8. APPENDICES

8.1 Appendix 1: The human remains and burial evidence

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8.1.1 Introduction

Eight burials from New Waverley underwent osteological analysis, including the seven skeletons excavated during the 2013–14 watching brief and excavations and the truncated remains of one adult skeleton (SK 010) that had been excavated in 1997 and reported on by the Lothian and Borders Police and Professor Anthony Busuttil. The articulated human remains were analysed in accordance with recommendations by English Heritage (1991), Historic England (2018) and guidance for recording outlined by the British Association of Biological Anthropology and Osteoarchaeology together with the Institute of Field Archaeologists (BABAO/IFA) (Brickley & McKinley 2004). Analysis of the disarticulated remains identified at least one more burial, additional to the eight articulated individuals. Results of the osteological analysis are summarised below and the full report is available in the site archive.

Analysis of the skeletal material confirmed the presence of seven adults and one older adolescent (15–20 years old). While biological sex was not able to be determined for the adolescent and two of the adults, the remaining five adults comprised four males and one female. Metabolic bone disease was indicated by evidence for a childhood episode of vitamin D deficiency (residual deformities from rickets). Two unusual examples of osteochondroses affecting the metatarsals of the feet (Freiberg's Disease) were also identified. Infectious lesions were present in three individuals, including one case of venereal syphilis. Respiratory disease indicated by maxillary sinusitis was also present. Fractures were present in two individuals, which included one individual with evidence of a severe fall resulting in vertebral fractures and an adult male with a healed hip fracture (SK 088).

8.1.2 Burial practice

Where burial position could be determined, seven of the eight inhumation burials were extended and supine. Excluding the truncated burials of SK 010 and SK 013, the six remaining burials were found with the arms extended by the sides and with the hands placed over the pelvis. The position of the feet was recorded in three instances, with the feet crossed over in two burials (SK 018 and SK 088) and side by side in one burial (SK 081). Seven of the eight burials were aligned west/east with their heads to the west of the grave. The eighth burial was heavily truncated and no body position could be ascertained (Table 1).

The coffins identified with most of the burials were poorly preserved and incomplete. In some cases, these were visible only as a soil stain. Where the shape of the coffin could be determined, they were of the shouldered and tapered or single break design, typical of the early post-medieval period (Litten 1991). Where possible, wood samples were retained for analysis in identifying the species used for coffin construction. Where preservation permitted, these were identified as pine (Jackaline Robertson, Appendix 9), similar to later post-medieval burials from English sites, which have produced timbers derived from oak, elm and pine coffins. SK 010 was comparatively better preserved than the other burials, found within a rectangular wooden coffin, Context [009], constructed of single planks for the sides, head and foot, while the base was formed from transverse slats. There appeared to be a lead wash painted over the internal elements of the coffin wood. Three corroded iron coffin nails were found from two of the burials (Table 1). Unfortunately, it was not possible to elucidate any further elements of coffin construction from the surviving remains. As is common in medieval coffins, no evidence of fixings or decorations such as lid motifs, escutcheons, grips or grip plates survived, and it is not possible to say whether the coffins were at all decorated, or plain.

A copper alloy object with attached textile (SF64), was found adjacent to the leg of SK 067 (Appendix 5). Similar finds associated with the medieval burials include a silver penny and an iron buckle from the Canongate (Holyrood Abbey) (Bain 1999: 1054). A Scottish farthing was found placed over the forehead of a later medieval/early post-medieval adult Christian burial from Coldstream to the south-east of Edinburgh (GUARD 2013), and coins were also found in the backfill of graves

Table 1 Summary of the grave forms from the New Waverley burials

Skeleton	Head position	Grave dimensions (m) Length	Breadth	Depth	Coffin wood species	Coffin fixings	Notes
010	West	0.60 truncated	0.50	0.17		None found	Female, altered bone growth during childhood development and non-specific infection
013	West	Truncated	Truncated			None found	Unknown sex, severe scoliosis or lateral bending of spine, rickets, degenerative joint disease of the knee
018	West	1.85	0.44	0.08	*Pinus* sp	None found	Unknown sex, adolescent (15–20 years old) with syphilis, unhealed rib fracture, found with intrusive burnt bone, shell, charcoal and pottery
062	West	1.35	0.22	0.13		None found	Unknown sex
067	West	1.9	0.5	0.13	*Pinus* sp	None found	Male, developmental defect of vertebra and sinusitis/disease of the upper respiratory tract, Freiberg's disease of the feet, small copper alloy object with attached fabric found adjacent to the leg
070	West	1.97	0.5	0.13	*Pinus* sp	None found	Male, likely had childhood rickets, trauma to sacral vertebra
081	West	2.09	0.5	0.15	*Pinus* sp	Corroded iron coffin nail	Male, intervertebral degenerative disc disease
088	West	1.8	0.58	0.10		Two corroded iron coffin nails, one bent 34mm length, one straight 40mm length	Male, Freiberg's disease of the feet, degenerative joint disease of the elbow, healed trauma of vertebrae, ribs and hip as a result of a severe fall, intervertebral degenerative disc disease

excavated from St Giles' Cathedral (Collard et al 2006: 19).

Turquoise-green staining was observed on 14 bones from seven of the eight burials, indicating contact between the bone surfaces and objects made from copper alloy. There is a similar pattern of which bones were stained (eg ribs, fragments of pelvis and tibiae), but the pattern cannot be matched to a specific type of binding, to specific items of funeral wear or specific patterns of funerary goods or coffin fixings. It is likely that the burials were wrapped in shrouds or partly covered with coffin sheets/linings, which may have been held in place by shroud pins – the spherical head from a wire-wound headed pin came from Grave [068]. These are one of the most frequently found copper alloy objects included in post-medieval burials.

As the coffins had collapsed, the overlying Context [003], of garden soil/midden, had spread over the human remains in some instances. This was demonstrable by the inclusions of animal bone found with the human remains in six examples: SK 013, SK 018 n.3, SK 067, SK 070, SK 081 n.4 and SK 088. This also likely accounts for an intrusive fragment of burnt bone found with burial SK 018 as well as shell, charcoal and pottery noted in and around the burials during the excavation.

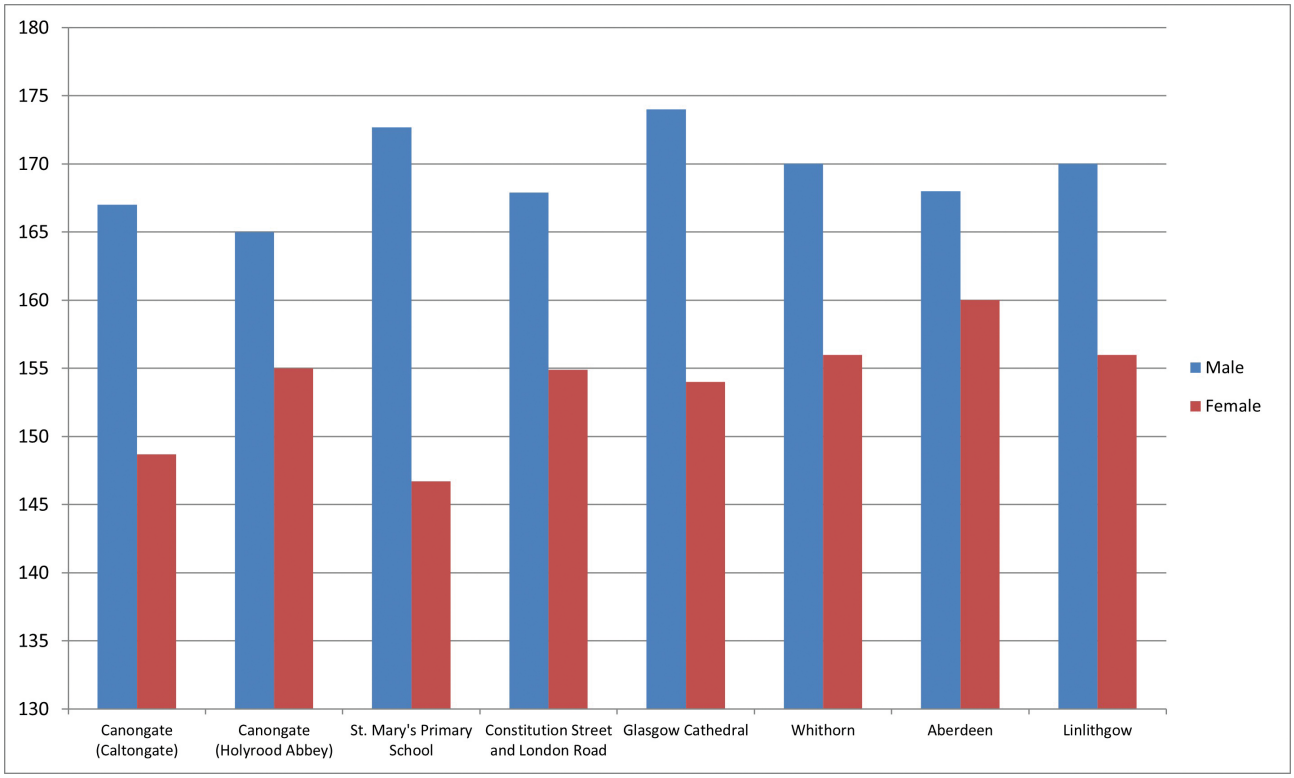
8.1.3 Demography

It was possible to determine biological sex and approximate age at death for five of the eight burials – four adult males (SK 088, SK 081, SK 067 and SK 070) and one adult female (SK 010). Sex was not determined for the remaining three individuals, which included adults SK 062 and SK 013, which were affected by poor preservation, and SK 018, an adolescent. While there were more males than females, the presence of an adult female and an adolescent indicates that there was no clear zoning of this area of the cemetery based on age or sex. Most of the burials (five of the eight) were young adults (18–25 years old) or middle adults (26–45 years old). The oldest individual was estimated to have been between 46 and 60 years old and the youngest individual was SK 018, an adolescent aged between 15 and 20 years.

Stature was calculated from long bone lengths, preferably femora wherever possible. Individual height is, in part, genetically determined (Ruff 2018). The potential to reach maximum potential height, however, is mediated by a complex range of environmental factors that include dietary quality (eg adequate provision of nutrients, calories and energy to permit and sustain growth) and health insults that may delay or alter growth (Mays et al 2009). It is important to note that some pathological conditions can stunt bone growth, while others can affect long bone shape; both factors potentially impact stature estimates. In the burials from New Waverley, one adult male (SK 070), showed evidence of medial curvature of the tibiae, most likely due to a childhood episode of vitamin D deficiency, or rickets. In this case, the humerus was therefore used for the stature estimate instead of the complete tibia (the femora were incomplete).

