 1975 to the rear of Southgate Street (GUAD 72; GHER 481). The plinth of the wall was apparently overlaid by c.0.9m of post-medieval deposits.

3.13 Excavations on the site of the Baptist Church in Southgate Street, in 1972 (GUAD 626), recorded a sequence of Roman deposits during work to construct new basements. Wall foundations, clay floors and mosaic surfaces were observed. Records suggest that the deposits were truncated by 19th century cellars.

3.14 In 1972, a cable trench c.5m deep and c.2m wide was dug along the length of Ladybellegate Street (GHER 14444). Roman buildings with mortar floors were observed and at the southern junction with Commercial Road deposits were interpreted as the Roman rampart. A ditch cut into the rampart was followed for 12m east to west and is reported to be on the line of the Roman wall.

3.15 In 1966, a mosaic floor, 'more than 28 feet long' was found, sealing a coin of Valens (AD364-378) at 33 Southgate Street (GUAD 684; GHER 21137).

3.16 Excavation of a shaft in Southgate Street in 1960 revealed a 'black soil' interpreted as the medieval city ditch (GUAD 1810).

4 Purpose of the monitoring

In the IfA document referred to at 1.2 above:

"The definition of an archaeological watching brief is a formal programme of observation and investigation conducted during any operation carried out for non archaeological reasons. This will be within a specified area or site on land, inter-tidal zone or underwater, where there is the possibility that archaeological deposits may be disturbed or destroyed. The programme will result in the preparation of a report and ordered archive." (IfA 2008)

"The purpose of a watching brief is to allow, within the resources available, the preservation by record of archaeological deposits, the presence and nature of which could not be established (or established with sufficient accuracy) in advance of development or other potentially disruptive works" (IfA 2008).

5 Methodology

5.1 Where possible, all intrusive groundworks were monitored by an appropriately qualified and experienced archaeologist. When deposits of archaeological interest were encountered they were investigated by hand to determine their extent, nature and chronology. All were then recorded on pro-forma record sheets with additional drawn plans and sections. Where appropriate a digital and film photographic record was captured.

5.2 The construction work being carried out consisted of the replacement of the existing road and pavement surfaces across the development area and the creation of two art features on Kimbrose Triangle. More specifically this included; the pedestrianisation of Southgate Street and rerouting of the line of Kimbrose Way; the removal of all macadam highways, underlying concrete bases and pavement surfaces, to an average depth of 0.4m BGL, and replacement with high quality stone paving; the lowering and rerouting of some modern service conduits and the excavation of new service conduits; piling and excavation works associated with construction of the Art Wall and Kimbrose Tower; identification and tracing of extant services using a vacuum excavator; and excavation works associated with the installation of new street furniture including tree pits.

5.3 The site archive is presently being stored at Shire Hall, Gloucester under a unique site code, GHER 34852, issued by the County Historic Environment Record. It is intended that it will eventually be deposited with The Gloucester City Museum and Art Gallery, under accession number GLRCM 2010.29, for long-term storage.

5.4 A Ministry of Justice Licence for the removal of human remains was obtained (no.10-0046) to enable the legal exhumation and recovery of human skeletal material during the works. The licence was amended on the 7th December 2011 to defer the requirement to rebury the remains and enable their deposition with the site archive at the Gloucester City Museum.

6 Results

6.1 In general, the construction works were relatively non-intrusive upon the archaeological resource. The existing access to shops and buildings within the development area necessitated that the replacement paved surfaces remained at the pre-works levels. Hence, following the removal of the existing surfaces, very little significant excavation work was conducted below the made-up layers. Furthermore, the presence of extensive modern services across the development area highlighted the very disturbed nature of the majority of the deposits encountered. However, despite these factors, where works did extend below 0.5m in depth BGL, for example within the tree pits, ducting trenches and in the excavations associated with the Art Wall, then archaeological deposits were encountered.

6.2 Due to the works being conducted across a number of different areas, features and finds recorded are discussed by general development areas as defined below.

6.3 Court Area, Figure 2

6.3.1 This area covered the access steps to the docks and the surrounding paved frontages of the Gloucester County Court and Dental Practice building up to the line of Kimbrose Way and extending down Commercial Road to the line of Ladybellegate Street. Extensive disturbance from modern services and tree pits was present across the entirety of this area.

6.3.2 During ground reduction works within the forecourt to the docks steps, a section of stone built wall was uncovered. Wall [207] was revealed to be constructed from large irregular pieces of stone within mortared courses. Wall [207] measured approximately 5m in length by 0.8m in width and was located at a depth of 0.5m BGL (Figure 2 and Plate 1). Wall [207] contained a later brick built conduit [209] as evidenced by cut [210]. Wall [207] was located and aligned almost exactly with a wall shown on the First Edition Ordnance Survey map (OS 1884-6) to the rear of the Masonic Hall (Figure 3) and was interpreted as post-medieval in date. The majority of wall [207] was removed by the contractors during subsequent works. Abutting wall [207] was a deposit of greyish black silt (201). Deposit (201) contained fragments of clay tobacco pipe, glazed pottery and oyster shell and was also interpreted to be of post-medieval date. Overlying deposit (201) and observable across most of this area was deposit (203). Deposit (203) was composed of brick, clay and rubble and varied in depth across the area. Deposit (203) was interpreted as demolition material of post-medieval/modern date. Deposit (203) was sealed by deposit (200), a modern deposit of hardcore, 0.3m in depth.

6.3.3 Three large fragments of an 18th or 19th century gravestone were recovered from deposit (203) (Plate 2). The inscription on the stone reads “Sacred to the Memory of ...”. The stone was a greenish sandstone with the inscription having traces of a white paint within the lettering. Unfortunately no fragments with either a name or date were recovered. In addition, a partial human femur and broken humerus were also recovered from deposit (203) (Appendix 1).

6.3.4 An assemblage of disarticulated human remains and coffin furniture (iron nails and handles) was recovered from a small ducting trench excavated between the Dental Practice and County Court buildings (Figure 2). The remains were recovered from deposit (211), a dark greyish black clay, at a depth of 0.4m BGL. The remains consist of 49 broken and fragmented bones representing a minimum of three individuals, based on the presence of three left temporal bones all from adults. Of particular note were two parallel cut marks observed on a distal femoral fragment that, if inflicted while the individual was alive, could have resulted in significant blood loss and possibly death. However, the cut marks could also have been incurred post-mortem, for example during an autopsy (Appendix 1). Further human remains revealed within the base of the trench were covered with sand and left *in-situ* (Plate 3). During the construction of the County Court and Dental Practice, over 300 burials were discovered (GHER 27268). These are believed to have originated from the Infirmary Burial Ground, formerly located to the west of this area; the cemetery of St Owen’s Chapel (destroyed by the extension to the docks in 1847) and also from the cemetery of the Independent Chapel, located immediately to the south of this area (Figure 3). It is probable that the remains represent residual material from one of these cemeteries in a secondary context.

This is supported by the disarticulated nature of the remains, the extensive and intensive nature of the building works and services present across the area and the fragments of gravestone and human remains from deposit (203). Deposit (211) was overlain by deposit (203), (see above).

6.3.5 Disarticulated human remains were recovered from a tree pit just north of the Dental Practice entrance (Figure 2). The remains were recovered from deposit (700), a black silt, at a depth of 0.5m BGL, and located within the south-eastern quadrant of the tree pit. The assemblage consisted of 24 complete and fragmentary bones representing a minimum of two adults and one juvenile. A parietal fragment from this assemblage also displayed evidence of sharp force trauma. A pair of cut marks possibly indicates an assault from the front and above, with no sign of healing to the lesions, suggesting the blow was delivered around the time of death (Appendix 1). This tree pit is located within the grounds of the former Independent Chapel (Figure 3). It is likely the remains were within a secondary context having been disturbed by an earlier tree pit and modern services observed within the remainder of the intervention. Overlying deposit (700) was a modern layer of hardcore material deposit (705), 0.4m in depth.

6.3.6 Human remains and a brick built well [904] were revealed in the tree pit immediately to the south of the Dental Practice entrance (Figure 2). Well [904] was approximately 2m in diameter and backfilled with deposit (905) which contained pieces of concrete and a large fragment of 19th century gravestone (Plate 4 and 5). The gravestone was dedicated to Catherine Jennings (1790-1838) and her husband the late Reverend Robert Jennings (1797-1831) and is known to originate from the Independent Chapel (see Appendix 2 for further details on Robert and Catherine Jennings). The inscription reads "also of CATHERINE Relict of The Revd. Robert Jennings (Missionary at Chittoor in the East Indies) who died Oct 30th 1838 Aged 48 Years". Human remains were recovered from deposit (902), a mid bluish grey clay that well [904] had been cut through. These consisted of 35 complete and fragmented bones from a minimum of two adults and one child (Appendix 1). Overlying deposit (902) was a modern layer of hardcore material, deposit (900), up to 0.6m in depth.

6.3.7 A brick built foundation [901] was also observed within the pavement area adjacent to the Dental Practice building (Figure 2). This was composed of mortared brick and tile, measured approximately 3m in length and was oriented northeast to southwest. Wall [901] was interpreted as a remnant structural element of the Independent Chapel (Figure 3). Overlying wall [901] was deposit (900), a layer of modern hardcore material up to 0.6m in depth.

6.3.8 A second well was revealed within a tree pit close to the entrance of the County Court (Figure 2). Well [1000] was brick built with a diameter of 1.5m. The water level was approximately 2m below the top and the total depth of the well was determined to be in excess of 13m. The location of well [1000] coincides closely with the position of a pump marked on the First Edition Ordnance Survey map (OS 1884-6; Figure 3). Well [1000] was capped by the contractor and left *in-situ* at the base of the tree pit.

6.4 Kimbrose Triangle and works associated with the Art Features, Figure 4

6.4.1 The area around Kimbrose Triangle encompassed the former raised flower bed and the pavement area from the corner of number 84 Southgate Street around to number 15 Commercial Road. This part of the development was of particular interest as construction of the Art Wall and Kimbrose Tower features involved the most invasive excavations of the project within an area close to the former line of the Roman city wall, south gate and the probable site of St Kyneburgh's Chapel. Extensive modern services were again present across the area, the most significant of these being a large BT chamber, located on the line of the Roman wall, and its associated cable trenches and also the cabling and controls of the former traffic light system.

6.4.1.1 Works across the area included identification of services using a vacuum excavator, excavations and piling for the Art Wall, piling for Kimbrose Tower, more widespread ground reduction works, and excavations for new drainage.

6.4.2 Remnants of a limestone block built wall, [308], were revealed on the Southgate Street side of the development during service tracing works with the vacuum excavator (Figure 4 and Plate 6). Wall [308] was 1.8m long and 0.5m wide and aligned northeast to southwest. Abutting wall [308] to the west was a brick built wall [309], only partly uncovered within the intervention. Wall [308] is on the same alignment as various buildings depicted in the historic mapping and is close to the site of the former south gate. Wall [308] was interpreted to be of a post-medieval date. Abutting walls [308] and [309] was a later deposit of mixed demolition material, (310), consisting of brick, tile and hardcore.

Deposit (310) was overlain by (301), a mixed deposit composed of brick and curb fragments, 0.5m in depth. Deposit (301) was sealed by deposit (300), a modern layer of sand, 0.1m in depth.

6.4.3 A wall [503] was uncovered in the location of piles 9 and 10 of the Art Wall during a key-hole excavation to determine the nature of the underlying deposits (Figures 4 and 5, Plate 7). Wall [503] was built from small regular limestone blocks, up to 0.45m x 0.25m. Approximately 0.9m in width of wall was exposed within the excavation, with three courses visible, measuring a total of 0.44m in depth. The top of wall [503] was located at 17.55m aOD and appeared to be oriented north-south. Only a small section of wall [503] was exposed during the excavation works, hence it was difficult to interpret. It appears to lie on the projected line of the Roman city wall, but is unlikely to represent part of the Roman wall itself as the orientation is incorrect. It is possible that wall [503] may be a remnant structural element of St Kyneburgh's Chapel, based upon the orientation and location (Rhodes 2007). Wall [503] was overlain to the east by deposit (505), a dark black organic rich silt, up to 0.22m in depth. Deposit (505) contained abundant finds including clay tobacco pipe fragments and glazed ceramic sherds dated to the 18th and 19th centuries (Appendix 3). It was unclear if deposit (505) was within a cut feature [504], a possible pit, or simply a dumped deposit. Overlying deposit (505) was deposit (502), a mixed demolition layer composed of brick, stone and mortar fragments and measuring up to 0.13m in depth. Above deposit (502) was deposit (506), a mid greyish black silt, 0.5m in depth. Deposit (506) was interpreted as a possible subsoil within the former Kimbrose Triangle raised flower bed. Above deposit (506) was a layer of light yellow hardcore material, deposit (501). Deposit (501) was sealed by deposit (500), a dark greyish black topsoil, up to 0.5m in depth.

6.4.4 A double inhumation was uncovered within a grave in the location of pile 7 of the Art Wall (Figures 4, 6 and 7). The grave was oriented east-west and located at a height of 17.08m aOD. The grave [601] was cut into deposit (600), a mid bluish grey clay that contained Roman and medieval pottery fragments dated to the 13th to 14th century (Appendix 3). The two skeletons were in an extended supine position with the heads to the west facing east and the arms crossed over the torso. The burial position, along with coffin nails and fragmentary pieces of wood from the grave fill (607) indicate a formal burial in the Christian tradition. The grave fill, deposit (607), was composed of a mid bluish green clay, similar to deposit (600), and contained pottery sherds and animal bone. The four sherds of pottery recovered, include a single piece of Roman Severn Valley ware and three fragments of medieval oolitic ware dated from the 12th to 14th century (Appendix 3). Overlying deposit (600) was a mixed layer of demolition material composed of brick and limestone pieces, deposit (609), with a maximum depth of 0.6m.

6.4.4.1 The two skeletons were interred one on top of the other. SK1 was the uppermost skeleton, and hence the second interment into the grave (Figure 6, Plates 8, 9 and 10). Osteological analysis of the remains indicate that SK1 was a mature adult female, with evidence for mild degenerative joint disease along with inflammatory lesions on the ankles and inner table of the skull (Appendix 1).

6.4.4.2 SK2, the primary interment, was a mature adult male. The skull of SK2 had been severely truncated by a BT service trench [605] across the western end of the grave (Figure 7, Plate 11). Osteological analysis of the skeleton of this individual indicates that he also suffered from mild degenerative joint disease and had suffered from mild trauma including a fractured rib and collar bone, (Appendix 1). SK2 was radiocarbon dated to 920 ± 30 BP, giving a calibrated date of death of between 1020 to 1190 AD at 95.4% probability (Appendix 4). Based on the dating evidence, it is plausible that SK2 and SK1 may have been buried within the grounds of St Kyneburgh's Chapel itself, recorded as existing from the time of the Norman Conquest (Herbert 1988, 5-12).

6.4.5 A section of the Roman city wall was uncovered during works associated with the Art Wall in the location of piles 11 and 12 (Figures 8 and 9, Plates 12, 13 and 14). The wall [802] was exposed in the southwest section of a large hole dug around the piles to enable the construction of the pile cap. Wall [802] was composed of large faced rectangular oolitic limestone blocks, measuring up to 1m x 0.5m x 0.5m. Two complete courses were exposed, both two blocks wide. A third upper course was composed of fragmentary limestone blocks, the smallest of which were loose and surrounded by a dark greyish black silt, (801). Deposit (801) was 0.4m in depth and contained pottery and modern glazed china fragments dating from the 19th century. The top of the solid wall was located at a height of 16.95m aOD. One of the large limestone blocks displayed anathyrosis, where a panel had been chiselled from the centre of the block to facilitate the creation of a close joint when faced with other similar blocks (Plate 15). As this face of the block was facing outwards, it would indicate the block had been reused from an earlier phase of the city wall. A similar example was recorded during excavation works at the East Gate (Heighway 1983, 43 and Plate XIII).

It is probable that the wall [802] represents the foundation of the third phase of the city defences, which would have been constructed from concrete with small facing stones, internal offsets and putlog holes (Hurst 1986, 122). This would have rested on a foundation of large oolite blocks without any mortar bonding and originating from the first phase of the city defences (Hurst 1986, 111) as observed within the excavation.

6.4.5.1 Wall [802] was the earliest feature exposed within the intervention. To the northeast, and abutting [802], was a mortared deposit (803) containing fragments of limestone. Deposit (803) appeared to have been cut by [804] a linear cut with a 90° return which was filled with a mid yellowish orange mortar (805). Deposit (805) was interpreted as the foundation for a brick wall that was removed during the piling and excavation works but was visible in section. Also cutting (803) was [806], a discrete feature containing a dark greenish grey clay (807). No finds were recovered from deposit (807) and interpretation was thus difficult. To the northeast of deposit (805) was a deposit of demolition material (808), composed of loose brick, slate, glass and mortar. A 19th century bottle was recovered from this deposit and would indicate a post-medieval date. Wall [802] was overlain by deposit (801), see above. Overlying deposit (801) was deposit (800), a compact layer of building demolition material 0.38m in depth. To the northwest, wall [802], deposit (801) and (800) had been truncated by the cut for the BT chamber and its associated cable trenches [809]. Cut [809] was filled with a compact deposit of light yellow gravel (810).

6.4.5.2 Following the completion of the pile cap, the Roman wall was covered with a double layer of terram membrane and the excavation backfilled with clean hardcore material.

6.4.6 During the piling phase for Kimbrose Tower, a brick built surface [1100] was noted at a depth of 2m BGL within a small trial excavation. It is assumed that this structure represents part of a cellar floor, probably from the 19th century. Overlying this surface was a deposit of rubble and hardcore material (1101).

6.5 Southgate Street, Figure 10

6.5.1 The majority of the work at Southgate Street was limited to the top 0.4m of deposits. These mostly consisted of modern layers of concrete, hardcore and sand. The presence of extensive modern services across the entirety of this part of the scheme also negated the possibility of encountering any *in-situ* undisturbed archaeological deposits.

6.5.2 During the excavation of a ducting trench across the southwest end of Southgate Street a limestone built wall and surface were recorded. The trench spanned the width of the street from Collectors Choice to just south of the Baptist Church on the western side (Figure 10). The trench measured 0.6m – 0.75m in depth, 0.8m in width and approximately 19m in length. The presence of numerous modern utilities necessitated that the majority of the trench be dug by hand following the removal of a layer of concrete forming the former road base. At the eastern end, a limestone block built wall, [403], was revealed. Wall [403] was aligned parallel to the street, northeast-southwest, and measured 0.4m in width. The top of the wall [403] was located 0.6m BGL at 17.7m aOD. Wall [403] was interpreted as a residual structural feature probably dating to the post-medieval period. Abutting [403] to the east, was a dark greenish black silt deposit (402), containing fragments of clay tobacco pipe and post-medieval pottery fragments. At the western end of the trench, a hard standing [404] composed of pebbles, ceramic building material (CBM) and numerous pieces of animal bone within a mortared matrix was revealed. The surface was located at a depth of 0.75m BGL at a height of 17.5m aOD, with 2m in length visible within the trench. No dating evidence was found. Hard standing [404] was interpreted as a remnant street surface of post-medieval date. Overlying [403], [404] and deposit (402) was a mid grey clay with areas of iron discolouration, (401). Deposit (401) was up to 0.4m in depth. Sealing all these deposits was a modern layer of hardcore, deposit (400), of varying depth.

6.5.3 During ground reduction works along the frontage of St Mary de Crypt Church a possible opening was noted (Plates 16 and 17). This consisted of a sub-street level opening that had been filled up with limestone blocks, up to 0.9m in length and 0.25m in depth. Above this was a curbing of limestone. The opening appeared keyed in to the foundations of the church and is hence contemporary with the original construction, as shown in historic paintings of the church.

7 Conclusion

7.1 In general, the scope of the works had a limited impact on the archaeological resource present due to the shallow nature of the excavations. However, a number of significant archaeological finds and features were recorded during the more intrusive works for the Art Wall feature on Kimbrose Triangle. This included a previously unrecorded section of the Roman city wall and a medieval double inhumation. The remains of the Roman wall were represented by large limestone blocks. These were interpreted as the foundation of the third phase of the Roman city defences, the blocks having been reused from earlier phases of the wall. The primary interment (SK2) of the double medieval inhumation has been radiocarbon dated to 920 ± 30 BP, giving a calibrated date of between 1020 to 1190 AD at 95.4% probability. The date indicates that the burial probably took place within the burial ground of St Kyneburgh's Chapel, recorded as existing from the time of the Norman Conquest (Herbert 1988, 5-12). A wall recorded during foundation piling for the Art Wall, may be a remnant structural element of the chapel.

7.2 Evidence from the post-medieval period comprised a 19th century gravestone, disarticulated human remains, coffin furniture and a number of structural features. The 19th century gravestone fragment was found dumped in a disused well adjacent to the Dental Practice on Southgate Street and originated from the Independent Chapel. The historical background associated with the gravestone provides interesting insights into the personal history of a 19th century Gloucester couple. The disarticulated human remains and coffin furniture may also have come from the Independent Chapel. The structural features recorded comprised two wells, four walls and two surfaces and in most cases these were features which appeared on the historic mapping.

8 References

Arcus	Forthcoming	*Report on archaeological monitoring of utility pipes.* Unpublished typescript
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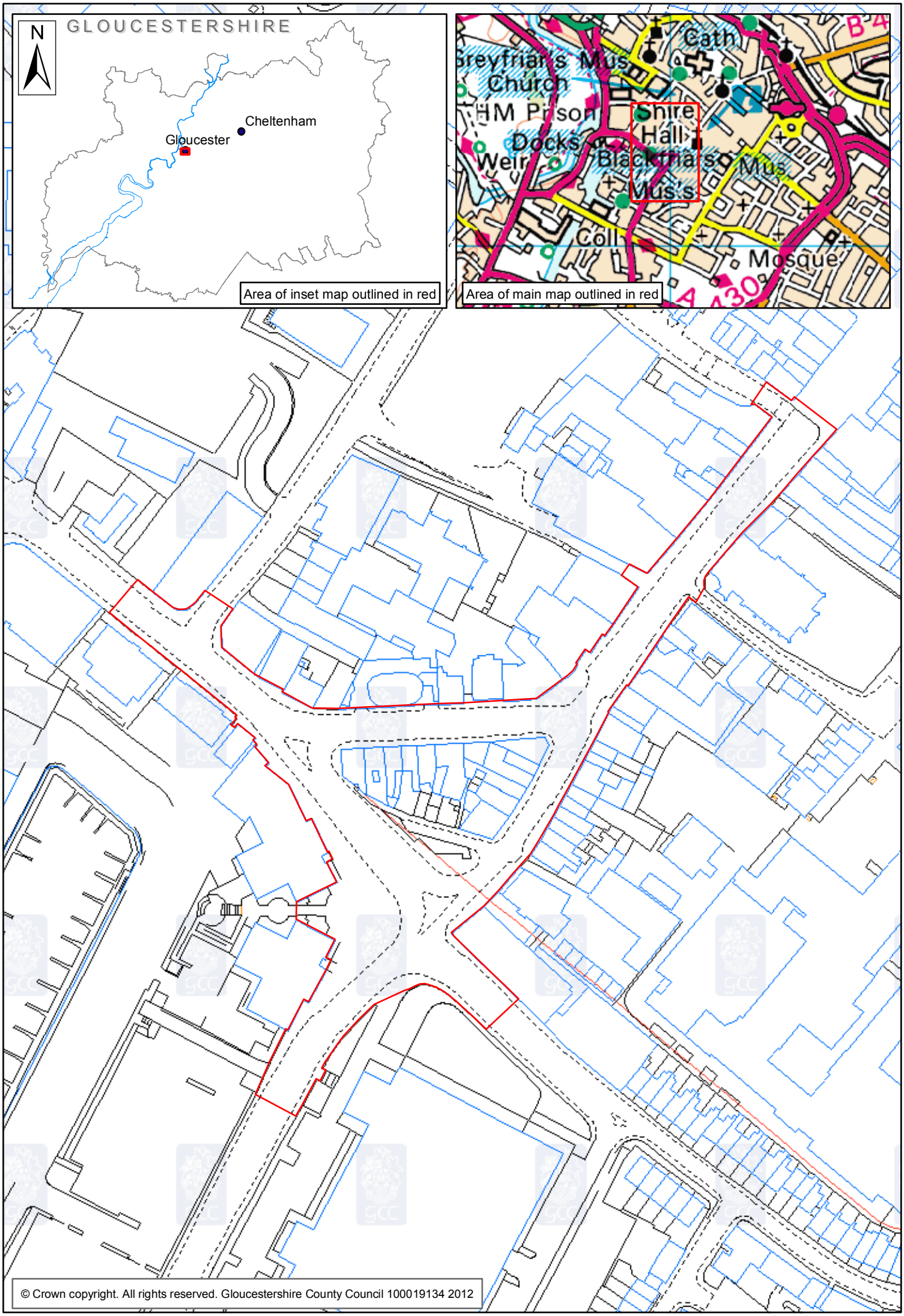


Figure 1: Area of Gloucester Quays City Centre Linkage Scheme outlined in red (Scale 1:1500 @ A4)