Stature estimates were compared with the earlier parish burials from the Canongate (Holyrood Abbey) (Hazel 1999: 1067), contemporary burials excavated from Constitution Street and London Road, St Mary's RC Primary School, Leith, as well as other Scottish medieval and post-medieval sites (Churchill 2016; Franklin et al 2019; Roberts & Cox 2003; Illus 14). Comparatively, the individuals from Caltongate were similar in height to medieval individuals from the Canongate and Holyrood Abbey, as well as those from the medieval burials excavated from Constitution Street and London Road (Franklin et al 2019), St Mary's RC Primary School (Churchill 2016), and St Giles' Cathedral in Edinburgh (Collard et al 2006). The males from Caltongate were slightly shorter on average (165cm) than from other sites in Edinburgh (average 168.5cm) – though only 1cm shorter than the next-shortest average, from London Road, Leith (166cm). Interestingly, the greatest disparity in stature (7.7cm) between contemporary Scottish sites was between Caltongate and St Mary's RC Primary School, less than 3km away (172.7cm). The female from Caltongate was also the shortest female observed from the Scottish late medieval sites, except for those from St Mary's RC Primary School. Caution is required in interpreting these results, however, due to the small sample size, with only one female found from the New Waverley excavation, and only four from Holyrood Abbey.

The stature results tentatively indicate that those living within the urban environment of the



Illus 14 Comparison of estimated adult stature of the Canongate Kirkyard burials, Holyrood Abbey burials, other Scottish medieval burial sites and British period-based mean stature estimates

later medieval and early post-medieval period in Edinburgh were on average slightly shorter in stature than in other parts of Scotland; however, the small sample size limits interpretations that can be drawn from the stature results.

8.1.4 Dental health

Six individuals analysed had one or more teeth present, adults SK 013 and SK 067 being the exceptions. Most of the absent teeth were either not preserved or lost post-mortem, and there was very little evidence for ante-mortem tooth loss (AMTL) in the assemblage, with only one individual affected: SK 088, who had lost the right second premolar (tooth 15). The low prevalence of AMTL is likely linked to the young average age at death of the assemblage. Teeth tend to be lost with older age, due to the cumulative effects of carious lesions, calculus deposition and increased periodontal disease (Lee et al 2019; Raitapuro-Murray et al 2014).

Five of the six individuals with observable dentition showed the development of carious lesions in one or more teeth. All six individuals showed one or more teeth affected by calculus, or mineralised deposits of plaque. Five individuals also showed evidence for periodontal disease and four individuals also had periapical abscesses. SK 067, SK 070 and SK 081 were affected by all four dental pathologies, indicative of a lack of oral hygiene. The high prevalence of calculus (100% of observable individuals, 82.3% of teeth present), and in conjunction with the high rate of caries, is indicative of diets high in starchy carbohydrates (Hillson 2005; Lieverse 1999). A high rate of calculus development is consistent across medieval burials from Edinburgh, with 64% of the Canongate parish burials from Holyrood affected, and 94.8% of adults from Constitution Street affected (Hazel 1999: 1068; Franklin et al 2019: 96). The proportion of individuals with carious teeth, however, was much higher at Caltongate (83.3%) than at Constitution Street (31.2%; Franklin et al 2019: 96) or the Canongate (19%; Hazel 1999: 1068). While this proportion could be a result of the small sample size, it could be indicative of an increasingly carbohydrate-rich diet through time.

8.1.5 Childhood development defects, illness and stress

Four adult skeletons, SK 010, SK 013, SK 067 and SK 070, provided insights into sub-adult development and childhood illness and stress. SK 010 showed parietal bossing, which can result from either delayed or altered bone formation, or from compression of the soft cranial bones during young infant growth. There was additional posterior overgrowth of the right side of the occipital bone, suggesting that some degree of slightly altered bone development had occurred during childhood.

SK 013 showed a severe developmental defect present in the vertebrae. While the remains of this individual were incomplete, clear evidence of severe scoliosis or lateral bending through the upper thoracic vertebrae, resulting from under-development during childhood, was found. This would have primarily affected the left side of the body, slightly reducing the height of the torso, and may have led to some compression of the chest. SK 067 exhibited a cleft through the midline of the posterior arch of the first cervical vertebra, as well as stunted development of the right transverse process of the first lumbar vertebra.

Individual SK 070 showed marked medial bending of the proximal and middle portions of the left and right tibiae, as well as marked posteromedial bending of the distal left fibula. There are a number of environmental factors or congenital conditions that can result in variations in skeletal bending deformities, but it is likely that the changes in this case represent residual deformities of a childhood episode of vitamin D-deficiency rickets. Adult SK 013 may also have suffered from vitamin D deficiency, although incomplete preservation prevented a clear diagnosis. Vitamin D is obtained from exposure of the skin to sunlight and the dietary intake of oily fish and eggs. Factors such as air pollution from dense coalsmoke, cultural practices that limit skin exposure, and/or habitual practices that require significant amounts of time spent indoors, together with limited diets, are factors likely to have contributed to the onset of this condition. It is also possible that individuals who were ill may have been kept indoors or were unable to go outdoors during the illness or during recovery, which could have contributed to the deficiency (cf Ortner & Mays 1998).

Further evidence of poor health during childhood was identified within the dental assemblage. Five of the six individuals (83.3%) that had one or more teeth present showed enamel defects referred to as dental enamel hypoplasias (DEHs), evidence of disturbances that had occurred during the formation of the enamel during childhood growth. These anomalies can be indicative of illness, malnutrition or generalised stress (Hillson 2005; 2014). The anomalies are usually observable as a linear band or groove in the enamel surface or a series of pitted defects in the tooth crown (Hillson 2014).

8.1.6 Specific and non-specific infection

Adolescent SK 018 showed signs of severe infectious disease across the skeleton, including the area of the left clavicle, humerus, ulna and radius, the pelvis, the tibiae and the base of the skull. The pattern is suggestive of a systemic infection and none of the lesions were well healed, indicating the individual died during the course of its development across the skeleton. The presence of pathognomonic lesions (caries sicca) on the right parietal is indicative of treponemal disease, most likely venereal syphilis in this case (Ortner 2003: 274).

Several individuals showed evidence of non-specific or secondary infection-related changes through the skeleton. SK 010 showed subperiosteal new bone formation, evidence of a non-specific infection in the tibiae and cranial bones. SK 067 exhibited extensive formation of a plaque of porous woven bone over the infratemporal and anterior walls of the right sinus, with a slightly smaller spread of plaque along the infratemporal wall of the left maxillary sinus. These lesions are representative of maxillary sinusitis, formed as a result of a chronic inflammation of the paranasal sinus, and are indicative of a chronic disease of the upper respiratory tract (cf Roberts 2007). Such conditions can result from a range of factors, including poor air quality, allergens (like pollen) or bacterial particulates. Industrial working and pollution contributing to poor air quality (influenced by particulates from coal smoke or gases), have been shown to cause chronic respiratory illnesses, though exposure to dust, damp or mouldy conditions, as well as animal vectors such as dust mites can also cause chronic sinus inflammation (ibid.). Regardless of the cause,

the bone changes affecting the paranasal sinuses are indicative of a chronic condition that persisted for over two months.

8.1.7 Circulatory conditions

Two individuals (SK 088 and SK 067) showed pathological bone changes affecting the feet, represented by unusual lytic lesions on the metatarsals. These appear to indicate a form of osteochondroses or localised bone tissue death (necrosis) with subsequent bone remodelling. The lesions were most likely caused by a defect in local blood supply to the bone, potentially from injury or prolonged stress (Resnick 1995: 3576), and are associated with Freiberg's infraction or disease. Freiberg's disease is the deformation of the distal head of the second metatarsal and is the result of chronic, repetitive injury, found more commonly in girls in the modern period, starting during adolescence (Donaldson et al 2020).

There is a tendency in cases of Freiberg's disease for a congenitally long second metatarsal or a shortened first metatarsal to exist in those affected, as this causes more stress to the second metatarsal (Salter 1999: 351; Resnick 1995). The two examples from New Waverley, however, were both from adult males and had well healed. One of the males (SK 088) had a small irregular bone fragment, which could have resulted in localised pain towards the front of the foot when standing or walking, as well as tenderness and restricted movement in the metatarso-phalangeal joint (Salter 1999: 351; Resnick 1995: 3576). Clinical studies note that similar small osteochondral fragments (small pieces of the joint) may become separated from the remainder by the process of cell tissue death (Salter 1999: 351; Resnick 1995: 3576). While modern studies have suggested a high occurrence of these lesions in females, especially among those wearing shoes with high heels (Salter 1999: 351), the fact that SK 088 was male indicates there were likely other contributing factors in past populations. Whether the condition was connected with occupation-related repetitive stress or was influenced by styles of footwear and the physical environment is unclear.

In addition to the two cases of Freiberg's disease, SK 070 exhibited a depression or lesion in the first sacral vertebra that may have had a circulatory cause, resulting from a fracture or trauma which may have damaged the intra-vertebral disc and compressed the surface of the bone endplate. The presence of lamellar bone indicates the body had at least started the attempt to heal.

8.1.8 Joint disease

Two individuals exhibited degenerative joint disease (DJD): SK 013 and SK 088. SK 013 showed evidence of DJD in the knee, with pitting on the joint surface of the right femoral condyle and right patella. There was no evidence for joint disease elsewhere in the individual, but also no apparent exacerbating factors such as an associated injury. The other adult, SK 088, showed osteoarthritis development in the distal radio-ulna joint (ulna joint affected), which seemed likely to have been secondary to remodelling at the joint following a possible fracture or injury.

Three of the seven observable individuals showed minor osteophyte formation throughout the vertebral bodies. This can develop as wear and tear and mechanical pressure on the vertebrae causing a minor bone formation at the margins of the vertebral bodies. Two individuals (SK 081 and SK 088) also showed the development of inter-vertebral degenerative disc disease (IVD). This occurs where the cartilage joint over the vertebral body surface degenerates, resulting in porosity and pitting through the bone surface (Roberts & Manchester 2005: 140). SK 081 showed quite severe manifestations of IVD, which had also contributed to the development of osteoarthritis on the superior and inferior surfaces of the C3 and C4 vertebral centra. Both SK 081 and SK 088 showed evidence for osteoarthritis in the vertebrae, with slight development of mechanically related degenerative osteophyte formation. These patterns are likely to be largely influenced by the relatively young average age at death of the assemblage.

8.1.9 Non-metric traits

The fragmented nature of some of the burials, together with the small sample size, limits the interpretation of the non-metric traits identified. Calcaneal double facets were the most frequently noted trait in the sample. While previous studies

have found a link between the presence of anterior calcaneal facets and ancestry, it was not possible to determine whether family relationships existed between any of the individuals (Spiros 2019).