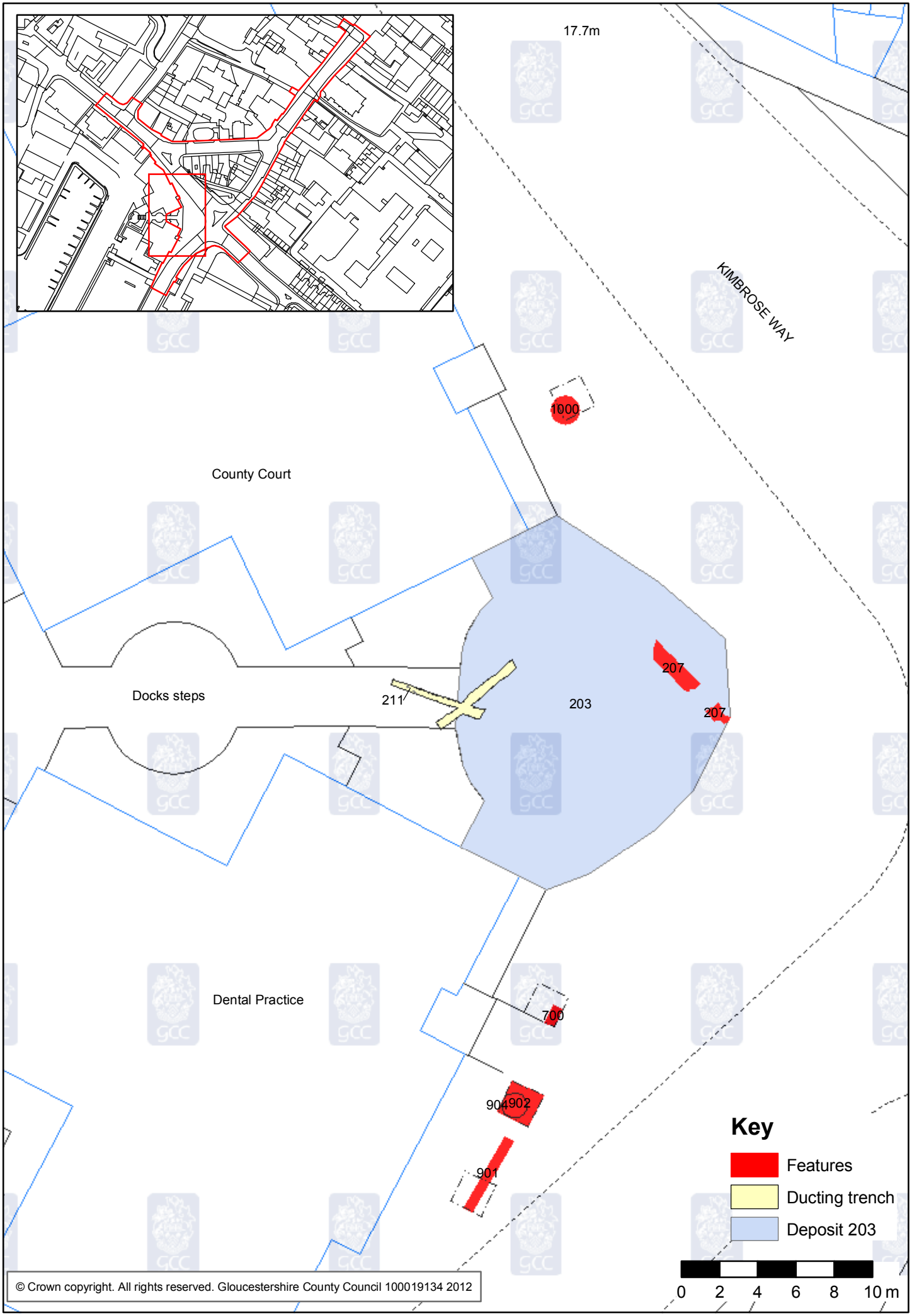
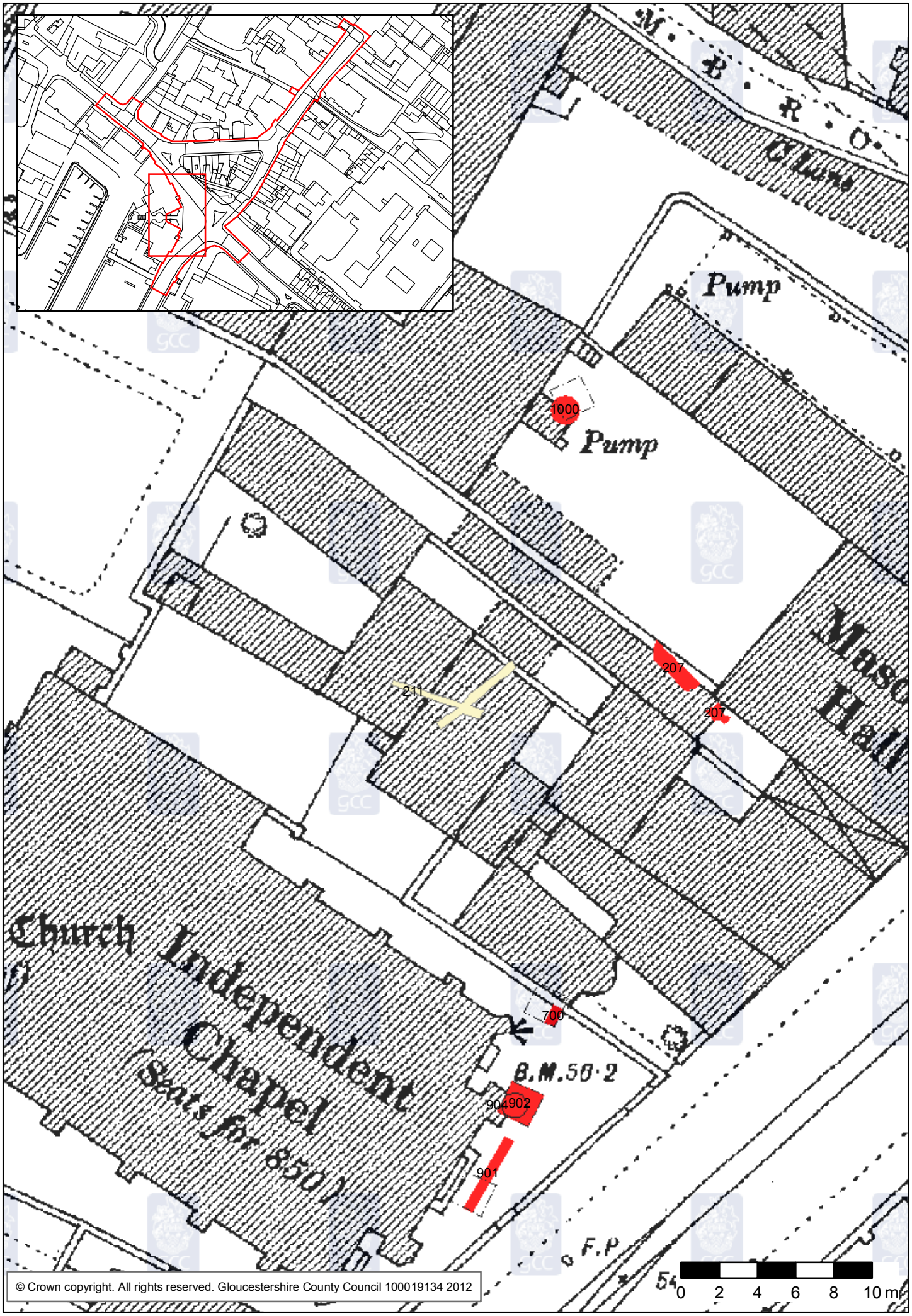


Figure 2 : Court area archaeological deposits and features (Scale 1:250 @ A4)



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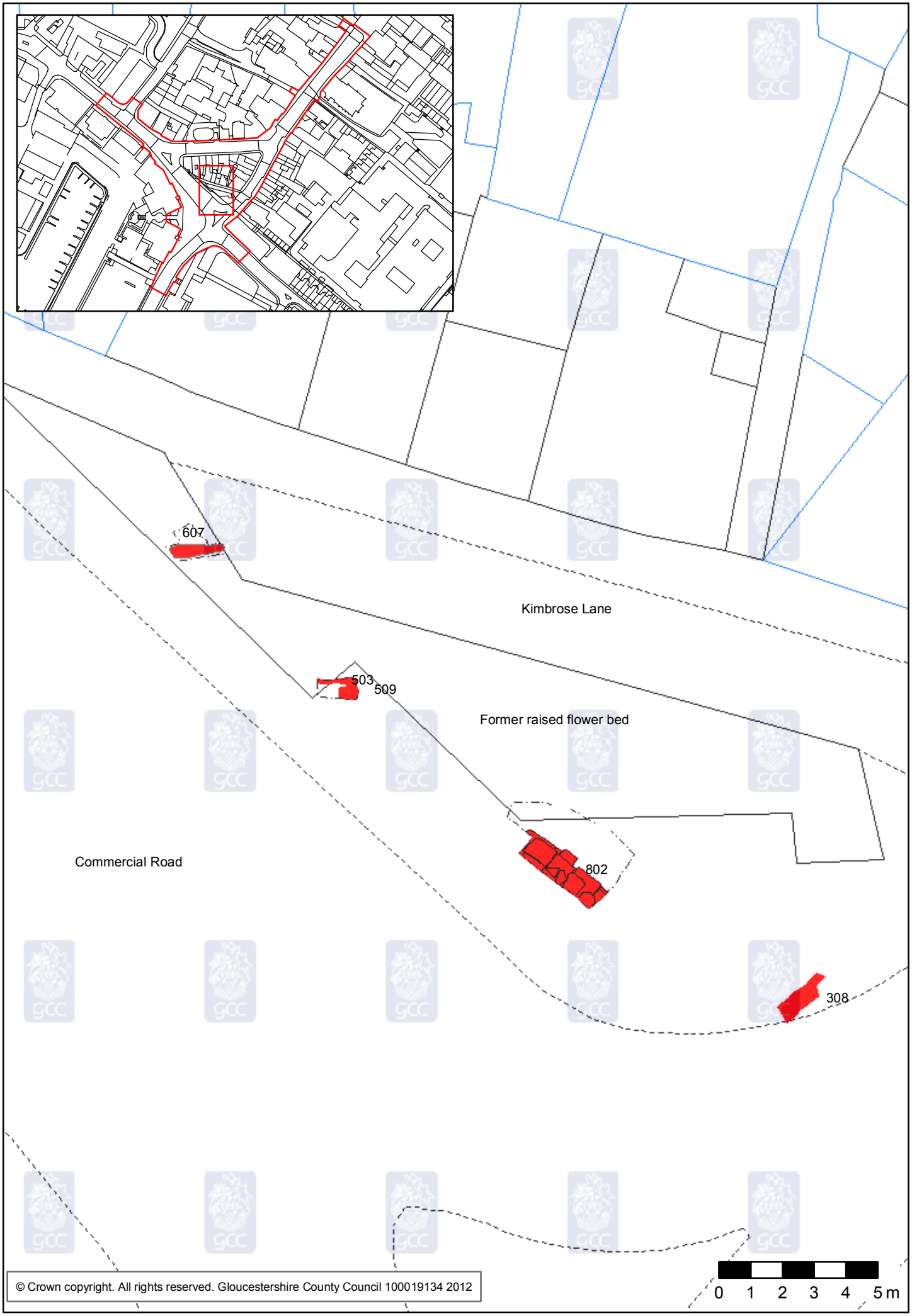

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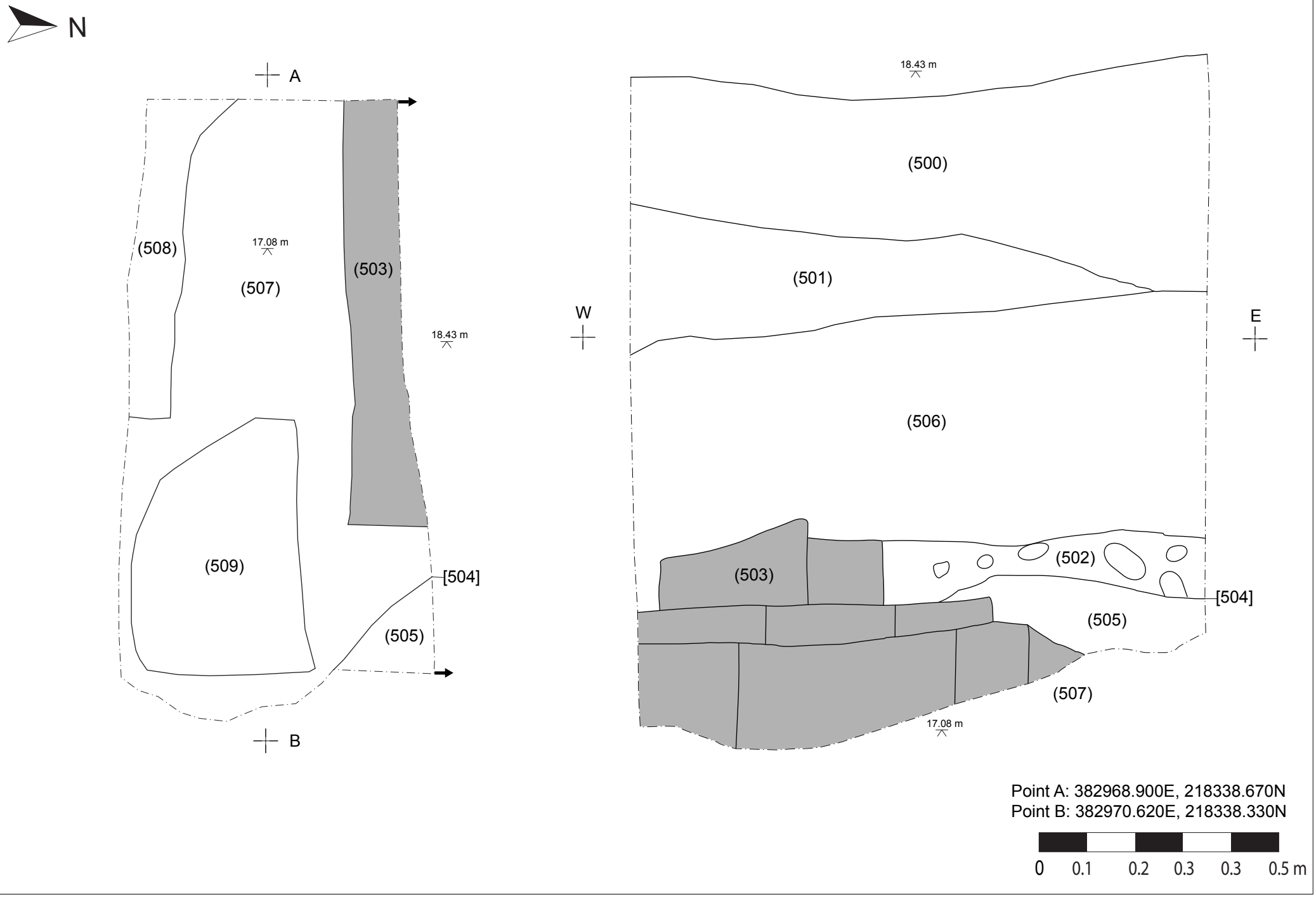

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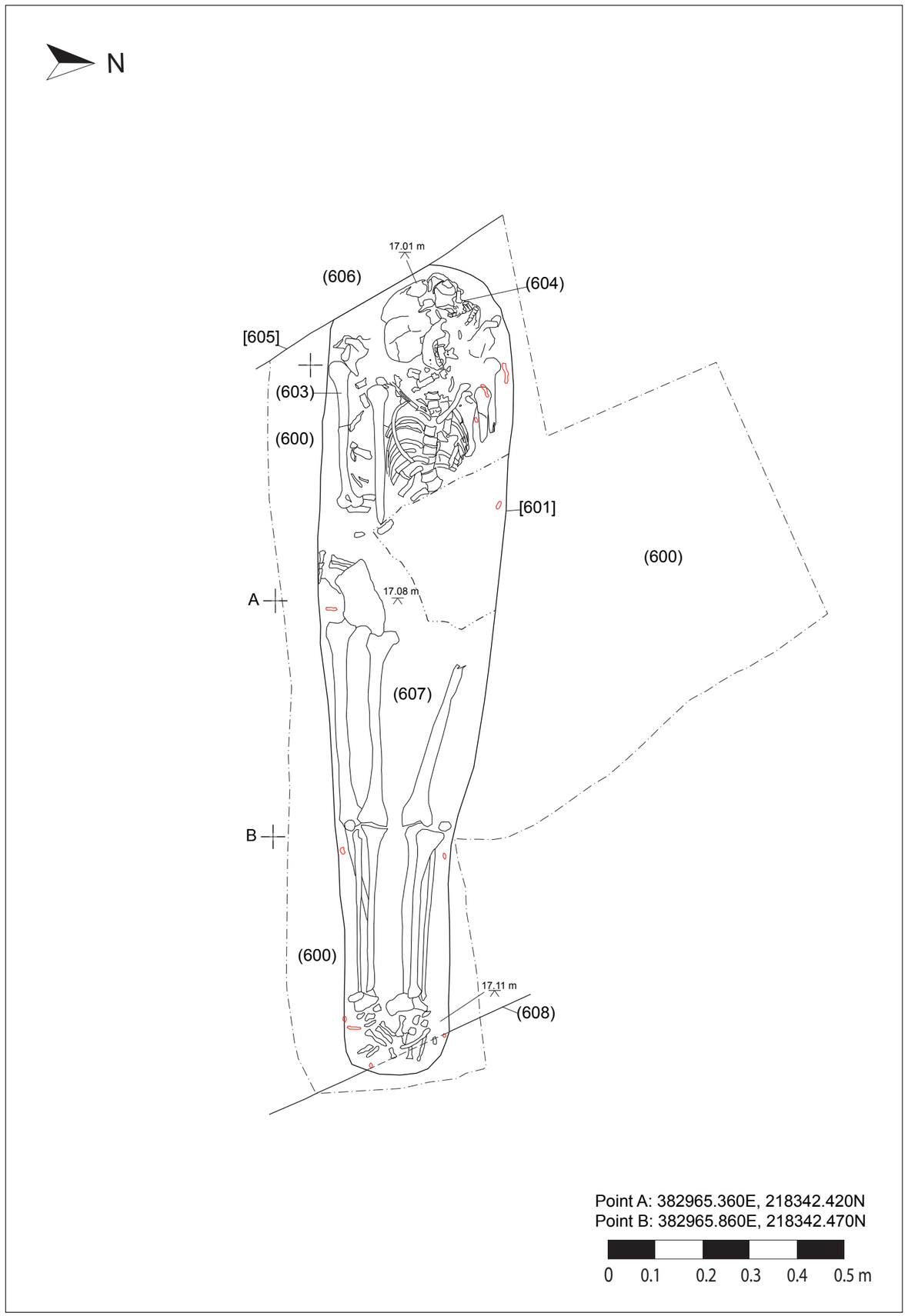

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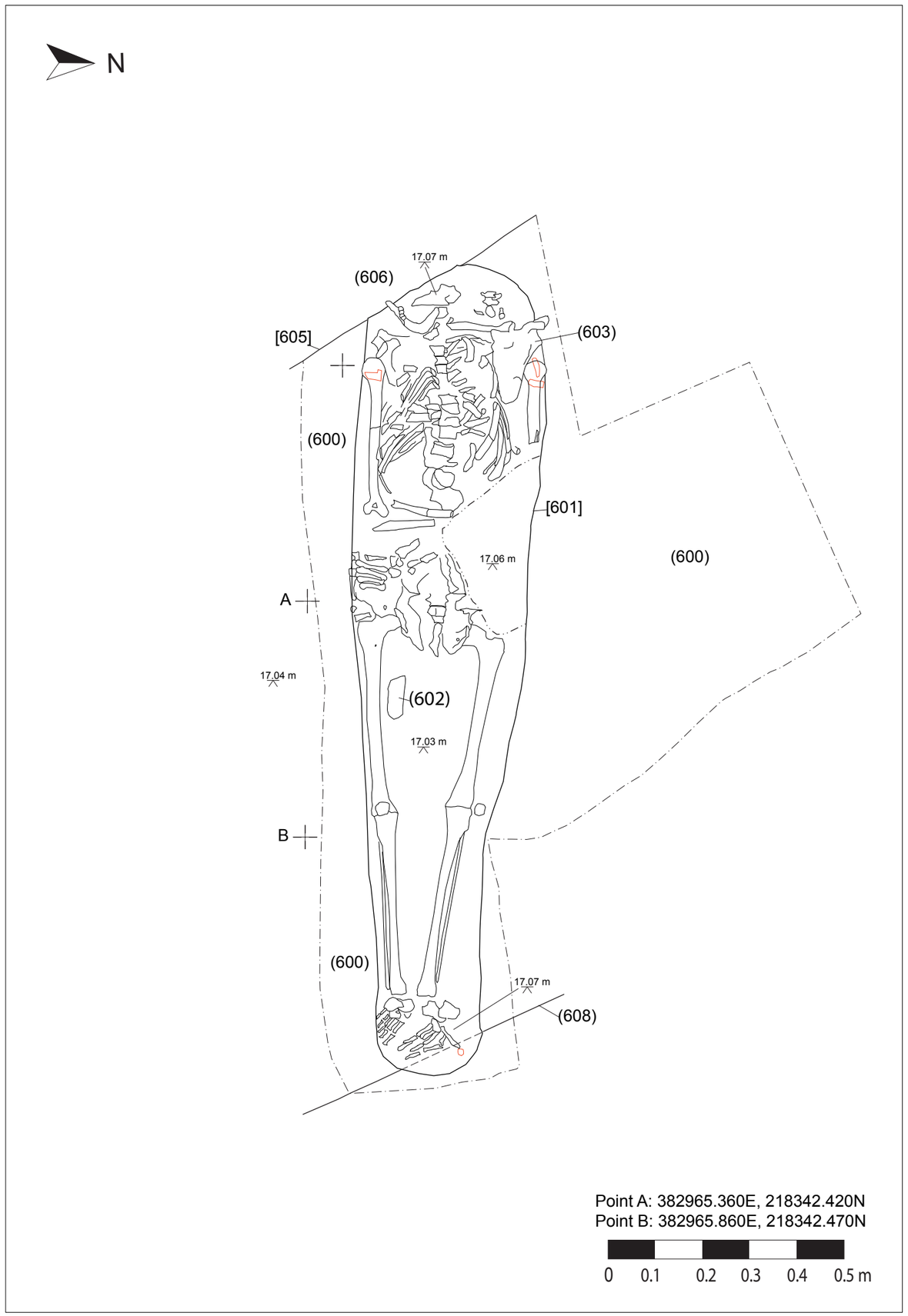

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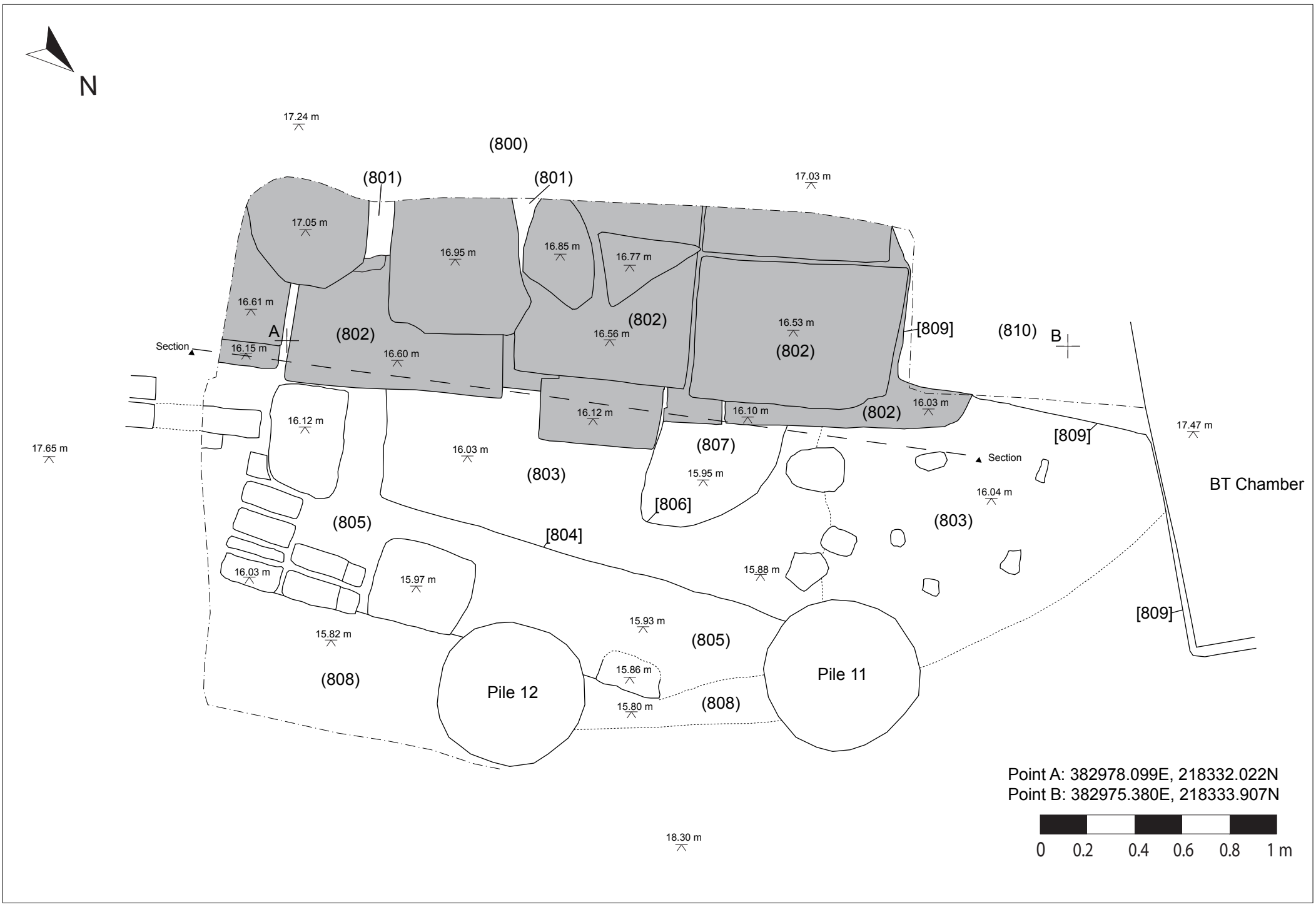

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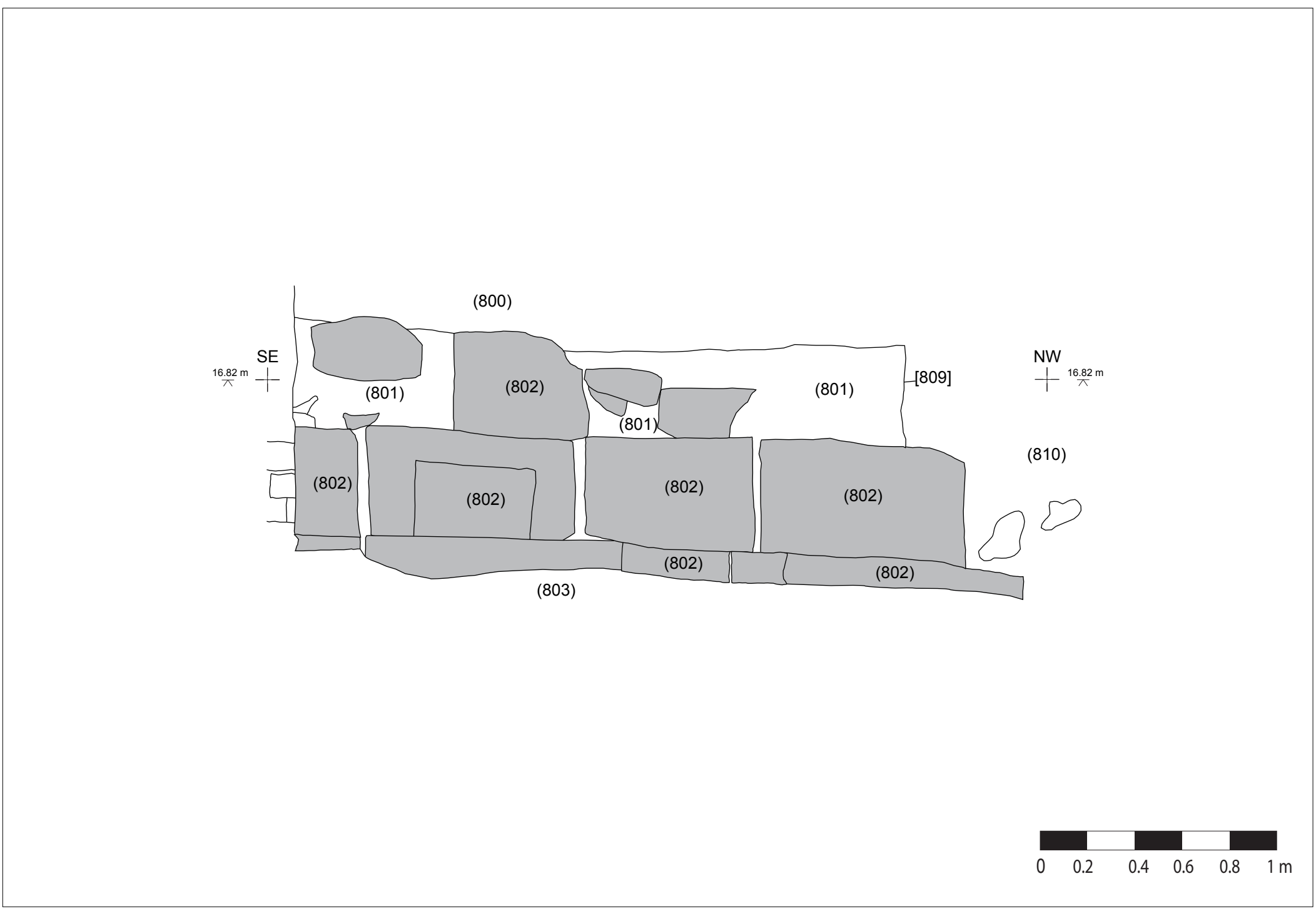