8.1.10 Trauma

Two of the individuals showed evidence of trauma, SK 088 and SK 018. Adult male SK 088 had fractures across five bones, including two vertebrae, one rib and a hip fracture. All of these fractures exhibited the same degree of healing and are likely to have occurred during a single incident. This individual exhibited a fracture line through a thoracic vertebra as well as a fractured lumbar vertebra, both fractures likely the result of a heavy fall. One left rib had also been fractured but this injury was also healed. The same accident may also have been responsible for causing a severe but healed fracture non-union of the femoral neck (hip fracture). Adolescent SK 018 showed a probable unhealed fracture in the shaft of a rib fragment.

8.1.11 Disarticulated bone

Several fragments of disarticulated human bone were recovered during the New Waverley excavation. Most of the disarticulated elements could be matched with the articulated burials. A minimum number of individuals (MNI) assessment, however, determined the presence of at least one additional individual apart from the eight articulated inhumations. Fragments that could not be matched with the articulated skeletons described above are reported in the site archive.

8.1.12 Discussion

The nine individuals excavated at New Waverley likely represent local parishioners who were interred within the limits of the Canongate Kirkyard. Based on the small assemblage excavated at Caltongate, all were buried supine and extended, in poorly preserved narrow wooden coffins. The use of coffins rather than simple shrouded burials is likely to have been a feature of medieval to early post-medieval burials in towns, consistent with archaeological evidence from other 14th-century burial sites in Edinburgh (Collard et al 2006: 19). Henry Grey Graham noted, however, in his *The Social Life of Scotland in the Eighteenth Century*, that in the earlier part of the 18th century it was common for 'the poor [not to be] interred in coffins, they were only carried to the grave in the parish coffin' (1899: 148). Despite the recovery of a small copper alloy object with attached textile and evidence of staining on several of the other individuals, the overall lack of grave goods is also consistent with other Christian burial sites in the period.

The demographic profile of the burials from the New Waverley excavation suggests that there was no clear zoning of this area of the cemetery based on age or sex. It is not clear, however, whether the clear majority of males represents the overall composition of burials in the remainder of the ground. The inclusion of burials of women and children in the grounds surrounding the chapel of Holyrood Abbey suggests the cemetery was used for the Canongate burgh population rather than just for the convent of the abbey (Bain 1999: 1065). It is likely that this pattern continued, following the laying-out of the abbey's successor cemetery at the Canongate Kirk. Most of the burials were of younger adults, with five individuals younger than 46 years of age, and one adolescent between 15 and 20 years old.

Dental disease was prevalent in the assemblage, with both caries and calculus present in nearly all of the observable adults. These trends indicate poor oral hygiene, especially in cleaning the molars towards the back of the mouth. It is likely that a diet high in starchy carbohydrates, especially in the form of oat pottage and potatoes, from the early 18th century on (Wilson 1992), also contributed. The presence of these dental pathologies on the remains from New Waverley fits within the trends in both the medieval and post-medieval periods from sites studied in Britain (cf Roberts & Cox 2003). The prevalence rates are comparable, but slightly higher than those noted in the larger sample of parish burials from the Canongate excavated from Holyrood Abbey, as well as from the contemporary burials at Constitution Street, in Leith (Bain 1999; Franklin et al 2019). Aside from the dental pathologies, the prevalence of defects in enamel among most of the individuals with observable dentition suggest that the adults suffered from some element of physiological stress that resulted in the disturbance of enamel formation during childhood. This is also a frequent finding from this period and is difficult to interpret beyond

a generalised impression of acute childhood stress.

A number of pathological conditions were noted among the burials from New Waverley, including evidence of infectious diseases and traumatic events. Two of the skeletons displayed healed injuries (one a hip fracture) that were likely the result of accidents, rather than interpersonal conflict. Surgeons and barbers were established in Edinburgh by the 16th century (and physicians in the 17th century) and would have been available to provide treatment to those who could pay for such services, and perhaps to provide limited treatment to the very poor (The Royal College of Surgeons of Edinburgh). The trauma to the femoral head exhibited by SK 088 was quite severe and would have necessitated some bed-rest while the injury healed. The fracture healed, but without bone union between the femoral head and the shaft, meaning there would have been instability in the hip and perhaps a limp during walking.

Comrie notes there was a great deal of 'irregular practice' in the city by the early 18th century, with quacks routinely operating (1927: 112). Cases of disease were most frequently treated by blood-letting, either by cutting or by leeches, as well as cold affusions, brisk purging, blistering using hot cups applied to the back to raise the skin and draw out the illness, and vomiting brought on by emetics of tartar (Comrie 1927: 235). The Royal College of Physicians of Edinburgh produced the first edition of a *Pharmacopoeia* in 1699 aimed at standardising prescriptions and the substances used for treatments, and provided instructions for the preparations of waters, syrups, powders, lozenges, pills and ointments, among others (ibid.: 111).

It is likely that the individual with syphilis (SK 018) would have suffered considerable chronic pain, with very limited treatments available at the time. Morton's review (1962: 176) of documentary evidence for syphilis in later medieval Scotland indicates that the condition was quite widespread, and in his description of pathological changes, he explained that 'patients were tortured with pain'. In 1497 *Ane Grandgore Act* ordered all infected and incurable persons to Leith to be taken by boat to the island of Inchkeith in order to protect the king's lieges, 'fra this contagius seikness' (Morton 1962: 175). Morton (ibid.: 177) notes that mercury, guaiacum and sarsaparilla were imported from the continent during the 15th and 16th centuries, most likely in order to treat cases of the infection.

There was little evidence for degenerative changes to the joints, including the vertebrae. Two individuals showed manifestations of joint disease, only one with quite severe changes and osteoarthritis in the spine. The overall pattern is likely influenced by both the small assemblage size and by the relatively young age profile of the group, as joint degeneration is a process that progresses through life. Regardless, the low prevalence rates are comparable to other assemblages, including Constitution Street, though notably lower than contemporary sites outside Edinburgh, like Aberdeen (Franklin et al 2019; Stones 1989). A form of osteochondroses or localised bone tissue death with subsequent bone remodelling on the metatarsal bones of two individuals most likely arose due to a defect with the local blood supply to the bone (Resnick 1995: 3576). This is associated with Freiberg's infraction or disease, which results from chronic repetitive injury or stress. The two examples from New Waverley were both from adult males and had well healed. Whether the condition was connected with occupation-related repetitive stress or was influenced by styles of footwear and the physical environment is unclear.

Overall, the eight articulated New Waverley inhumations show a diverse and interesting range of pathological conditions indicative of life in a developing urban centre of the later medieval/early post-medieval period. The male bias in the burials is of interest but is limited in potential understanding, in view of the small sample size. While the relatively young age at death of the assemblage may be reflective of mortality in the period, the burial registers for the site indicate the survival of some into older adulthood, suggesting some bias within the recovered sample.

8.2 Appendix 2: The ceramic assemblage

George R Haggarty and Derek W Hall

A total of 1,175 sherds of pottery were recovered during the excavations, the majority of which (561 sherds) came from Phase 5 Context [003]. The full detailed pottery report and catalogue is contained within the site archive.

8.2.1 The medieval assemblage

The arrival of monasticism in the second quarter of the 12th century facilitated the introduction into Scotland of large-scale wheel-thrown pottery production (Haggarty 1985). The vast majority of the medieval pottery recovered from the New Waverley site was recovered from Context [007] and comprised Scottish White Gritty Ware (SWGW). Sherds of SWGW are generally white, occasionally light pink or light grey, and most are heavily quartz-gritted. Most of the sherds recovered from [007] were small and badly abraded SWGW; in no case was it possible to create a profile. Two jar/cooking pot rims and a jug rim have been illustrated (SF08, SF136 & SF22a) (Illus 15A, 15B & 15C). A few of these sherds may date from the late 12th century, but the majority appear to be from the 13th or 14th century.

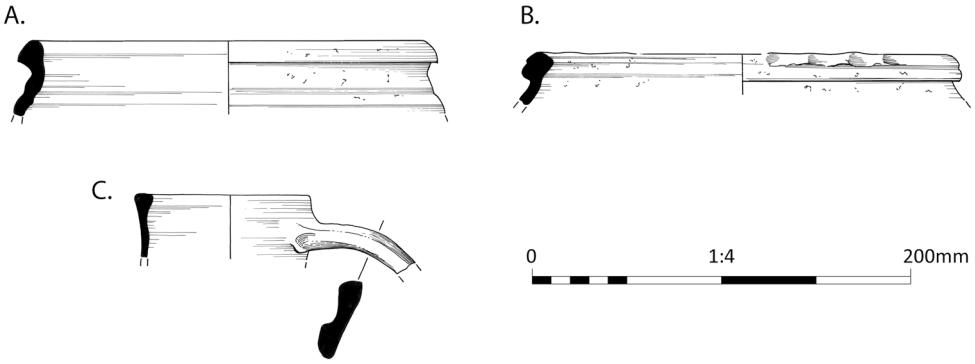
At present, only one SWGW production site is known in the Lothians, at Colstoun near Haddington (Brooks 1981; Hall 2004). Recent results from an Inductively Coupled Plasma (ICP) mass spectrometry project on SWGW sherds from a site at Niddrie on the outskirts of Edinburgh suggest that the 13th/14th-century pottery from Colstoun may have been widely traded, and that East Lothian was the main source for much of the Niddrie medieval pottery (Haggarty & Hughes 2012). However, a preceding geochemical study (R Jones et al 2003) clearly demonstrates that SWGW sherds recovered during earlier excavations in the Canongate, Edinburgh and Leith were obtained from a number of different sources. This suggests that other white ware kiln sites await discovery.

Imported medieval whitewares from Yorkshire are represented by two sherds, one rim from Context [007] (SF22b) (Illus 16A) and a piece of a handle (SF188) (Illus 16B). Large amounts of 12th- and 13th-century pottery from a number of Yorkshire kiln sites have been recovered from excavations in Scottish east coast burghs, in particular the Bon Accord site in Aberdeen (Haggarty & Hall 2021). There is a residual, clear lead-glazed Saintonge body sherd, possibly from a polychrome jug (SF09), with a fine off-white micaceous fabric – these are thought to date from between 1275 and *c* 1325 (cf Haggarty 2006: Word File 5 and Map C and Haggarty 2013b).

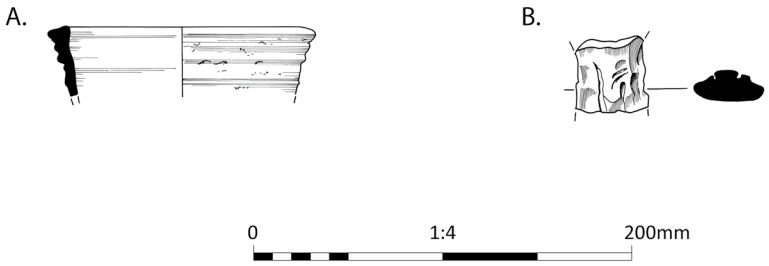
8.2.2 The post-medieval assemblage

Most of the post-medieval ceramic assemblage recovered from the site derives from Context [003] and consists of sherds of SPMOW, with a sprinkling of SPMRW. Both these fabrics have a ubiquitous distribution within Scotland; evidence suggests that the industry started some time in the late 15th century and continued, at least in the Forth littoral, into the third quarter of the 18th century (Haggarty 2004).