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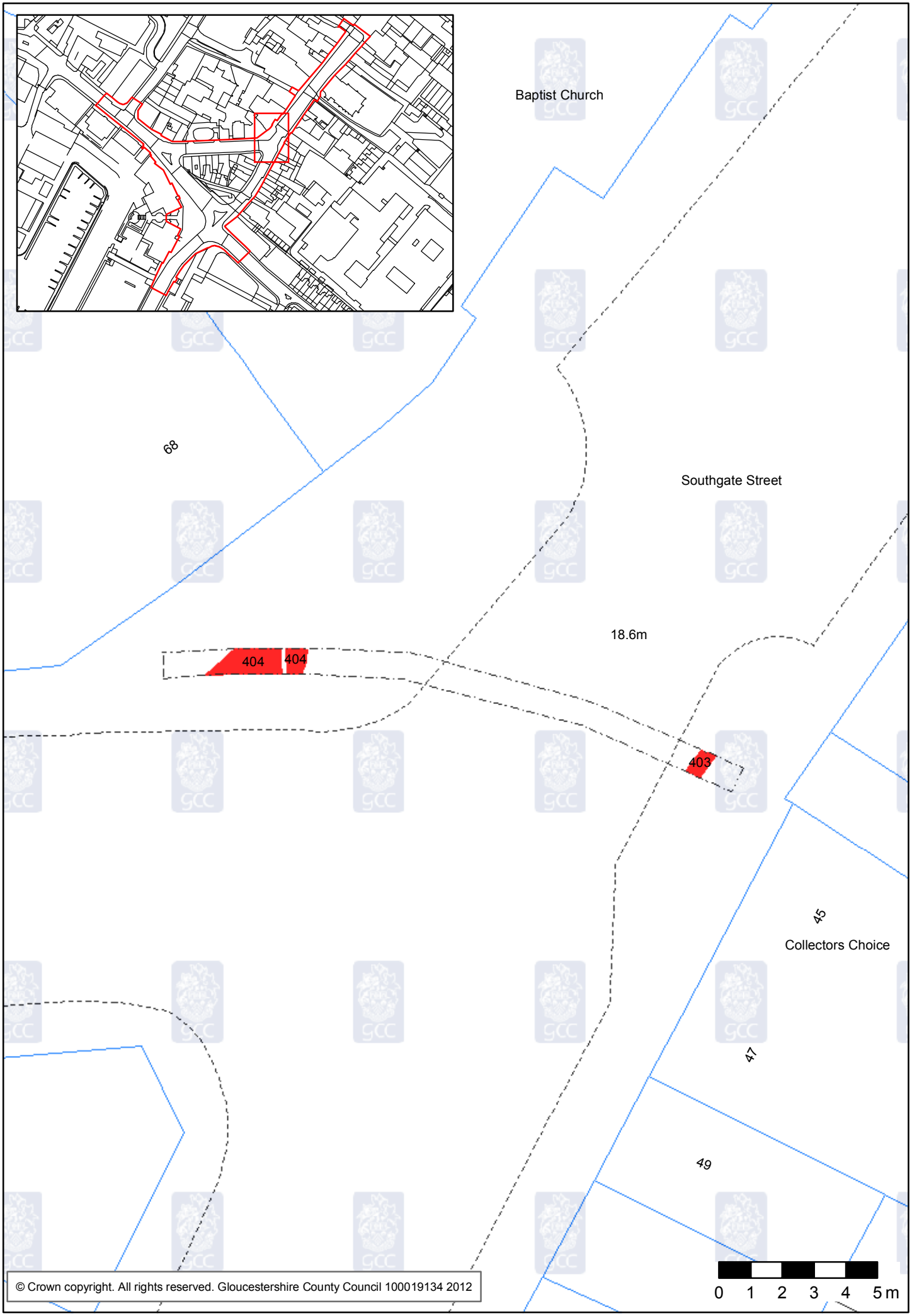

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Summary

In 2011 York Osteoarchaeology Ltd was commissioned by Gloucestershire County Council Archaeology Service to carry out the osteological analysis of two articulated skeletons and a small assemblage of disarticulated human bone. The remains were recovered during archaeological excavations around Kimbrose Triangle, Gloucester, Gloucestershire (OS NGR 382978 218358).

Two articulated skeletons had been interred within a single grave; the individuals were in an extended supine position and were buried in the typical Christian manner. The remains date to the 11th to 12th century based on AMS dating. They are thought to have been located within the limits of the grounds of St Kyneburgh's chapel which dates to the 11th century and were found associated with coffin furniture. Osteological analysis revealed that the articulated skeletons were that of a male and female, both mature adults. A further three adults and two non-adults were identified in disarticulated human remains recovered, of which two appeared to be female and a further individual could be identified as male.

Both articulated adults suffered from mild degenerative joint disease. The male also had inflammation of the legs that had healed at the time of his death. The female individual exhibited inflammatory lesions on her ankles and the inner table of her skull, both of which were active at the time of her death. Trauma was noted in the mature adult male, who had fractured a rib and his collar bone. Localised bone death caused by an interrupted blood supply was also evident in both adults. Further evidence of trauma was also recorded amongst the disarticulated remains; a skull revealed signs of repeated sharp force trauma, as did a distal femoral shaft fragment.

Childhood stress was experienced by the articulated male and female, as well as individuals in the disarticulated assemblage, in the form of growth cessation and dietary deficiencies.

Acknowledgements

York Osteoarchaeology Ltd would like to thank Nathan Thomas and Paul Nichols of Gloucestershire County Council Archaeology Service for their help and support.

1.0 INTRODUCTION

In January 2011 York Osteoarchaeology Ltd was commissioned by Gloucestershire County Council Archaeology Service to carry out the osteological analysis of the remains of two articulated skeletons and a small disarticulated assemblage of human bone. Excavations around Kimbrose Triangle, Gloucester, Gloucestershire (OS NGR 382978 218358) were carried out in advance of the city centre linkages scheme.

The skeletal remains were recovered from a single grave cut [601] (Table 1), in which SK2 was placed first and SK1 lay on top. Finds recovered from the backfill provide a *terminus post quem* of the 12th century and SK2 has been AMS dated to the 11th to 12th centuries. Coffin furniture, recovered from the backfill of the grave, would suggest that at least one of the individuals was coffined. Wooden coffins were occasionally used in the Anglo-Saxon period, but became more common in the tenth and eleventh centuries, especially in northern England (Hadley 2001).

Table 1 Summary of archaeological information of articulated skeletons

Skeleton No	Cut No	Position	Orientation (head first)	Burial Type	Date
1	601	Supine extended	West to east	Simple, possibly coffined	Post-medieval
2	601	Supine extended	West to east	Simple, possibly coffined	Post-medieval

The graves were located on the southern edge of Kimbrose Lane, 10m northwest of the probable site of St Kyneburgh's Chapel, dating to the 11th century. The grave is believed to have been situated within the limits of the chapel cemetery.

A further four contexts yielded small assemblages of disarticulated human remains, the greatest quantity of which was recovered from Context (211) and, according to Ordnance Survey maps provided by Gloucestershire County Council Archaeological Service, may relate to a post-medieval infirmary burial ground located nearby. Context (203), recovered from a similar location, produced only a very small quantity of bone. Contexts (700) and (902) combined yielded a similar quantity of bone as that from Context (211) and were recovered from an area that falls within the area of the grounds of St Owen's church and those of the Southgate Street Independent Chapel.

1.1 AIMS AND OBJECTIVES

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

1.2 METHODOLOGY

The remains were analysed in detail, assessing the preservation and completeness, calculating the minimum number of individuals present as well as determining the age, sex and stature of the individuals. All pathological lesions were recorded and described. The osteological and palaeopathological catalogue forms part of the site archive, but is not reprinted here.

2.0 OSTEOLOGICAL ANALYSIS

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

2.1 PRESERVATION

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

mortem breaks, but disregarding completeness.

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

SK1 was in very good condition (Table 2), with little surface erosion or abrasion evident. The collapse of the overlying coffin may have been responsible for the survival of SK2 in only moderate condition.

The preservation of the disarticulated material varied within each context, unsurprising considering the heavily disturbed nature of the deposits from which they were recovered. Some skeletal elements, most notably those of the skull, suffered from heavy erosion of the outer table; however, other more delicate elements such as the vertebrae were in excellent condition, surviving without any surface erosion or abrasion. Much of the assemblage was only moderately fragmented.

Table 2 Summary of osteological and palaeopathological results

Skeleton No	Preservation	Completeness	Age	Sex	Stature	Pathology
1	Very good	80%	46+ Mature adult	Female	161cm	Cribra orbitalia, osteochondritis dissecans on the proximal joint of the proximal foot phalanx for MT1, bilateral woven bone on fibulae, endocranial new bone formation on occipital and temporal, mild sinusitis, Schmorl's nodes, mild degenerative joint disease in the spine, both shoulders, left wrist and right hip
2	Moderate	85%	46+, mature adult	Male	177.6cm	Osteochondritis dissecans on right glenoid, possible healed fracture of left medial clavicle, bilateral periostitis of femora, tibiae and fibulae, fractured of right eleventh/twelfth rib, Schmorl's nodes, mild degenerative joint disease in the spine and right intermediate and distal foot phalanges

Both skeletons were almost complete; the missing elements derived largely from the upper limbs. The skull of SK2 was partly truncated and therefore largely absent.

2.2 MINIMUM NUMBER OF INDIVIDUALS

A count of the 'minimum number of individuals' (MNI) recovered from a cemetery is carried out as standard procedure in osteological reports on inhumations in order to establish how many individuals are represented by the articulated and disarticulated human bones (without taking the archaeologically defined graves into account).

The MNI is calculated by counting all long bone ends, as well as other larger skeletal elements recovered. The largest number of these is then taken as the MNI. The MNI is likely to be lower than the actual number of skeletons which would have been interred on the site, but represents the minimum number of individuals which can be scientifically proven to be present.

A minimum of two individuals were identified within grave cut [601] based on the presence of numerous duplicated elements, including two right and left tibiae, two right femora, the distal ends of two left femora

and the proximal ends of both left and right humeri.

Assessment of the disarticulated material revealed that Context (211) contained a minimum of three individuals; this was based on the presence of three left temporal bones. Two right adult orbits and a child's radius were recovered from Context (902), suggesting a minimum number of three individuals. Context (700) contained two left adult iliae and a juvenile's left femur, suggesting that at least three individuals were present amongst the comingled remains from the deposit. Context (203) yielded two fragments of human bone suggesting a minimum number of one individual (Appendix A). In total, ten individuals were identified from four distinct contexts. However when all of the bone from the disarticulated assemblages was combined only three distinct adults could be identified (based upon the presence of three left temporals and three proximal right humeri) a further child and juvenile were also identified, based on the presence of a distal unfused radius and an unfused proximal femur respectively. This, combined with the two articulated individuals produced a minimum of seven individuals recovered from the Kimbrose Triangle excavations.

2.3 ASSESSMENT OF AGE

Age was determined using standard ageing techniques, as specified in Schaefer *et al* (2009), Scheuer and Black (2000a; 2000b) and Cox (2000). Age estimation relies on the presence of the pelvis and uses different stages of bone development and degeneration in order to calculate the age of an individual. Age is split into a number of categories, from foetus (up to 40 weeks in *utero*), neonate (around the time of birth), infant (newborn to one year), juvenile (1-12 years), adolescent (13-17 years), young adult (ya; 18-25 years), young middle adult (yma; 26-35 years), old middle adult (oma; 36-45 years, mature adult (ma; 46+) to adult (an individual whose age could not be determined more accurately as over the age of seventeen). The categories defined here should perhaps be taken as a general guide to the relative physiological age of the adult, rather than being an accurate portrayal of the real chronological age; no doubt many of those aged '46+' would in actuality have been in their sixties, seventies or eighties when they died.

The ageing of both skeletons relied upon analysis of the degenerative changes to the hips. The hips of SK2 suggested that this was a mature adult, aged 46 years or older. The pelvis of SK1 suggested that this was also a mature adult (see Table 1).

Within the disarticulated material, Context (211) contained the remains of at least two adults (the lack of the necessary skeletal elements meant that the age of the individuals could not be more accurately estimated) and a child (based on the presence of an un-fused distal radius).

In Context (700), the remains of a juvenile (identified by the presence of an un-fused proximal femur and an un-fused iliac spine) were present.

2.4 SEX DETERMINATION

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

It was possible to determine sex of Skeletons 1 and 2. The skull and hips were clearly female in SK1 and metrical analysis of the long bones revealed that the measurements fell within the female range. SK2 had a male skull and pelvis, and metrical analysis further confirmed this.

Within the disarticulated material, were the remains of at least two females; two mandibles and two left frontal bones exhibited female morphological characteristics and further cranial fragments displayed ostensibly male characteristics, suggesting at least one male was also present.

2.5 METRIC ANALYSIS

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

SK1 (female) was 161cm tall, which corresponded with the mean stature (161cm) for the early medieval period (410-1050AD), but was slightly taller than the late medieval mean (159cm) given by Roberts and Cox (2003). The stature of SK2 (male), being 177cm, was taller than the mean (172cm) given for early medieval and late medieval (171cm) sites by Roberts and Cox (2003).

The *meric* index is a method of calculating the shape and robusticity of the femoral shaft. Calculations revealed that both individuals fell into the *platymeric* (broad or flat) range. The *cnemic* index of the tibiae was calculated in order to establish the degree of tibial shaft flatness. The tibiae of SK2 were both *mesonemic* (flattened), while the tibiae of SK1 were *ecneurycnemic* (not flattened).

The cranium of SK 1 was so fragmented that it was not possible to carry out any metric analysis on it, while the skull of SK2 had been truncated preventing any cranial measurements from being taken.

None of the disarticulated bones were complete enough to measure.

2.6 NON-METRIC TRAITS

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

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

Cranial non-metric traits were only observable in SK1, these included an ossicle at the *parietal notch* (extra bone behind the ear), *mastoid foramen extrasutural* (a hole behind the ear), *precondylar tubercle* (small lump of bone in front of the foramen magnum), *bridging of the supraorbital notch* (bony bridge on the orbital margin) and an *accessory supraorbital foramen* (extra hole on the skull above the eye).

In the post-cranial skeleton *transverse foramen* (extra holes in the side of the vertebrae for blood vessels), *hypotrochanteric fossae* (grooves on the back of the femoral shaft) and *third trochanters* (nodules of bone on the posterior surface of the proximal femur) were seen in both individuals. SK1 also exhibited a *septal aperture* (small hole above the distal humeral articulation), *exostosis in trochanteric fossa* (spicules of bone), *double anterior calcaneal facets* and *double inferior talar facets* (small variations in the shape of the bones of the ankle). SK2 had *circumflex sulci* (grooves on the back of the scapula caused by the impression of blood vessels).

In the disarticulated assemblage was a cervical vertebra with a *bipartite transverse foramen* (extra small hole on the side of the vertebra), *mastoid foramen extrasutural, mastoid foramen sutural* (small holes behind the ear), *bridging of the supraorbital notch* (small hole above the eye orbit), *parietal foramen* (small hole at the top of the skull) and *incomplete foramen ovale* (small hole at the base of the skull) from Context (211). In Context (203), a femoral shaft had a *third trochanter* (tubercle of bone on the back of the femur), while in Context (700) a trochanteric fossa (groove at the back of the femur), a *parietal notch bone* (extra bone in the suture behind the ear) and *mastoid foramen extrasutural* (small hole behind the ear) were recorded. The bones recovered from Context (902) did not exhibit any non-metric traits.

2.7 CONCLUSION

The skeletal remains were moderately to very well preserved, though fragmented. One individual (SK1) was a female mature adult who was of average height for the medieval period, while SK2 was an adult male of above average height for the period. In the disarticulated assemblages were a minimum of five individuals, of which three were adults and two were juveniles. Two females and one male were identified in the disarticulated remains. The individuals from the Kimbrose Triangle works exhibited a variety of non-metric traits, none of which would have had any effect on them during their lives.

3.0 PATHOLOGICAL ANALYSIS

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

3.1 INFECTIOUS DISEASE

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

3.1.1 Periosteal Inflammatory Lesions

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

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

Periostitis was evident on the legs (medial and posterior surface of the distal left fibula and the posterior surface of the distal right fibula) of SK1 (mature adult female); the bone was woven in appearance, suggesting it was active at the time of death.

Periosteal reaction was also present on the medial shaft of the femora of SK2; however, the bone appeared to be remodelled and incorporated into the cortical bone surface. The tibiae and fibulae of the same individual also exhibited well remodelled lamellar bone along the shafts that appeared to be most florid on the medial and lateral surfaces of the tibiae.

A femoral shaft fragment recovered from Context (211) also exhibited well remodelled lamellar bone on the anterior surface of the distal end, suggesting the inflammation had receded at the time of death. Further new bone formation was evident on the posterior surface of a distal femur fragment from Context (902) and appeared to be active at the time of death. A left tibial mid-shaft fragment was also recovered from the same context, which had thick lamellar new bone on the medial and posterior shaft of the bone, suggesting that the inflammation was not active when the individual died. Finally, new bone was also recorded on a mandible fragment recovered from Context (902). The new bone was located on the lateral surface of the right mandibular ramus and was woven in appearance, indicating that the inflammation was still active.

Inflammatory lesions on human bones can be indicative of infectious diseases, such as leprosy and syphilis, and of non-specific localised infection, such as varicose veins, leg ulcers or trauma to the shins. However, the lesions only form on the bone if the inflammation is chronic and long-standing (Roberts and Manchester 1995, 125). Evidence for infection was common before the introduction of antibiotics and is therefore frequently observed in populations derived from archaeological contexts. Periosteal inflammatory lesions affected 14.08% of the populations during the medieval period and 26.26% of the population during the post-medieval period, according to Roberts and Cox (2003).

3.1.2 Endocranial Bone Formation

New bone formation on the endocranial (internal) surface of the cranium is more commonly seen in infants and young children, and is believed to result following inflammation or haemorrhage of the meningeal blood vessels. The possible causes identified include chronic meningitis, trauma, anaemia, neoplastic disease (cancer), metabolic diseases (scurvy and rickets), venous drainage disorders and tuberculosis (Lewis 2004 & 2007).

Plate 1 SK 1, endocranial lesions

Endocranial bone formation was observed on the occipital and right transverse sulci and the right cerebella fossa of the occipital bone (back of the skull) (Plate 1). Woven bone was also evident on the internal surface of the temporals; on the left temporal the new bone was limited to the sigmoid sulcus, while on the right side the new bone concentrated around the squamous part of SK1 (mature adult female). Vascular impressions were noted within the new bone. These sinuses are associated with venous drainage from the skull. The exact cause of skeleton lesions was not certain.

3.1.3 Maxillary Sinusitis

Sinusitis is characterised by the inflammation of the mucous membrane of the sinuses (cavities in the cheek bones). Acute sinusitis lasts between seven days and one month, but the condition is classed as chronic if it persists for more than three months (Merrett and Pfeiffer 2000, 304). If untreated, chronic sinusitis can persist for years, and skeletal changes occur after a number of weeks (Lewis *et al* 1995, 498). In modern groups, around 60% of patients with chronic sinusitis develop bone changes that are radiographically visible (Boocock *et al* 1995:484). Most commonly, the skeletal manifestations take the form of pitting or spicular bone formation on the floors of the sinuses. Symptoms include pain in the forehead, cheeks and eyes, together with fever and a general unwell feeling (Youngson 1992, 551). The quality of life and productivity can be greatly reduced for those suffering from sinusitis.

Maxillary sinusitis commonly occurs as a result of upper respiratory tract infections, pollution, smoke, dust, allergies, or a dental abscess that has penetrated the sinus cavity (Roberts and Manchester 2005). SK1 (mature adult female) had mild new bone formation in the right maxillary antrum. A crude prevalence rate for the occurrence of sinusitis reveals that 13.3% of the medieval and 6.88% of the post-medieval population was affected (Roberts and Cox 2003).

3.1.4 Respiratory Infections

Lung infections can lead to deposits of new bone on the visceral surfaces of the ribs (Roberts and Manchester 2005) and in a high percentage of individuals these lesions have been associated with tuberculosis (Santos and Roberts 2006, Matos and Santos 2006, Mays *et al* 2002, Santos and Roberts 2001). Recent research on three skeletal collections from the late nineteenth and early twentieth centuries, containing individuals who died of known causes, has demonstrated that new bone formation can be related to tuberculosis, particularly rib lesions.

Kelley and Micozzi (1984) found that 8.8% of those with pulmonary tuberculosis suffered from rib manifestations in the form of periosteal inflammatory lesions, or to a lesser extent from localised abscesses. Research on living individuals and cadavers from the Terry Collection in the United States (Roberts *et al* 1994) and skeletons from the University of Coimbra, Portugal (Santos and Roberts 2001), has shown a much higher correlation between tuberculosis and new bone formation on the ribs. In the Terry Collection, 61.6% of those who had died of tuberculosis had rib lesions, whereas only 22.2% of those who died of a non-tuberculous cause had such new bone formation (Roberts *et al* 1994). In the Portuguese collection, 90.9% of individuals with pulmonary tuberculosis had rib lesions. Fourteen percent of those with other forms of tuberculosis, and 14.3% of those suffering from other pulmonary conditions, had new bone formation on the ribs (Santos and Roberts 2001, 41). Only one individual had the vertebral lesions, and this was an adolescent with enteric, rather than pulmonary, tuberculosis (*ibid*, 42).

Other diseases known to produce rib lesions, but to a much lesser extent than tuberculosis, are non-tubercular *empyemas* (a collection of pus between the lungs and the chest wall), thoracic surgery, blunt trauma, chronic bronchitis, pneumonia, metastatic tumours, and actinomycosis (bacterial infection) (Santos and Roberts 2001).

Aufderheide and Rodríguez-Martín (1998, 124) also suggest that rib lesions are more likely to be the result of empyema caused by tuberculosis than by acute pneumonia, as individuals would rarely have survived pneumonia for long enough to develop rib manifestations. Clinical diagnoses of tuberculosis do not mention the subtle bone lesions which are expressed as bone formation, rather than destruction. This is probably because they are not visible on x-rays and are, therefore, not used as diagnostic criteria, nor are they examined in modern autopsies (Santos and Roberts 2001, 46).However, diagnosis of tuberculosis cannot be made solely based on the presence of rib lesions, since other respiratory infections (e.g. chronic bronchitis and pneumonia, Roberts and Cox 2003), exposure to smoky or polluted atmospheres, and inhalation of fungal spores (Aufderheide and Rodríguez-Martín 1998) can also cause new bone formation on the ribs. Other parts of the skeleton (e.g. the spine, and major joints) are affected in a relatively small proportion of individuals suffering from tuberculosis (Santos and Roberts cite between 1% and 9%, 2001), meaning that direct archaeological evidence for the disease is uncommon. New bone formation elsewhere in the skeleton combined with rib lesions has been associated with tuberculosis and Santos and Roberts (2001) describe a young woman with pulmonary tuberculosis who showed extensive new bone formation affecting much of her skeleton as well as her ribs. On balance, it is safest to attribute rib lesions without associated changes to an unspecified lung infection, although tuberculosis remains a real possibility.

A rib fragment recovered from a disarticulated assemblage from Context (700) had deposits of plaque like new bone formation along the visceral shaft, suggesting the individual had been suffering from a respiratory infection when they died.

3.2 TRAUMA

The type and distribution of traumatic lesions sustained depends upon the environment that the population existed in and is therefore often population-specific. Factors influencing trauma frequency include rough terrain, hard physical labour or dangerous work and interpersonal violence.

3.2.1 Fractures

SK2 incurred a fracture of the right twelfth rib. The fracture was located on the rib neck and appeared to be a well-healed oblique fracture. The callous surrounding the fracture was well remodelled and no evidence of overlap between the fragments was visible. A spicule of bone projected inferiorly from the inferior border of the fracture and may represent trauma to the surrounding soft tissue (Plate 2).

Plate 2 SK 2, rib fracture and soft tissue trauma

Tomczak and Buikstra (1999, 255) found that an impact from behind tends to fracture ribs near the spine, and force to the side of the chest fractures the ribs either near the spine, or at the front of the chest, near the sternum. Similarly, Dandy and Edwards state that single rib fractures are often caused by a direct blow to the chest, back or side, although in elderly patients ribs can break as a result of severe coughing fits (1998, 159). Alternatively, rib fractures have been observed following falls and compression of the chest. In both cases the ribs were well healed without any visible angulation or overlap; Dandy and Edwards state that isolated cracks can heal quickly and are often treated in the same way as severe bruises (1998, 159). It is possible that the individual suffered a fall onto their back or received a blow from behind, but the fracture would have been unlikely to have prevented them from carrying out their daily tasks. The well remodelled nature of the callous suggested that it occurred sometime before the individual's death.

The same individual also had a healed transverse fracture of the left medial clavicle. The two fragments appeared to be well aligned with no visible overlap and a well remodelled callous. Dandy and Edwards suggest that fractures to the clavicle are among the most commonly seen fractures (1998, 181). Such fractures are caused by a fall onto an outstretched arm and may take up to six weeks to heal (*ibid,* 182), however mal-union commonly occurs due to the weight of the arm forcing the fragments to overlap. SK2 did not exhibit any overlap of the fractured fragments; this may suggest that

Plate 3 SK 2, healed fracture

the fracture was manipulated and the limb immobilised allowing the bone to set properly, however, this is unlikely, as even with modern medical techniques some degree of overlap is unavoidable (*ibid*). Alternatively, the individual may have fractured the bone as a child, resulting in a greenstick fracture, so called because of the similar characteristics that juvenile bone and green sticks share when forces are applied to them. Under such circumstances, usually only one side of the cortex breaks, avoiding overlap and the need for medical intervention.

3.2.2 Osteochondritis Dissecans

Trauma can damage the blood supply to part of a joint surface leading to localised death of the tissue, and this small piece can then become detached from the rest of the joint surface (Roberts and Manchester 2005). In skeletal remains the lesion manifests as a roughly circular, porous hollow in the joint surface.

Both SK1 (mature adult female) and SK2 (mature adult male) exhibited evidence of trauma which resulted in an interrupted blood supply and localised bone death. SK1 had a small circular lesion on the proximal articulation of the first proximal foot phalanx. SK2 had a similar lesion on the right glenoid (shoulder joint).

3.2.3 Sharp Force Trauma

Context (700) yielded a parietal (side of the skull) with two incised marks on the superior-medial ecto-cranial surface. The first lesion was located 15mm from the sagittal suture, measured 11mm in length, while the second lesion was located 8mm anterio-posteriorly of the first and measured 14.5 mm in length. Both lesions were orientated anterio-laterally to posterio-medially, with a smooth posterior-medial edge and a roughened anterio-lateral margin. Both lesions cut through the outer table of the cranial vault, revealing the diploe and appear to have been struck with a degree of force. The appearance of the lesions suggested that the assault had been delivered from the front and above the individual. No evidence of healing was apparent; the margins of the lesion were sharp and well defined, suggesting that the injury was sustained around the time of death. It is unlikely that the sharp force trauma alone was fatal.

Plate 4 Context (700), blade wounds

A femoral fragment recovered from Context (211) exhibited two further incised marks on the mesio-posterior surface of the distal shaft. The lesions were parallel to one another and measured 5mm in length and were located 5mm apart. Both lesions had a smooth inferior edge and a roughened superior margin; neither lesion revealed any signs of healing. Such incisions, if inflicted while the individual was alive, may have damaged the femoral artery, which could have resulted in significant blood loss and the individual's death. Alternatively, the lesions may have been incurred post-mortem during a medical investigation, such as an autopsy or dissection.

3.3 JOINT DISEASE

The term joint disease encompasses a large number of conditions with different causes, which all affect the articular joints of the skeleton. Factors influencing joint disease include physical activity, occupation, workload and advancing age, which manifest as degenerative joint disease and osteoarthritis. Alternatively, joint changes may have inflammatory causes in the *spondyloarthropathies*, such as sceptic or rheumatoid arthritis. Different joint diseases affect the articular joints in a different way, and it is the type of lesion, together with the distribution of skeletal manifestations, which determines the diagnosis (Rogers 2000, Roberts and Manchester 2005).

3.3.1 Degenerative Joint Disease

The most common type of joint disease observed tends to be degenerative joint disease (DJD). DJD is characterised by both bone formation (osteophytes) and bone resorption (porosity) at and around the articular surfaces of the joints, which can cause great discomfort and disability (Rogers 2000). Both adult skeletons revealed evidence of mild DJD (see Table 1). SK1 (mature adult female), exhibited mild osteophytic lipping on the bodies of one cervical and five thoracic vertebral bodies and on two cervical articular facets. SK2 had mild osteophytic lipping on the body of one cervical vertebra and four thoracic vertebral bodies, moderate porosity was also present on two thoracic vertebral bodies and mild osteophytic lipping was also present on four cervical articular facets and four thoracic articular facets.