SPMRW sherds derive mainly from large jugs, which often have multiple neck grooving and incised wavy bands on the shoulder, and are covered with thick dark olive-green lead glaze (SF139a, Illus 17A). Sherds of SPMOW are normally from a range



Illus 15 Scottish White Gritty Ware from Context [007]: A. SF08 cooking pot; B. SF136 cooking pot/jar; C. SF22a Scottish White Gritty Ware jug



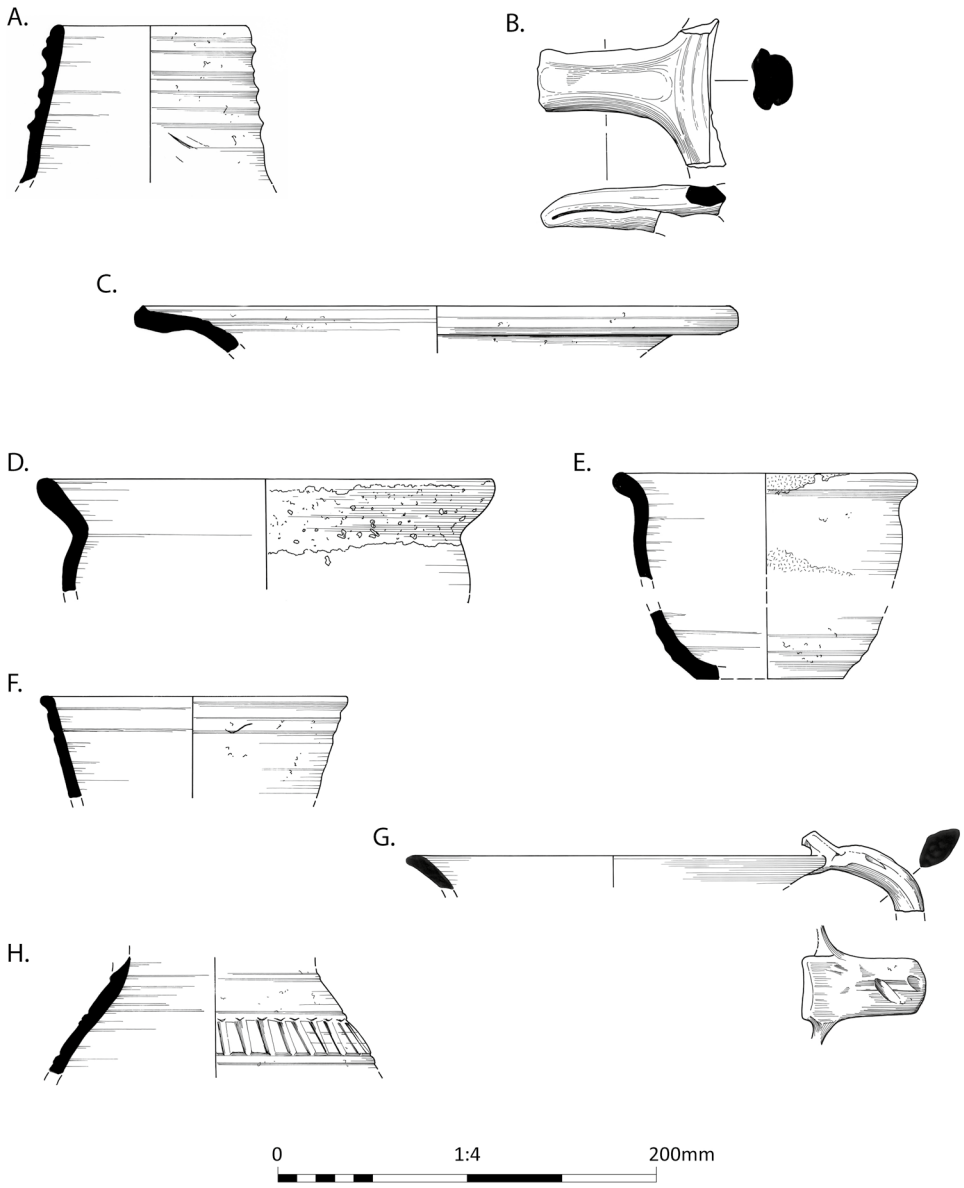
Illus 16 Imported medieval whitewares from Yorkshire: A. SF22b Yorkshire whiteware vessel, Context [007]; B. SF188 Yorkshire whiteware decorated medieval strap handle, Context [003]

of smaller vessels, including jugs; handled skillets (SF28a, Illus 17B), unstratified; flanged plates (SF196, Illus 17C); cooking pots (SF164a & SF05, Illus 17D & 17E) from Contexts [092] and [003], and small drug pots (SF95a) and an unnumbered find (Illus 17F). A range of forms in this fabric have been published (Haggarty 1980: 11–22; Caldwell & Dean 1992: 1–46; Franklin 2008; Haggarty & Lawson 2013), although they can be extremely hard to identify from single sherds, eg unusual rim (SF207, Illus 17G).

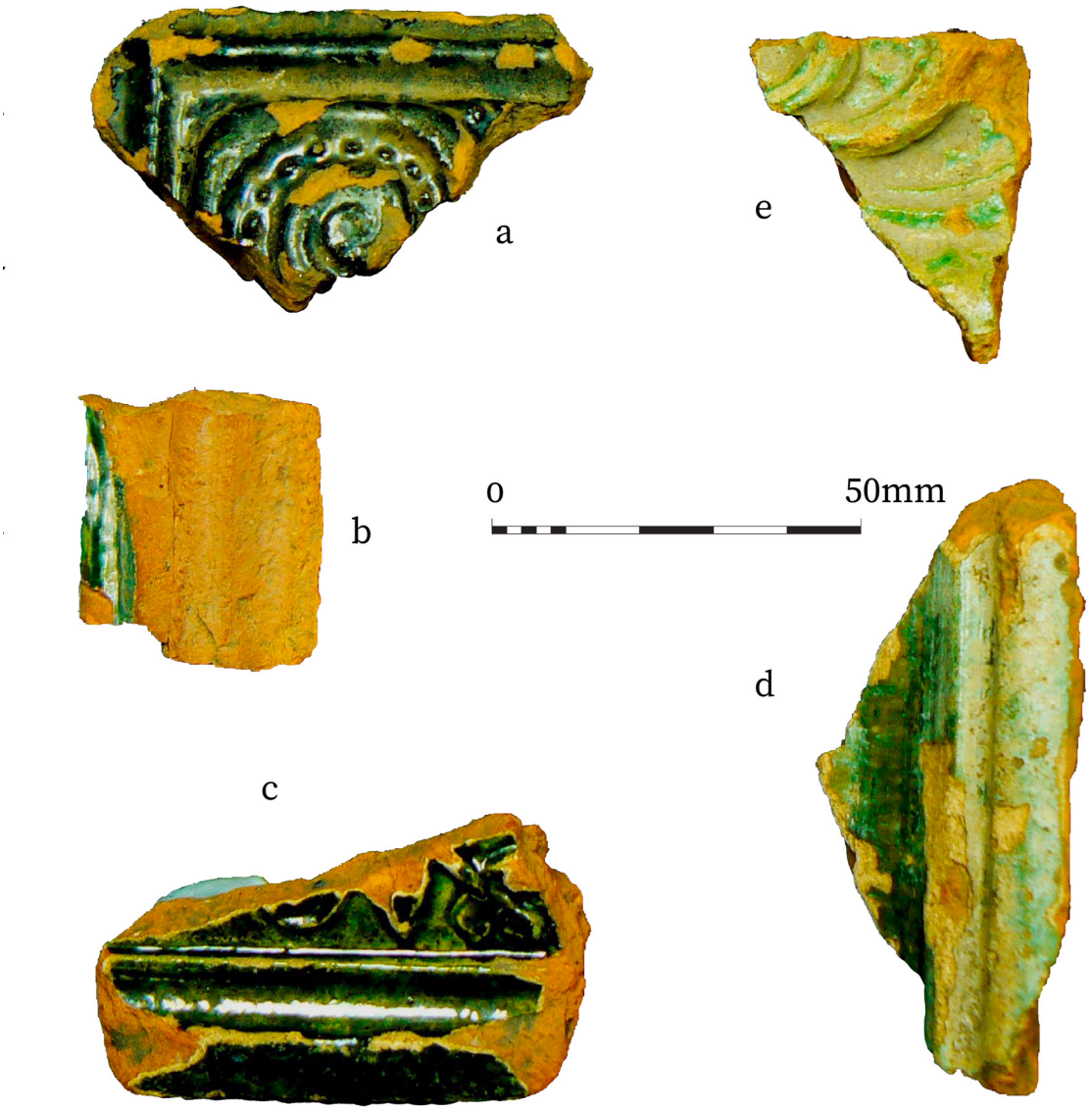
Recent analysis (Chenery et al 2004; Haggarty et al 2011) suggests that the Scottish post-medieval pottery industry is far more complicated than previously believed and that more Scottish production sites await discovery. Research on ceramic production in the Edinburgh area has revealed that at least seven potters were working just outside the city wall, in the area of Potterrow, in the first half of the 17th century (Haggarty et al 2011: 16). While this might suggest that most of the iron-rich SPMOW and SPMRW pottery recovered from excavations in and around Edinburgh had been produced locally, recent work at Niddrie suggests some pottery found there was not locally produced. Rather, Throsk in the upper Forth may have been the source for a proportion of the Niddrie sherds (Haggarty & Hughes 2012: 63); one of the few distinctively decorated SPMOW sherds from a Throsk vessel (Caldwell & Dean 1992: 66–8, 20 figs) can be paralleled by a fragment from Context [093] (SF231a, Illus 17H) at New Waverley.

Five green-glazed tile sherds from closed stoves were recovered: one unstratified (Illus 18a); two (Illus 18b & 18c) from Context [092] (SF211a & SF308), and two (Illus 18d & 18e) from Context [003] (SF04a & SF139b). These, along with a sherd from a North German polychrome stove tile recovered from the opposite side of the Canongate (Haggarty 2016: 21), double the number now recorded from Scotland. Interestingly, two of the previous six find spots were also in the Canongate, while the others were from Edinburgh, St Andrews, Perth and Stirling (Haggarty & Hall 2010). High-status stoves were, in the 15th and 16th centuries, shipped downstream from North Germany, where they were assembled for customers in the Low Countries (Gaimster et al 1990: 10). Chemical analyses of the first six Scottish finds shows that they were not of local manufacture, but, as yet, there is little comparative ICP chemical data on continental examples (Haggarty et al 2011: 4, figs 4 and 5). From 1508, the Walcheren port of Veere became the entry port for Scottish ships trading with the Low Countries, with this commerce predominantly in the hands of Edinburgh merchants through the port of Leith. It cannot, however, be assumed that the stoves were shipped from Veere, as records show Scottish ships did occasionally call in at other Low Countries ports (Lynch & Strang 1996: 239). Trade was also conducted with merchants at The Hague, Haarlem, Delft, Enkhuizen, Flushing and several other Dutch towns (Brown 1996: 270–1).