Degenerative changes were seen in the appendicular skeletons of both individuals; SK1 had mild osteophytic lipping on the articular margins of the proximal humeri (shoulder), the left pisiform (small bone of the wrist) and the right acetabulum (hip). SK2 had similar lesions on the margins of both auricular surfaces (joints of the hips and sacrum), three right distal hand phalanges and the distal articulation of one right intermediate hand phalanx.

In Context (211) of the disarticulated assemblage were a first and second cervical vertebra, both of which exhibited mild osteophytic lipping of the dens and fovea respectively. The glenoid of a right scapula had mild porosity on the inferior surface of the articulation. In Context (902) was a left second metatarsal, which had moderate marginal osteophytic lipping on the proximal articulation. A right fourth and fifth metatarsal had severe osteophytic lipping on the shared articulation between the two bones.

Roberts and Cox (2003) report a crude prevalence rate for extra spinal DJD of 20.90% for the medieval period and 11.02% for the post-medieval period.

3.3.2 Osteoarthritis

Osteoarthritis (OA) is a degenerative joint disease of synovial joints characterised by the deterioration of the joint cartilage, leading to exposure of the underlying bony joint surface. The resulting bone-to-bone contact can produce polishing of the bone termed 'eburnation', which is the most apparent expression of OA. Other features associated with degeneration of the joint include osteophytes (bone formation) on the surface or around the margins, porosity on the surface, and the development of cysts (Rogers 2000; Roberts and Manchester 2005). OA is frequently associated with increasing age, but can be the result of mechanical stress and other factors, including lifestyle, food acquisition and preparation, social status, sex and general health and body weight (Larsen 1997; Roberts and Manchester 2005). OA was recorded as present when at least three of the features associated with OA were present (e.g. osteophytes , porosity, joint contour change); eburnation, even if occurring alone, was always considered to be indicative of OA (Roberts and Manchester 2005).

Osteoarthritis was observed on the right auricular surface of SK1 (mature adult female) with mild eburnation, porosity and marginal osteophytes affecting the joint surface. Roberts and Cox suggest that during the medieval period 16.78% of the population suffered from extra spinal osteoarthritis. For the post-medieval period the figure is estimated at 24.53% (2003, 353).

Within the disarticulated assemblage from Context (211), osteoarthritis was present on the inferior right articulation of a first cervical vertebrae and the superior right articulation of a second cervical vertebrae.

3.3.3 Schmorl's Nodes

Schmorl's nodes are another condition that can affect the spine. They manifest as indentations in the upper and lower surfaces of the vertebral bodies caused by the pressure of herniated vertebral discs (Aufderheide and Rodríguez-Martín 1998). Discs may rupture due to trauma, but vertebrae weakened by infection, osteoporosis or neoplastic disease may be more vulnerable (Roberts and Manchester 2005). Rupture of the discs only occurs if sufficient axial compressive forces are causing pressure on the central part of the discs; frequent lifting or carrying of heavy loads can cause this. Schmorl's nodes are often associated with degenerative changes to the vertebral bodies (Aufderheide and Rodríguez-Martín 1998, Hilton *et al.* 1976), and are most commonly seen in the lower thoracic vertebrae (Hilton *et al.* 1976).

Schmorl's nodes were present on the inferior body of thoracic vertebrae five, six, seven, nine and eleven and on the superior bodies of thoracic vertebrae seven, eleven and twelve of SK2 (mature adult male). Schmorl's nodes were also present on the inferior bodies of thoracic vertebrae nine, ten and twelve and also the superior body of thoracic vertebra twelve of SK1 (mature adult female).

3.4 METABOLIC DISEASE

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

In addition, many of the skeletal changes that develop in a child as a response to nutritional deficiency will be largely remodelled by the time the individual reaches adulthood (Ortner 2003, Lewis 2007).

3.4.1 *Cribra Orbitalia*

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

Both eye orbits of SK1 (mature adult female) exhibited porotic lesions at the anterior portions of the orbital roofs, suggesting that she endured a severe episode of childhood stress. A disarticulated cranial fragment recovered from Context (211) also had porotic lesions in the left orbital roof, the morphology of the bone suggested that this individual may have been female. Crude prevalence rates for *cribra orbitalia* for the medieval period and post-medieval period suggests that 10.82% and 8.95% respectively of the population had the lesions (Roberts and Cox 2003, 307).

3.4.2 Rickets

Rickets is caused by prolonged vitamin D deficiency during childhood, and is characterised by bowing of the weight-bearing bones. The majority of vitamin D is obtained directly from ultraviolet light. Rickets was little known before the demographic shift into cities during the post-medieval period (Aufderheide and Rodríguez-Martín 1998, 305). Industrial pollution, crowded housing, increased population density, dress customs, and children working in factories or mines during daylight hours caused a dramatic rise in rickets in the seventeenth and eighteenth centuries (Roberts and Manchester 1995, 174). Rickets became so common in British industrial centres and mining areas that it was known as the 'English Disease'. While rickets gradually increased in urban areas during the medieval period, it remained almost absent from villages (Stuart-Macadam 1989, 210-212).

Rickets tends to occur most commonly during rapid growth spurts between the ages of six months and four years, as well as in puberty, and is most prevalent in winter, when people spend less time outside (Ortner and Putschar 1985, 274; Stuart-Macadam 1989, 202). Rickets may also be seen in sick children who are kept indoors to recover from another disease.

The lack of vitamin D causes softening of the bones and cessation in cartilage mineralisation. Subsequent skeletal manifestations include bowing of weight-bearing long bones, distortion of the pelvis, vertebrae and sacrum, porous and flared rib ends and long bone metaphyses, cranial porosity, periosteal inflammatory lesions or thickening (Ortner and Putschar 1985, 275; Ortner and Mays 1989, 45). Additionally, retardation in growth can occur, which may result in shortened femora. However, bowing of long bones cannot occur if the growth is very retarded, as some bone growth needs to take place to cause bowing deformities (Stuart-Macadam 1989, 208). The bones may heal and remodel, although the frontal part of the skull and the concave surfaces of long bone deformities may remain thicker, even after years of healing (*ibid*, 209). Swaddling of babies was a popular method of attempting to prevent bowing of bones (Sweet 1997, 820). However, tight bandaging would only have exacerbated the disease, further inhibiting the child's contact with sunlight. Swaddling could also cause flesh compression and gangrene, as well as circulation disruption, and the tradition was abandoned in the eighteenth and nineteenth centuries (*ibid*).

Symptoms of vitamin D deficiency include restlessness, irritability, flabby muscles, pallor, gastrointestinal upsets and susceptibility to infectious disease (Stuart-Macadam 1989, 207). Females who suffered from a distorted pelvis as a result of childhood rickets often experienced very difficult and sometimes fatal births.

A bowed humerus was recovered from the disarticulated human bone from Context (203); this displayed bilateral medio-lateral bowing of the humeral shaft, which can occur when infants with rickets are crawling and bear most of their weight on their arms. It is likely that the individual was afflicted during early childhood and had since recovered. Crude prevalence rates for the medieval and post-medieval period suggests that 0.73% and 3.65% respectively of the population had rickets (Roberts and Cox 2003, 310).

An alternative diagnosis for long bone bowing has been put forward by Stuart-Macadam *et al* (1989), who suggest that some bowing deformities are due to childhood trauma which, in an adult with a less supple bone structure, would have fractured the long bone. This condition, also termed 'acute plastic bowing deformity', can also be associated with inflammatory bone formation. However, the fact that no evidence for fractures or other types of trauma was noted in the individuals with bowed long bones suggests that rickets is the more likely cause.

3.5 CONCLUSION

The male and the female mature adults exhibited mild degenerative joint disease, typical of their advanced years. Both individuals also exhibited multiple lesions within the spine indicative of repetitive lifting and carrying of heavy loads. Further evidence of the physically demanding lifestyle that both individuals experienced was evident in the traumatic lesions that both individuals incurred; the mature adult having broken his rib and collar bone as well as traumatic incidents which resulted in localised bone death n the big toe and shoulder. Both individuals also experienced periods of infection, from which the female was still suffering at the time of her death. Lesions in the woman's orbits may also indicate periods of poor childhood health.

A number of disarticulated bones exhibited periosteal inflammatory lesions that may indicate the poor health, resulting from low living standards or a high pathogen load. Indicators for childhood stress in the form of infection or Vitamin B12 deficiency and possible rickets were also present and may further attest to diets deficient in the necessary vitamins and minerals for healthy growth and development. Two possible incidents of peri-mortem trauma may imply individuals were exposed to violent episodes, or may provide evidence for autopsies.

4.0 DENTAL HEALTH

Analysis of the teeth from archaeological populations provides vital clues about health, diet and oral hygiene, as well as information about environmental and congenital conditions. SK2 had a complete mandible but only the left maxilla was present, despite this all of the right maxillary teeth were present. In total, 23 tooth positions could be observed and 29 of the individual's teeth were present. Only the mandible of SK2 was present, providing sixteen tooth positions for observation. Despite this, eighteen of the individual's teeth were present. In total, 39 tooth positions could be observed (23 female, 16 male) and 47 teeth were present (29 female, 18 male). Context (211) contained 37 observable tooth positions and a total of 39 teeth. All of the teeth discussed formed part of the permanent dentition and were fully erupted.

Dental wear tends to be more common and severe in archaeological populations than in modern teeth. Severity of the dental wear was assessed using a chart developed by Smith (1984): each tooth was scored using a grading system ranging from 1 (no wear) to 8 (severe attrition of the whole tooth crown). The dental wear exhibited by both SK1 and SK2 was only mild, and certainly less severe than expected for mature adults in the medieval period. Limited wear may reflect the refined diet available to the individuals, which in turn caused less attrition to the occlusal surfaces of the teeth. The teeth recovered from Context (211) also exhibited limited wear.

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

Deposits of calculus were medium to heavy on the lingual surfaces of the lower incisors of SK1 (mature adult female) but only slight to moderate on the molars; 23 of her 29 teeth (79%) were affected by calculus. SK2 (mature adult male) had moderate deposits of calculus on his anterior dentition but calculus was less severe on the lower left molars, all of his teeth (100%) were affected by calculus. The male had more calculus, perhaps suggesting that he had a different diet or that the female practiced better oral hygiene. Of the teeth recovered from Context (112), 26 (67%) exhibited slight or moderate deposits of calculus.

Dental caries (tooth decay) forms when bacteria in the plaque metabolise sugars in the diet and produce acid, which then causes the loss of minerals from the teeth and eventually leads to the formation of a cavity (Zero 1999).

Simple sugars can be found naturally in fruits, vegetables, dried fruits and honey, as well as processed, refined sugar; since the latter three contain the most sucrose they are most cariogenic. Complex sugars are usually less cariogenic and are found in carbohydrates, such as cereals. However, processing carbohydrates, including grinding grains into fine powders or cooking them, will usually increase their cariogenicity.

SK1 had two carious lesions (6.9% of teeth); one was located on the occlusal surface of the crown of the second molar. SK2 had seven caries (38.9% of teeth), all of which were located at the crown root junction. The crude prevalence rates would suggest that the male individual may have had access to a sugar rich diet, or alternatively, that the female had a more fastidious dental hygiene regimen. Of the teeth recovered from Context (211), seven had carious lesions (17.9% of teeth).

Dental enamel hypoplasia (DEH) is the presence of lines, grooves or pits on the surface of the tooth crown, which occur as a result of defective formation of tooth enamel during growth (Hillson 1996). Essentially, they represent a period when the crown formation is halted, and they are caused by periods of severe stress, such as episodes of malnutrition or disease, during the first seven years of childhood. Involvement of the deciduous (milk) teeth can indicate pre-natal stress (Lewis 2007). The female had five teeth that were affected by dental enamel hypoplasia (17.3%), while the male had three (16.7%). It would appear that both individuals experienced periods of childhood stress severe enough to halt their growth, but that both individuals were capable of surviving these insults and reaching mature adulthood. Eighteen out of the 39 teeth (46.2% of teeth) recovered from Context (211) also exhibited enamel hypoplasia.

SK2 (mature adult male) had smooth neat crescents worn into their right lateral upper and lower right lateral incisors; these are often the result of pipe smoking (Capasso *et al* 1999). However, the facts that tobacco was not introduced to Britain until the late 1500s suggests that these wear facets were caused by a habitual activity other than smoking.

Differences in the dental health of SK1 and SK2 might suggest that they consumed different diets. It is possible that the male had a higher intake of sugars and protein or that the female practiced better dental hygiene regime. The degree of dental attrition observed amongst both individuals was less advanced than would normally be expected for mature adults; this may have been a result of a highly refined diet. Both individuals appear to have been exposed to childhood stress but were capable of surviving such insults. Of the teeth recovered from the disarticulated assemblage, the occurrence of calculus was comparable to that of Skeleton 1 and 2, the frequency of carious lesions fell between the male and female range, enamel hypoplasia, however was considerably higher amongst the disarticulated remains.

5.0 BURIAL PRACTICE

Both SK 1 and SK 2 were buried extended and supine (on their backs, with their legs extended), with arms symmetrically folded across the hips. As would be expected in a Christian burial ground, the burials were oriented west-east, with the heads to the west. At least one of the burials was contained within a coffin.

The location of the burials suggests that they may have been associated with St Kyneburgh's Chapel, which dates to the 11th century and SK2 has been radiocarbon dated to the 11th or 12th century. It appears that the burials were stacked on top of one another - SK1 (mature adult female) was placed on top of SK2 (mature adult male) - and it is possible that they were husband and wife. Equally, it is feasible that these represent brother and sister or even have no familial relationship.

Evidence for coffin furniture was found with the skeletons, suggesting that either one or both individuals were interred in coffins. Although wooden coffins are rare in the period, they were becoming more common in the 10th and 11th centuries than previously (Hadley 2001).

Various examples of medieval wooden coffins have been found (Hadley 2001), although the majority of bodies would have been removed from the coffin before burial and simply interred in a shroud (Gilchrist and Sloane 2005, 111). Examples of wooden coffins with grips or handles do exist in the medieval period, though they were uncommon (Gilchrist and Sloane 2005, 111-112).