Fragments of continental wares present within the New Waverley assemblage include Weser slip-decorated pottery from 1580 to 1630, produced over a very wide area of northern Germany between the rivers Leine and Weser (Stephan 2012: 100, Abb. 1),



Illus 17 Scottish Post-Medieval Reduced Wares (SPMRW) and Scottish Post-Medieval Oxidised Wares (SPMOW): A. SF139a SPMRW jug, Context [003]; B. SF28a SPMOW handled skillet, unstratified; C. SF196 SPMOW flanged plate, Context [003]; D. SF164a SPMOW cooking pot, Context [092]; E. SF05 SPMOW cooking pot, Context [003]; F. SPMOW drug pot, Context [003]; G. SF207 SPMOW unusual vessel rim, Context [003]; H. SF231a SPMOW decorated Throsk-type vessel, Context [093]



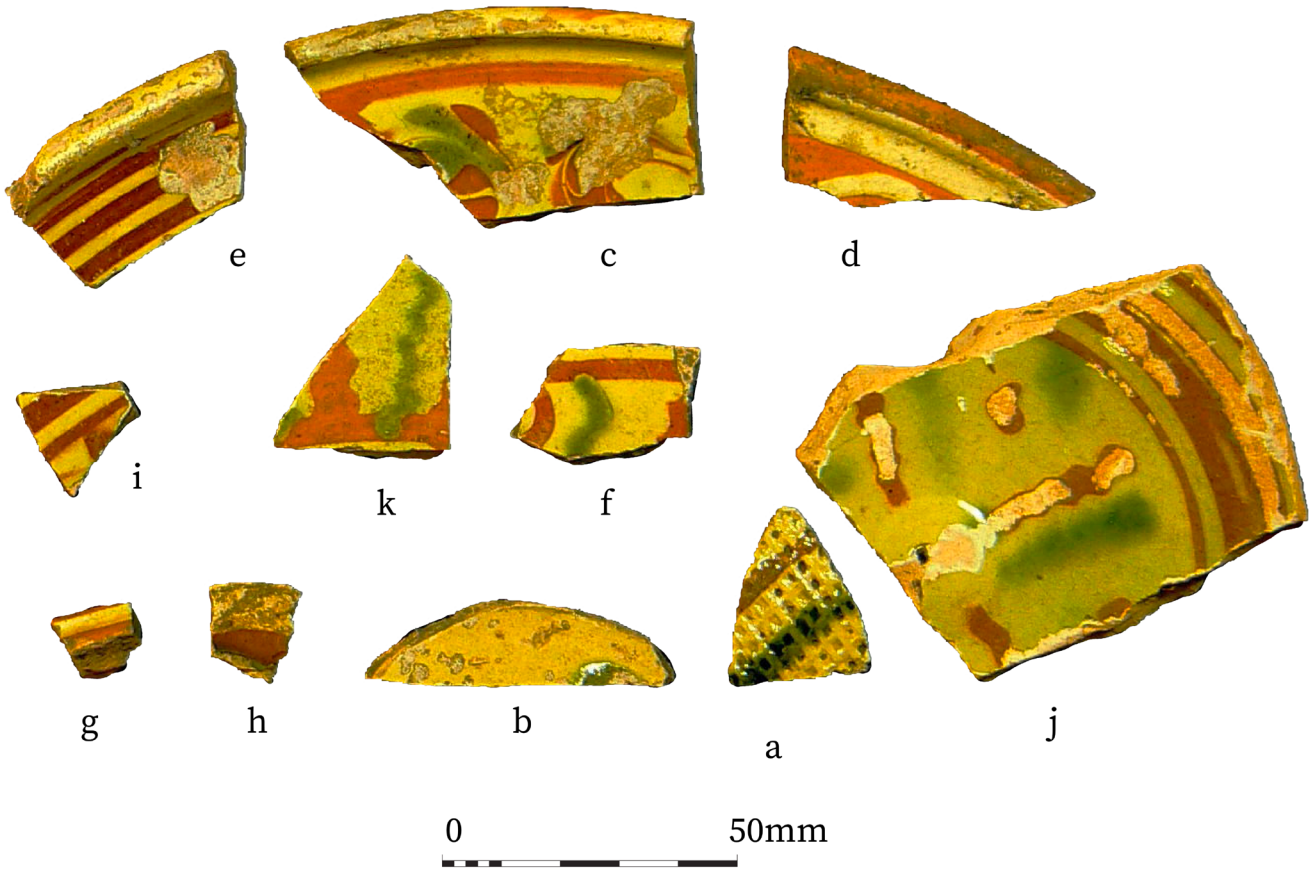
Illus 18 Green-glazed stove tile sherds: a. unstratified; b. SF211a, Context [092]; c. SF308, Context [092]; d. SF04a, Context 003; e. SF139b, Context [003]

and distributed as far as the English Channel, Ireland, Iceland, the Orkney Islands and North America, but not the Scottish mainland (Stephan 2012: 117, Abb. 21). It is likely that the New Waverley materials entered Leith as a by-product of the Baltic timber trade. Sherds of polychrome-decorated, wavy-band, hammer-headed Weser dishes have been found within 17th-century contexts at the Canongate backlands (Haggarty 2013a: 18–19, fig 13, nos 19 & D), the new Scottish Parliament Canongate site (Cox & Hall 2008: 43, fig 3.24, 75–9), and a recent excavation in Advocate's Close, Edinburgh (Haggarty 2017: 33). There is also a rim sherd from a recent excavation in Edinburgh's Cowgate (Hall & Haggarty forthcoming), and two from an excavation in the Edinburgh Old College Quadrangle (Haggarty forthcoming b). Of the 11 sherds from the New Waverley site (Illus 19), only two are not from hammer-headed dishes. One of those (SF50a), unique in Scotland, is most likely from the body of a grapen decorated with square-notch rouletting (Illus 19a); the other may be from its rounded base (SF04b) (Illus 19b). One of the hammer-headed rim sherds (SF201a) is from a dish decorated with

stylised swirling leaves (Illus 19c), another Scottish first. Of the three other rims, one (SF04c) (Illus 19d) has been decorated with a wavy band, while the remaining body sherds (SF04d, SF13a & SF17, Illus 19e, 19f & 19g; SF50b & SF50c, Illus 19h & 19i; and SF178 & SF201b, Illus 19j & 19k) all show evidence for more typical geometric designs, made up of banding and alternate wavy green and red-brown lines on a white slip background.

A small unglazed Siegburg stoneware sherd in a fine light grey fabric almost certainly came from the neck of a beaker dating to the 14th or 15th century. Siegburg was probably north-west Europe's largest ceramic production centre from the 13th to 16th centuries (Hurst et al 1986: 176–84).

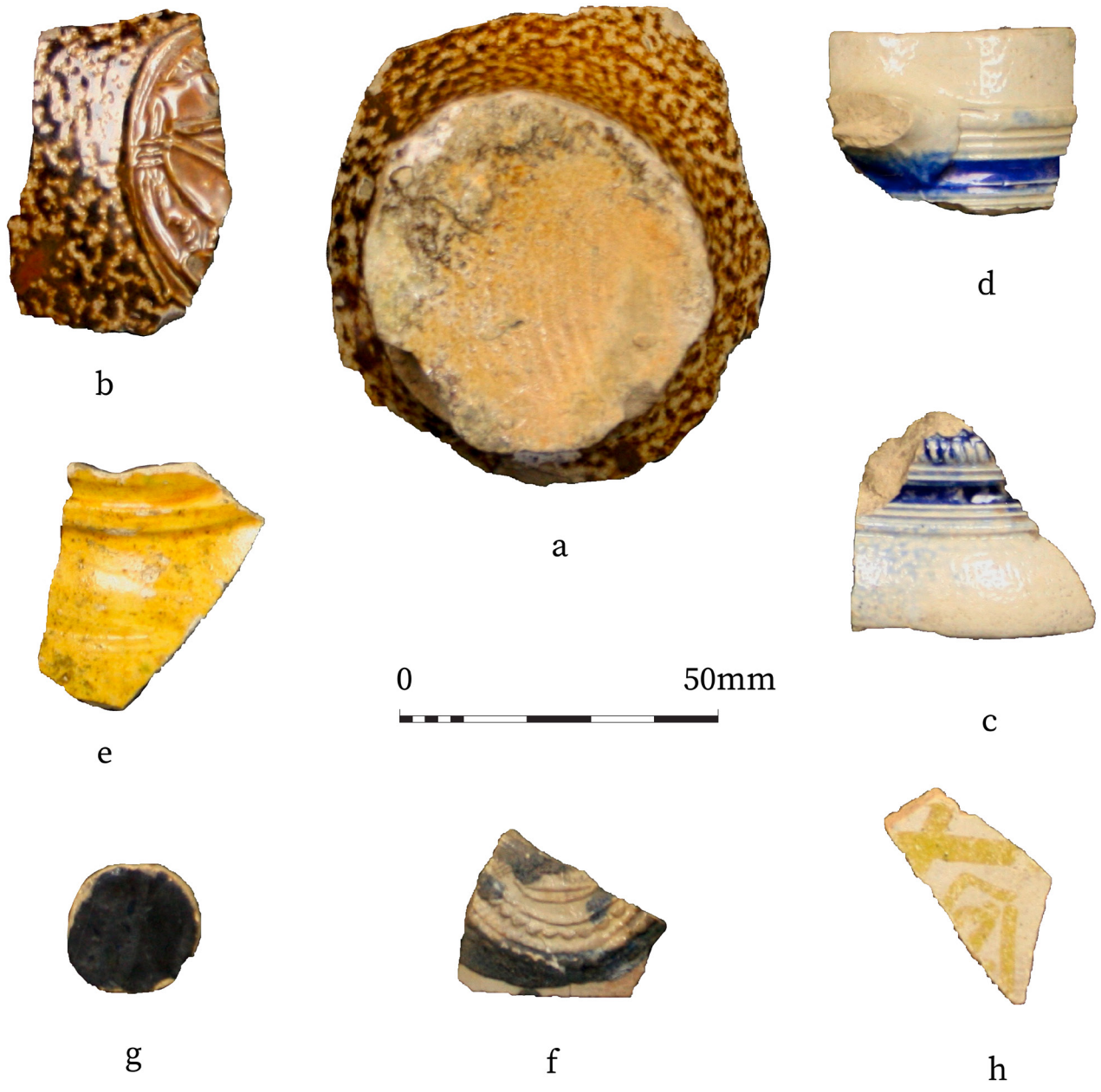
Seven classic Raeren salt-glazed, stoneware body sherds, probably from as many vessels, were recovered. All have slightly different-coloured interiors and two have heavy rilling. One of the sherds has traces of an ash glaze, similar to that more often seen on sherds from Siegburg. In the medieval period, Raeren was surrounded by a number of settlements supporting the stoneware potting industry (Gaimster et al 1990: 224). Between 1475 and 1525 new vessel forms were developed, including the classic Raeren drinking mugs, with squat necks and loop handles, which were exported in huge quantities. They are found all over Britain and were most in evidence in the first half of the 16th century (Hurst et al 1986: 196). These drinking mugs may have been Britain's



Illus 19 Weser slip-decorated pottery: a. SF50a Grapen decorated with square-notch rouletting, Context [003]; b. SF04b Possible base of grapen, Context [003]; c. SF201a Hammer-headed rim sherd of decorated dish, Context [003]; d. SF04c Hammer-headed rim sherd, Context [003]; e. SF04d Body sherd of hammer-headed dish, Context [003]; f. SF13a Body sherd of hammer-headed dish, Context [003]; g. SF17 Body sherd of hammer-headed dish, Context [003]; h. and i. SF50b and SF50c Body sherds of hammer-headed dish, Context [003]; j. SF178 Body sherd of hammer-headed dish, Context [003]; k. SF201b Body sherd of hammer-headed dish, Context [003]

first truly classless imported ceramic type.

The New Waverley site produced ten Frechen stoneware sherds, all of which are probably from Bartmann-type jugs. Three are unstratified, while one (SF231b) is from Context [093] and four (SF139c–f) are from Context [003]. Frechen wares appear to have replaced the Raeren jugs as the stoneware of choice from about 1550 onwards. The wares were widely distributed through Britain and the Low Countries until the end of the 17th century. All ten sherds are in a grey fabric, and one base has the typical wire marks (SF139c, Illus 20a). The sherd from Context [093] is in a dark grey fabric with a light grey/yellow rilled internal surface. Its exterior

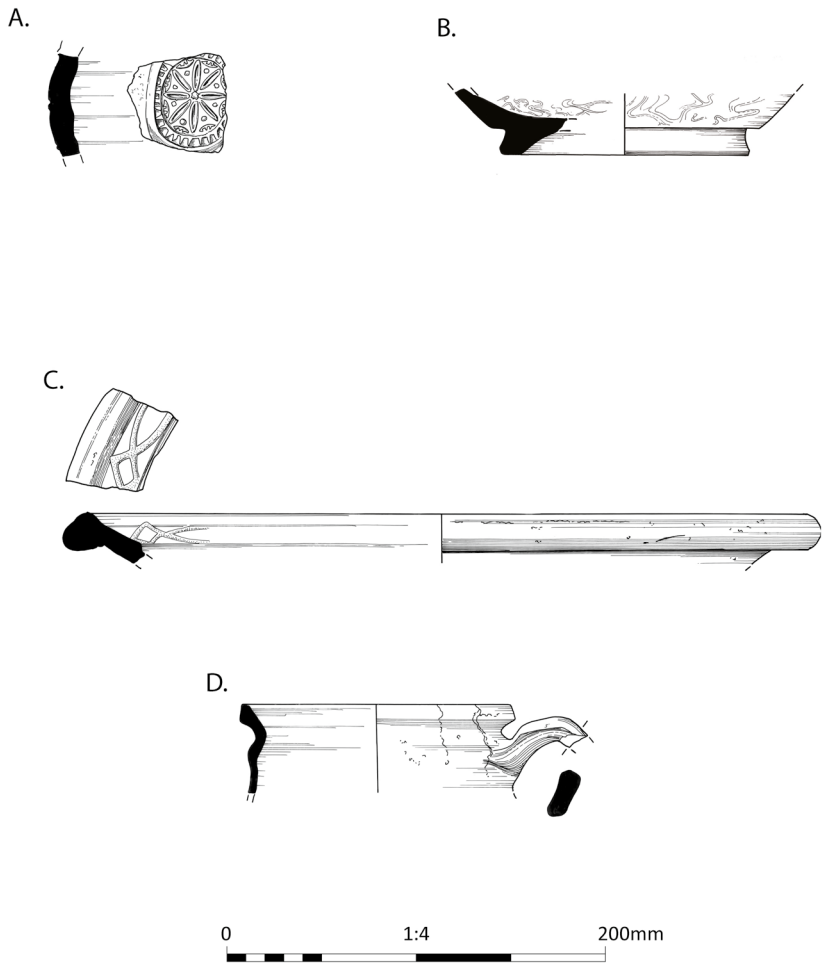


Illus 20 Imported pottery: a. SF139c Base of Frechen stoneware vessel, Context [003]; b. SF231b Frechen stoneware sherd with brown moulded medallion with part of a coat of arms, Context [093]; c. SF139g Basal angle sherd from a moulded Westerwald-type, biconic jug, Context [003]; d. SF28c Salt-glazed stoneware jug rim sherd, unstratified; e. SF211b Beauvais jug body sherd, Context [092]; f. SF211c and SF211d Two conjoining sherds of Beauvais or German whiteware with part of an applied medallion, Context [092]; g. SF310 Gaming counter from Mature Valencian Lustreware sherd, Context [092]; h. SF50d Body sherd of Late Valencian Lustreware, Context [003]

is covered with the typical dark and light brown mottled tiger-ware salt-glaze, around what remains of a plain brown moulded medallion showing part of a coat of arms, including a crown (SF231b, Illus 20b). One of the unstratified sherds has a light brown heavily rilled internal surface, while its exterior has most of a fairly common eight-petalled oval medallion (SF28b, Illus 21A).

One *c* 1600–50 salt-glazed stoneware basal angle sherd comes from a moulded Westerwald-type, biconic jug (SF139g, Illus 20c). The cordons above its base have been decorated with cobalt-blue. Cobalt decoration was introduced at Raeren by Jan Eames in 1582. From *c* 1590 some Raeren potters moved to Westerwald, where they made similar wares. Produced into the 17th century, they are termed Westerwald-type. An unstratified salt-glazed stoneware jug rim sherd (SF28c, Illus 20d), with a handle scar and a cobalt-blue band on its neck, may belong to the same vessel.

Throughout the late 15th century and the first half of the 16th, a range of Beauvais whitewares were produced and extensively traded. These imported French high-status fine white earthenware vessels have a wide distribution in Scotland. The small monochrome glazed jugs, copying a stoneware form, are less common than the large dishes (Haggarty 2006; Haggarty 2013b). These jugs are often decorated with applied medallions. From Context [092] there is a jug body sherd (SF211b) with a typical neck (Illus 20e), and two conjoining sherds (SF211c & SF211d) from an example with part of an



Illus 21 Imported and unknown wares. A. SF28b Frechen stoneware sherd with eight-petalled oval medallion, unstratified; B. Italian marbleised bowl, Context [003]; C. SF04e Metropolitan wheel-thrown, slipware dish, Context [003]; D. SF164d Mottled green, glazed vessel in a white fabric, Context [092]

applied medallion. The medallion is partly covered and surrounded with a degraded black substance which shows patches of cobalt-blue (Illus 20f). This may therefore not be a Beauvais product, but rather a sherd of German whiteware – if so, this would be a first from a Scottish site. One small orange/red body sherd comes from a Type II Martincamp flask (SF13b), a long-necked vessel dated to the 16th century (Hurst et al 1986, 103–4; Haggarty 2013b: 85, fig 6).

Two fragments of Spanish pottery were recovered, including a sherd of Mature Valencian Lustreware (SF310) from Context [092], which had been ground into a round gaming counter, *c* 20–22mm in diameter. It has a sandy reddish fabric with lighter margins and tin-glazed surfaces. On one face, two bands of lustre decoration are identifiable (Illus 20g). The second fragment (SF50d) is a body sherd of Late Valencian Lustreware in a pale pink fabric covered with lead glaze on its exterior and tin glaze on its interior. The tin glaze has been decorated with lustre painting (Illus 20h).

An unstratified basal angle sherd from an Italian marbleised bowl (Illus 21B) was also recovered, though it is not known to which of Valeri's large bowl types it belongs (Valeri 2012: 21, fig 23). Imported marbleised pottery has been identified at over 50 British sites (this is the fifth Scottish find spot), and in Holland it has been identified in contexts dating from 1575 to 1650 (Hurst et al 1986: 33–7; Baart 1983: 161–87, figs 24–5). A bowl rim sherd decorated with slips under a lead glaze was identified at an earlier excavation in the Canongate (Haggarty 2013a: 20) while two costrel sherds were recovered from Advocate's Close, Edinburgh (Haggarty 2017: 32). Excavation at Eldbotle (Hall & Haggarty 2013: 285, figs 17–10) recovered a sherd from a moulded lion-head lug from a bichrome, marbled, north Italian standing costrel, perhaps associated with the nearby Archerfield House. A second lion-head lug, similar to the Archerfield example, was identified by the author at excavations at Fetternear, an Aberdeenshire mansion, the late 17th-century headquarters of the Jesuit mission in Scotland.

A sherd from the rim and spout of an Italian tin-glazed jug in a soft, smooth, white fabric (SF231c) from Context [093] has been decorated with a manganese band and cobalt-blue painting below its exterior rim (Illus 22). Few sherds of later medieval Italian tin-glazed pottery have been identified from Scottish excavations: two sherds from Dumbarton (Hall 2005: 342, figs 41–2); two from Leith (Haggarty forthcoming a), and five from a late 15th-century Ligurian or Tuscan flower vase (Haggarty & Jennings 1992: 53, fig 5).

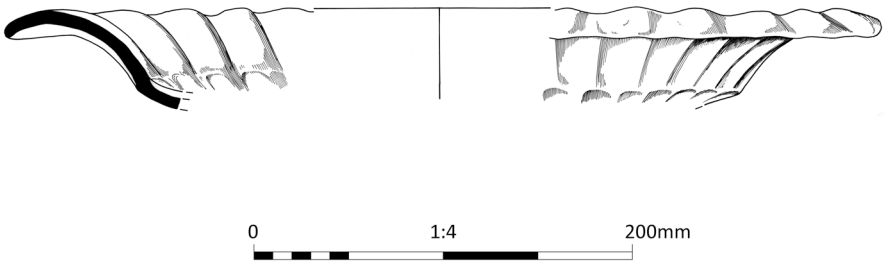
Several stoneware sherds are almost certainly of English origin, including a basal angle sherd from a salt-glazed stoneware two-tone mug in a rough off-white fabric with tiny black inclusions. There are also six unstratified salt-glazed sherds, which derive from a minimum of two vessels, both with two-tone, light grey/brown exteriors. The fabric has the same tiny black inclusions suggesting London products. Similar vessels, used as mercury containers, have been identified from an excavation in the Old College Quadrangle, Edinburgh (Haggarty forthcoming b). Finally, there are two thinly potted conjoining body sherds in a light grey salt-glazed fabric with a darker core, the exterior of which has been dipped in a matt chocolate-brown wash.