6.0 DISCUSSION AND SUMMARY

The osteological analysis of the human remains recovered from excavations around Kimbrose Triangle suggests that at least seven individuals were represented. SK 1 was a mature adult female of average stature for the period. SK2 was a mature adult male of above average stature for the period. Ten individuals were identified amongst the disarticulated material; eight of these were adults and two were non adults. Of the adults, three were male and a further three were female.

Both the male and the female mature adults exhibited mild degenerative changes to the spine and extra-spinal joints. Traumatic events were experienced by both individuals, the mature adult male having fractured his rib and collar bone, and evidence for localised bone death was noted in both Skeletons 1 and 2. Both individuals also experienced periods of infection, from which the female was still suffering at the time of her death. Childhood stress was experienced by both the male and female, evidence for which was found within the dentition and in the female's orbits.

The disarticulated skeletal material also exhibited signs of infection. *Cribra orbitalia* and a case of possible rickets may indicate physical stress during childhood in the form of infection or malnutrition. Two possible incidents of peri-mortem trauma may imply that the male was exposed to trauma at death, either through accident, workplace injury, or interpersonal violence, or alternatively, the lesions may provide evidence for medical investigations.

SK2 (mature adult male) expressed a greater degree of calculus and caries than SK1 (mature adult female), suggesting differential access to certain foods or worse oral hygiene in the case of the male. Smooth notches in the anterior dentition of SK2 may also indicate that this individual used their teeth for a habitual activity.

The presence of childhood stress indicators in the two articulated individuals suggests that they either suffered from disease or poor nutrition during childhood. However, the fact that they were both of average stature for the period, had little dental wear (indicative of soft foods) and were interred in coffins, suggest that they may have been of higher status, at least in adulthood.

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Appendix 2: Details regarding Catherine and Robert Jennings.

The gravestone recovered from context (905) was dedicated to Catherine Jennings (1790-1838) and her husband the Reverend Robert Jennings (1797-1831). The inscription reads “also of CATHERINE Relict of The Revd. Robert Jennings (Missionary at Chittoor in the East Indies) who died Oct 30th 1838 Aged 48 Years”. Robert Jennings himself is buried in Chittoor, Madras, having died there during mission work at the age of 34. Catherine Jennings is known to have returned to Gloucester, with their child Harriet following Robert’s death. Catherine Jennings died in Gloucester and was buried in the Independent Chapel on Southgate Street.

Robert Jennings served as a missionary with the London Missionary Society (LMS) in South India between 1827 and 1831. The LMS was a non-denominational missionary society formed in 1795, with a largely Congregationalist outlook and membership. The London Missionary Society's original *Register of Missionaries* contains the following biographical information:

"Jennings, Robert. Born, Feb. 22, 1797. Ch.m, at Gloucester (Bishop). Studied at Gosport, and Mission Coll., Hoxton. Appointed to Chittoor, South India. Ordained, April 4,1827, at Union Ch., Islington. Married -- BURTON, Ch.m., Gloucester (Bishop). Sailed April 11, 1827. Arrived at Madras, July 17, and at Chittoor, Aug.4. Died at Chittoor, Jun 1 1831. Mrs. Jennings returned to England, arriving Dec. 6, 1831."

Further documentation regarding Robert and Catherine Jennings is held in the School of Oriental and African Studies Archive, London. The Archive includes letters regarding Roberts’s appointment to the Mission, letters written by Robert himself prior to and during his mission, including his reports on the Mission progress, and also a letter written by Catherine Jennings to the Missionary Society following the death of her husband. The material also reveals that Robert worked at the Gloucester Herald print works prior to his appointment. Copies of the letters are contained in the project archive; in addition there is also a miniature portrait of Robert Jennings.

Details regarding Harriet Angelina Jennings are also available from the various censuses. Harriet is known to have married twice, first to the prominent Gloucester solicitor Thomas Avery, with whom she lived on the promenade Cheltenham. Her second marriage was to Edwin Broad, the uncle of the philosopher C.D. Broad. In his autobiography, C.D. Broad states that Aunt Harriet was a great influence upon him. Harriet later moved to Brighton where she died.

Appendix 3: Pottery assessment by Jane Timby

1 Introduction

1.1 The archaeological work resulted in the recovery of a small assemblage of 40 sherds of pottery, weighing 340g, dating to the Roman, medieval and post-medieval / modern periods

1.2 Pottery was recovered from four recorded contexts: (505), (600), (607) and (801). The sherds are of mixed condition the later material being generally better preserved. As three of the four horizons contained material of mixed chronology it would seem there has been a marked level of soil disturbance with the redeposition of material.

1.3 For the purposes of the assessment the assemblage was scanned to assess its likely chronology and quantified by sherd count and weight for each recorded context. The resulting data is summarised in Table 1. Named traded Roman wares are coded using the National Roman reference series (Tomber and Dore 1998).

2 Roman

2.1 The assemblage contained five sherds of Roman date recovered from contexts (600), (607) and (801). Despite the small size of the group the range of material was quite diverse in terms of composition, with continental and regional traded wares alongside more local products and chronology.

2.2 Continental imports include a small rimsherd from an amphora. This is probably from Cadiz, South Spain (CAD ASM) and may be from a Peacock and Williams 1986, class 18, although the rim is broken so the full shape cannot be determined. Alternatively it may be a Dressel 2-4. Both types have been documented from the Neronian levels at Kingsholm. Also amongst the traded wares is a sherd from a Lyon ware (LYO CC) roughcast beaker from (600), a pre-Flavian import also documented from the early levels at Kingsholm.

2.3 The single regional ware is a sherd of Dorset black burnished ware (DOR BB1) from a conical-shaped flanged bowl also from (600) which is likely to date to the later 3rd or 4th century.

2.4 The local wares are represented by a sherd of a grey ware jar, probably of early Roman date and a sherd of Severn Valley ware.

2.5 All the Roman material is redeposited.

3 Medieval

3.1 Sherds of medieval date were recovered from contexts (607) and (600) providing the *terminus post quem* for these two contexts. Eight sherds of Gloucester (Haresfield) oolitic limestone-tempered ware (Gloucester type fabric TF 41), all from jars or cooking pots, are present. This ware was current in Gloucester from the later 12th - 13th centuries (Vince 1983). Also present is a single handmade glazed sherd of oolitic-limestone-tempered ware from a different source and probably from a pitcher or jug of broadly similar date.

4 Post-medieval

4.1 The remaining 26 sherds, all from contexts (505) and (801) date to the post-medieval periods. These include a foot from a North Devon gravel-tempered tripod skillet of 17th-century date, porcelain, tin-glazed ware, industrial refined white earthenware (china), and 18th-century salt-glazed ware.

5 Potential and further work

5.1 The assemblage recovered from the Gloucester Quays City Centre Linkages Scheme is very typical of that to be expected from Gloucester where an extensive Roman and later settlement is known to exist. The diversity of the small Roman assemblage is of particular interest since it appears to contain at least two pre-Flavian imports of a type associated with the early fortress at Kingsholm and suggests activity in this area from an early date.

5.2 The assemblage is too small to warrant further work.

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Table 1

Context	Fabric	Form	No	Wt	Date
505	mocha ware	mug	6	24	C19th+
505	white salt glazed	bodysherd	1	31	C18th
505	industrial china	body and rim	11	24	C19th+
600	Dorset black burnished ware (DOR BB1)	flanged bowl	1	74	lC3-C4
600	Grey sandy ware	everted jar	1	18	prob C1-C2
600	Lyon ware (LYO CC)	beaker	1	1	pre-Flavian
600	Medieval oolitic ware (TF 41)	bodysherds	5	16	C13-14th
600	Medieval oolitic ware	bodhsherd	1	10	C13-14th
607	Medieval oolitic ware (TF 41)	jar/cooking pot	3	33	C12-14th
607	Severn Valley ware (SVW OX)	bodysherd	1	11	Roman
801	Devon gravel-tempered ware	tripod skilllet	1	38	C17
801	porcelain	bodysherd	1	4	C18-19th
801	tinglaze	bodysherd	1	13	C17-19th
801	industrial china	body and rim	2	12	C19th+
801	slip decorated ware	bodysherd	1	1	C18-19th
801	mottled brown glaze	bodysherd	2	6	C18-19th
801	Cadiz amphora (CAD AM)	rim amphora	1	24	C1
TOTAL			**40**	**340**	

Appendix 4: Radiocarbon dating results SUERC laboratory

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East Kilbride, Glasgow G75 0QF, Scotland, UK
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RADIOCARBON DATING CERTIFICATE

26 August 2011

Laboratory Code	SUERC-35587 (GU-24590)
Submitter	Nathan Thomas Gloucestershire County Council Archaeology Service Shire Hall Gloucester GL1 2TG
Site Reference	Gloucester Quays Linkages Scheme
Context Reference	607
Sample Reference	34852 SK2
Material	Human Bone : Homo sapiens sapiens
$\delta^{13}C$ relative to VPDB	-20.3 ‰
$\delta^{15}N$ relative to air	11.7 ‰
C/N ratio(Molar)	3.2
Radiocarbon Age BP	920 ± 30

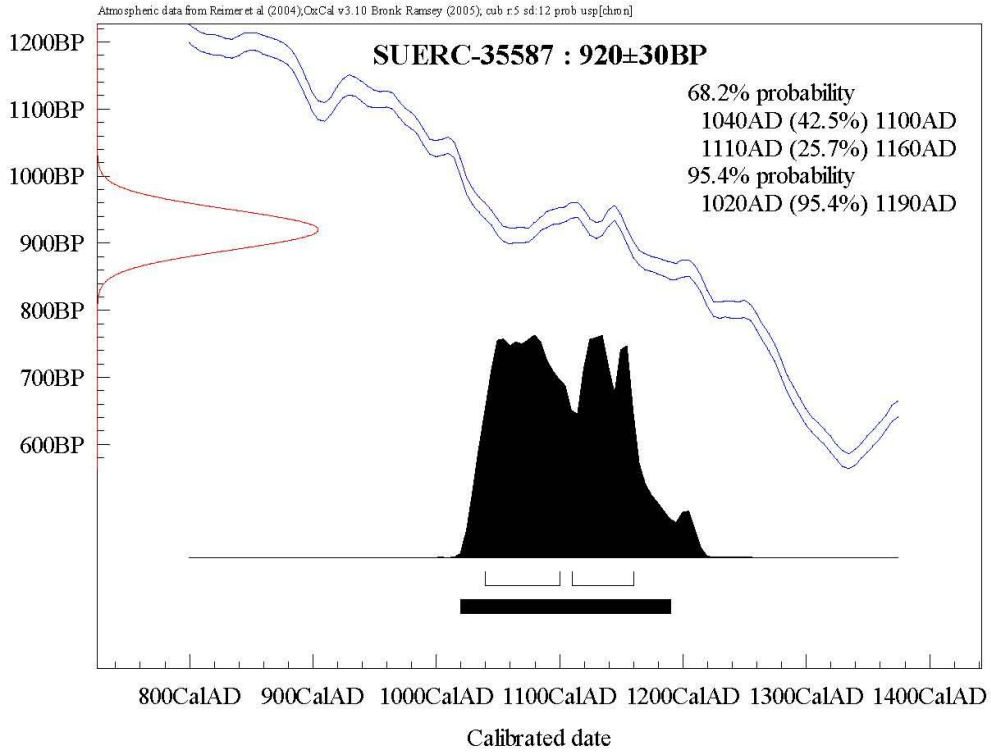
N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).
3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or Telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- P. Naysmith Date :- 26/8/11

Checked and signed off by :- E. Dunbar Date :- 26/8/11

Calibration Plot



Appendix 5: Finds inventory

Site/project name				
Gloucester Quays City Centre Linkages Project				
GHER	**Accession no.**	**Site code**	**Prepared by**	**Date**
34852	GLRCM 2010.29		N. Thomas	November 2011
Landowner (owner of finds)				
GCC				

Context	Artefact material	Artefact type	No.	Wt gms	date	Notes	Bags	Box no.
203	Stone	Gravestone	3	-	PM	Not retained	-	-
203	Bone	Human bone	2	-	-	-	1	
211	Fe	Coffin furniture	7	195	PM		1	
211	Bone	Human bone	49	-		-	1	
211	Bone	Animal	3	10			1	
505	Fe	Objects	3	53			1	
505	Bone	Animal	8	51			1	
505	Shell	Oyster	1	14			1	
505	Ceramic	China	18	82	PM		1	
505	Glass	Glass	1	7			1	
505	Ceramic	Pipe	9	14	PM		1	
600	Ceramic	Pot	9	122	M/RB		1	
600	Bone	Animal	7	34	-		1	
600	Fe	Nails	4	26	-		1	
607	Fe	Coffin nails	22	275	-		1	
607	Bone	Animal	23	139			1	
607	Ceramic	Pot	4	46	M/RB		1	
607	Slag	Slag	4	27	-		1	
607	Bone	Human Bone		-	M			
700	Bone	Animal	8	36	-		1	
700	Bone	Human bone	24	-	-		1	
801	Ceramic	Pipe	9	28	PM		1	
801	Ceramic	Pot	9	105	PM/RB		1	
801	Glass	Glass	1	6	-		1	
801	Shell	Shell	1	81	-		1	
801	Bone	Animal	4	41	-		1	
902	Fe	Coffin furniture	1	73	-		1	
902	Bone	Human bone	35	-	-		1	
905	Stone	Gravestone	1	-	PM	Very heavy	-	

Abbrev.	Period	Approximate date range
	early mesolithic	10000 - 7000 BC
	late mesolithic	7000 - 4000 BC
	early neolithic	4000 - 3000 BC
	middle neolithic	3500 - 2700 BC
	late neolithic	3000 - 2200 BC
BA	early Bronze Age	2500 - 1500 BC
	middle Bronze Age	1600 - 1000 BC
	late Bronze Age	1000 - 700 BC
IA	early Iron Age	800 - 400 BC
	middle Iron Age	400 - 100 BC
	late Iron Age	100 BC - 43 AD
RB	Roman/Romano-British	43 - 410 AD
med.	early medieval	410 - 1066 AD
	medieval	1066 - 1540 AD
PM	post medieval	1540 - 1901 AD
	modern	1901 - present