A rim sherd (SF04e) from a Metropolitan wheel-thrown, slipware dish in a red sandy fabric with reduced core was a product of the Harlow Kilns (Illus 21C), possibly of the Latton Street kiln, and has an underglaze decorated with a common white-trailed slip border pattern, type E13 (Davey & Walker 2009: 106–7, fig 201). These wares were

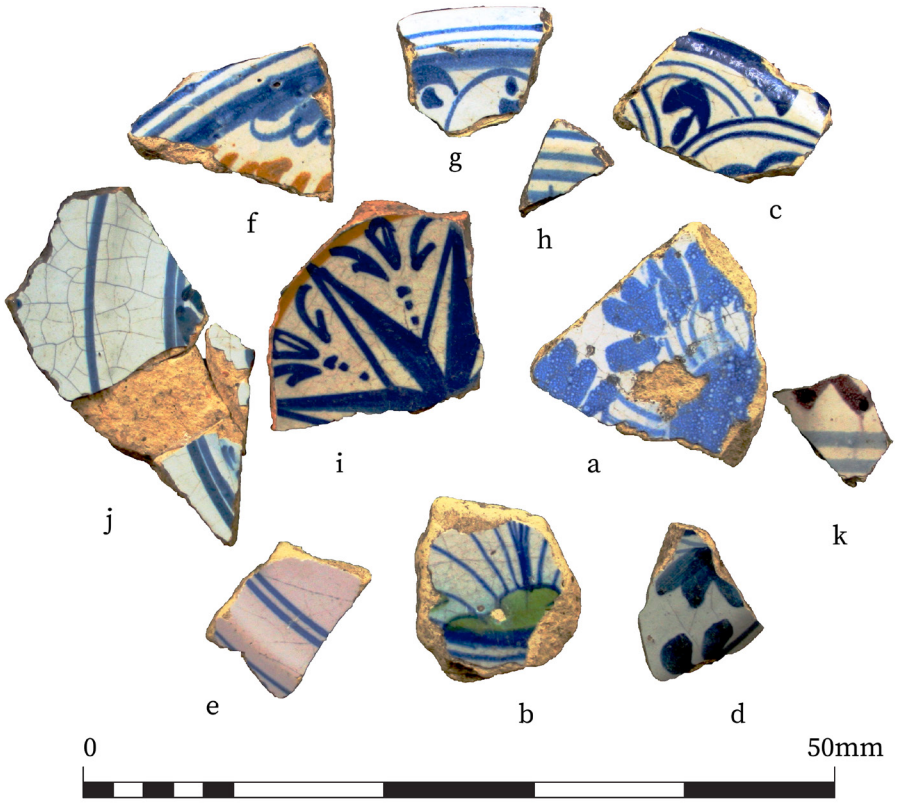
Illus 22 SF231c Sherd from a decorated Italian tin-glazed jug, Context [093]

traded in the 17th century and had previously only been recorded as far north as Newcastle.

Tin-glazed earthenwares are relatively common at the New Waverley site, with 32 sherds dating from the late 16th to 18th centuries. All of the sherds from [003] have lead-glazed bases and are of late 16th- or 17th-century date, but few are large enough to allow a source to be identified with confidence. Two interesting sherds come from the rim and upper body of a large moulded double-tiered, black-glazed gadrooned dish (SF214 & SF233a, Illus 23). Scottish examples from Finavon Castle, Niddry Castle, Edinburgh Cowgate and Leith Fort (Simpson 1958: 413; Aliaga-Kelly et al



Illus 23 SF214 & SF233a Dutch black tin-glazed earthenware moulded double-tiered gadrooned dish, Context [003]

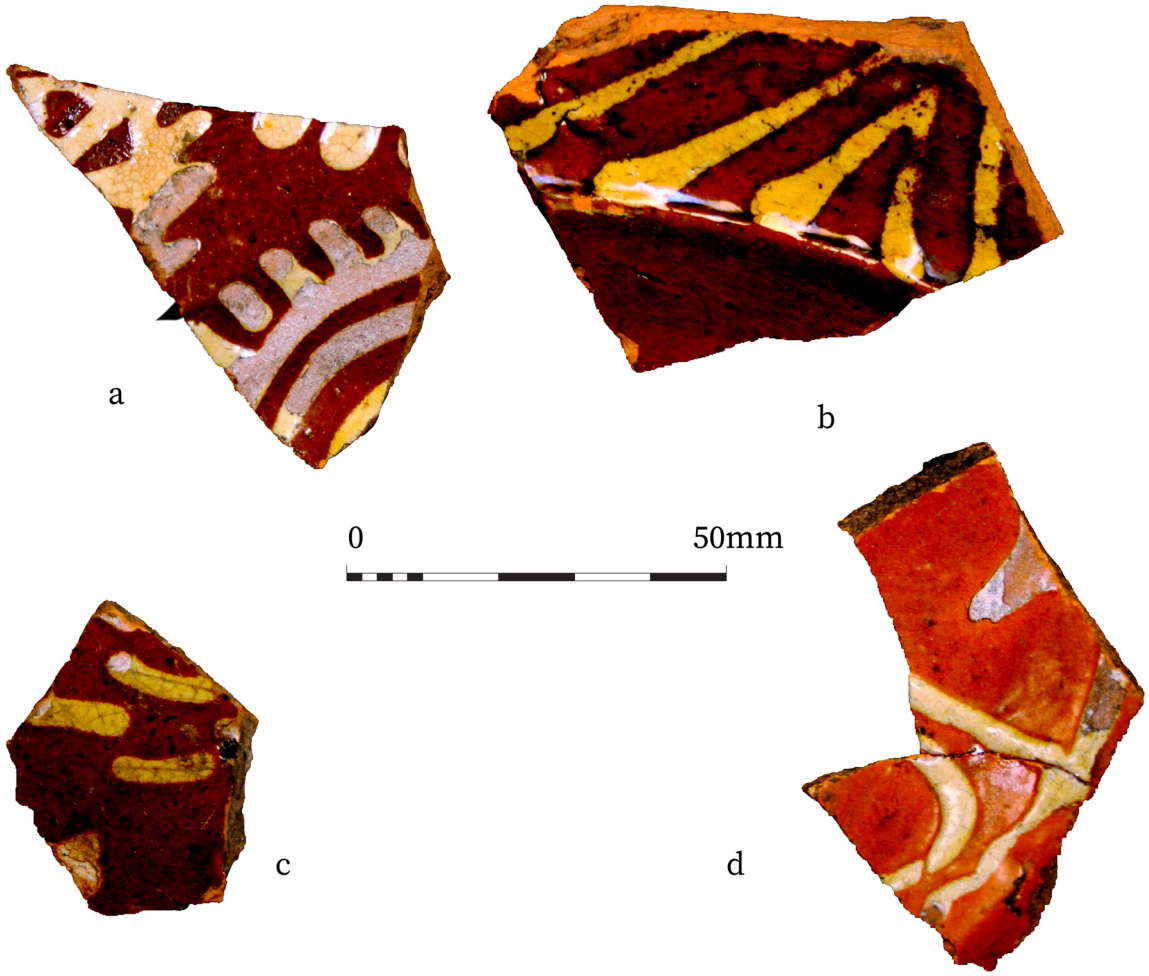


Illus 24 Anglo/Dutch tin-glazed (maiolica) pottery: a–e. SF19a–e Sherds from chargers or dishes, Context [003]; f.–h. SF139h–j Two dish rims and a body sherd, Context [003]; i. SF158 Base sherd, Context [003]; j. SF04f–j Five sherds from a dish/charger, Context [003]; k. SF04k Sherd from a drug jar, Context [003]

1998: 809, fig 112a; Hall & Haggarty forthcoming and Haggarty forthcoming a) demonstrate that the white undecorated type was more common, and this black-glazed example may be the first from a Scottish site. Copying earlier Italian and French examples, these were produced in the Netherlands from around the middle of the 17th century – a cesspit in Breda, dated to the 1660s, contained three white-glazed examples (Hupperetz 2010: 283, fig. 4). A perforated handle sherd from a type of porringer/bleeding bowl (SF201c), in a whitish fabric, is decorated on its upper surface with a splashed mottled green glaze, while its exterior was probably white. Excavated examples from Scotland are confined to Niddry Castle (Aliaga-Kelly et al 1998: 809, fig 18, item 2966), Edinburgh Castle (City of Edinburgh Museum) and Linlithgow Palace (Laing 1968: 137–8, fig 76).

Thirteen Anglo/Dutch tin-glazed (maiolica) sherds are in a variety of fabrics ranging from brick-red to white. There are two rims, two bases and a body sherd (Illus 24a–e) from chargers or dishes (SF19a–e); two dish rims and a body sherd (SF139h–j, Illus 24f–h); a single base sherd (SF158, Illus 24i); five sherds from a dish/charger (SF04f–j, Illus 24j) and one from a drug jar (SF04k, Illus 24k).

Context [092] produced eight small abraded cobalt-blue decorated sherds of late 17th- or early 18th-century date (SF211e & SF215). Among the unstratified tin-glazed (Delft type) material

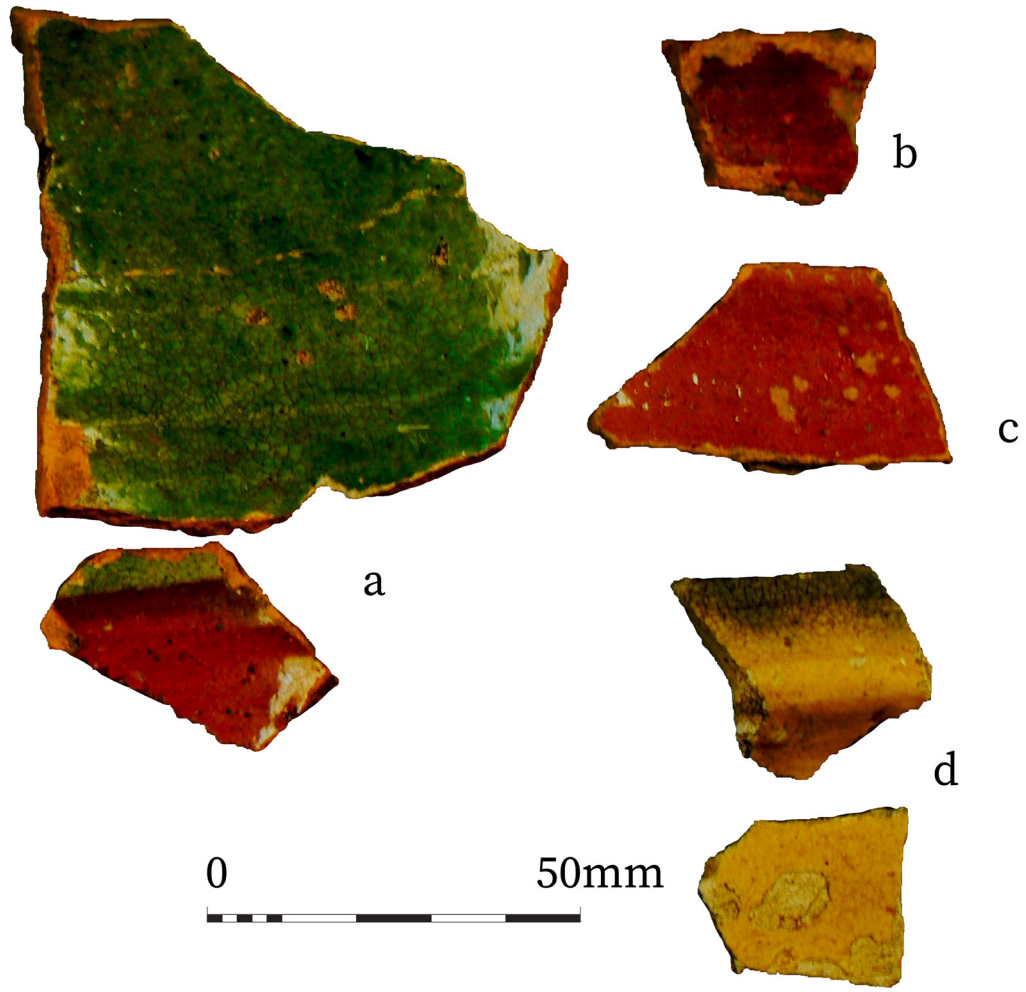


Illus 25 White-trailed slip-decorated sherds: a. SF231d Rim and cavetto decorated underglaze with white slip-trailed decoration, Context [093]; b. SF233b Sherd from the shoulder of a dish, Context [003]; c. SF4l Sherd in a red sandy paste, possibly from the Low Countries, Context [003]; d. SF95b–c Two conjoining sherds from the cavetto of a dish, possibly from the Low Countries, Context [003]

recovered were 13 sherds of various dates, two of which are from tiles. One has a white glaze, two possible pin holes and a cobalt-decorated spinnekop (spider head), suggesting that it is 18th-century and Dutch (however, references have been found to spinnekop motifs being in use in the latter half of the 17th century and so the example may be as early as mid-17th century; van Dam et al 1984: 174). Another English or Dutch sherd, of 17th- to early 18th-century date, in a whitish smooth fabric, has part of a female figure (perhaps a shepherdess) with a long pole or crook painted on its glazed surface.

There are a few problematic white-trailed slip-decorated sherds, one a rim and cavetto in a hard red sandy fabric decorated underglaze with white slip-trailed decoration (SF231d, Illus 25a). This sherd is similar to several others from the Canongate that have been analysed as part of the Scottish redware ICP project. As a fabric group the best match was from the Tweed Valley, possibly a kiln on the coast just south of the Tweed estuary (Haggarty et al 2011: 49, fig 46). The source of a sherd of hard-fired red fabric from the shoulder of a dish (SF233b, Illus 25b) is unknown. A sherd in a red sandy paste (SF4l, Illus 25c) and two conjoining sherds, again from the cavetto of a dish, may be from the Low Countries (SF95b & SF95c, Illus 25d). Sixteen sherds of Low Countries redware were recovered from this site, mainly from Contexts [003] and [009].

From Context [099] three body sherds from a heavily rilled vessel, possibly of Low Countries cooking pot form, in a dense brick-red sandy fabric



Illus 26 Low Countries redwares and whitewares: a. SF181a–c Sherds from heavily rilled vessel of possible Low Countries cooking pot form, Context [099]; b. and c. SF181d–e Redware rim and body sherds, Context [099]; d. SF164b–c Two sherds of Low Countries whiteware from vessel with evidence of trailed slip decoration, Context [092]

(SF181a–c) were recovered. Its interior has in part been white-slipped under a bright green glaze, while its lead-glazed exterior is brown (Illus 26a). From the same context came a redware rim and body sherd (SF181d–e), possibly from different vessels of similar form (Illus 26b–c). From Context [092] there are two sherds, one rim and one body, from another open vessel in a hard off-white fabric with numerous inclusions (SF164b–c). Its yellow interior shows signs of burning, while its exterior and rim are green, and has evidence of flaked trailed slip decoration (Illus 26d). Context [092] contained a rim neck and shoulder sherd with handle fragment from an unknown wheel-thrown dipped, mottled green, glazed vessel in a white finely gritted fabric (SF164d, Illus 21D).

8.2.3 Conclusions

The abraded nature of the small medieval ceramic assemblage suggests that the backlands to the rear of the Canongate were under cultivation during the medieval period. The post-medieval ceramic assemblage was mostly recovered from Context [003], thought to be made up of introduced soils. If this is the case, given the status of the ceramics it contained, they were almost certainly derived from elsewhere in Edinburgh. The imported sherds assist us in developing insights into the city's trading links and its socio-economic dynamics. Significantly, it probably also reflects a level of high-status consumption, along with evidence of ceramic display at a time when the sideboard was becoming an important feature in houses of standing. However, none of the eight tile sherds from luxury imported purpose-built smokeless stoves recovered to date from excavations in the Canongate can be associated with individual buildings, either of a religious or a secular nature.

8.3 Appendix 3: The clay tobacco pipe

Dennis Gallagher

A full detailed clay tobacco pipe report and catalogue is contained within the site archive.

8.3.1 Introduction

The pipes from the New Waverley excavation range from the early 17th century to the early 18th century. In total, 673 pipe fragments were recovered, comprising 128 bowl fragments, 530 stems and 15 mouth pieces. The habit of pipe-smoking declined in Scotland in the early 18th century as snuff became the favoured means of consuming tobacco. While pipe-smoking became popular again in the early 19th century, there are no 19th-century pipes in the present assemblage, despite the presence of the major pipe factory of Thomas White nearby in Jack's Close.

8.3.2 The assemblage

8.3.2.1 Early 17th-century bowls

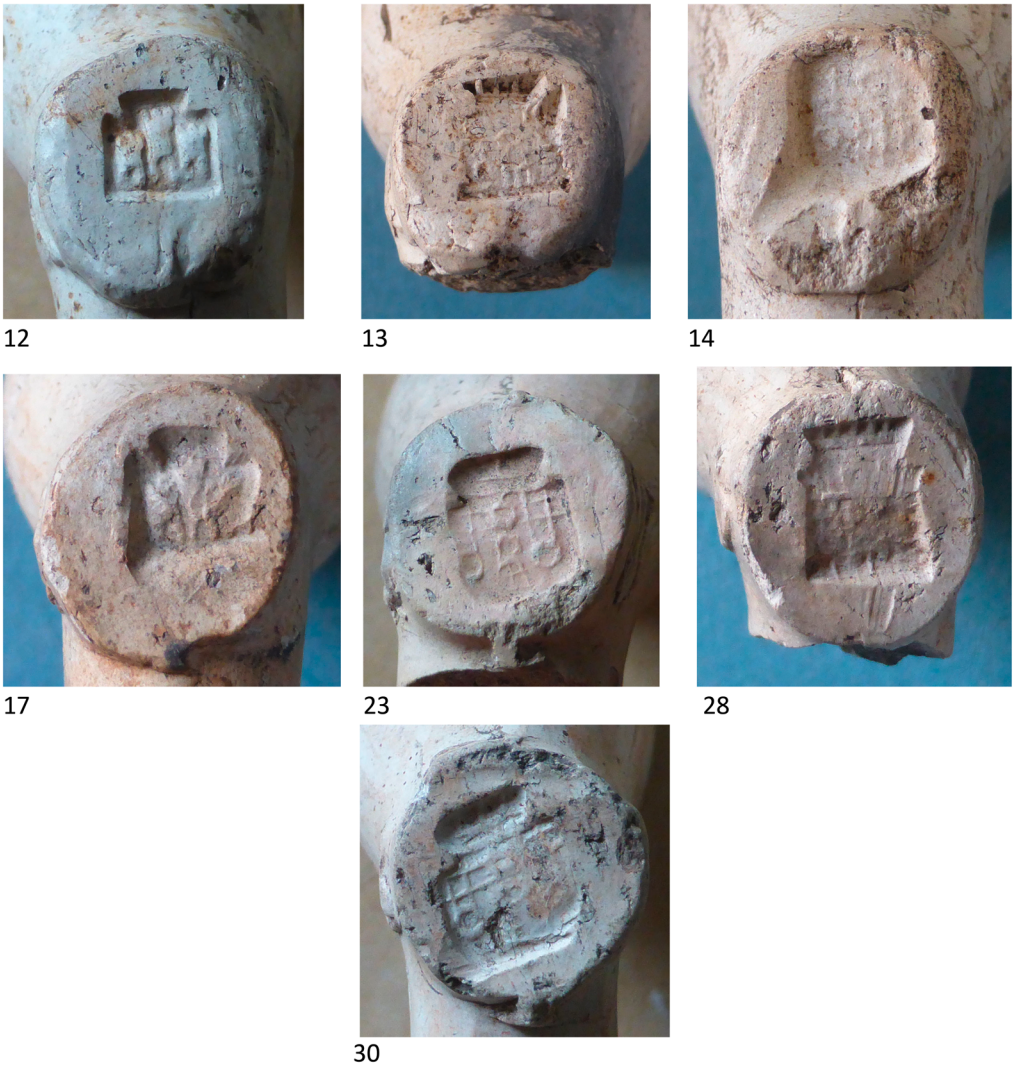
The assemblage includes seven unmarked bowls from the period 1610–40. Some may be early bowls by William Banks, but the lack of marks makes assignation to a particular maker difficult. The pipes are biconical forms similar to those excavated from a pre-1637 context at the Tron Kirk, Edinburgh (Gallagher 1987b; Haggarty & Lawson 2013: 29).

8.3.2.2 William Banks

The assemblage contains 23 pipes produced by the Edinburgh maker, William Banks (Illus 27). Banks is first recorded as a pipemaker in Edinburgh in 1622 and he was, until his death in 1659, by far the most prominent pipemaker in the city, enjoying a monopoly in the trade for much of that time (Gallagher 1987a: 5–8). The Banks pipes vary considerably in quality. Most pipes had mould-applied initials on the side of the base, as was usual on Scottish products in the 17th century. Many had a basal stamp based on the arms of the city – an indication of the maker's recognised position within the burgh. The highest-quality pipes were hand-burnished to give the clay a high polish, while some of the pipes show evidence of the mould-imparted letters of the maker's marks on the side of the bowl having been recut, a sign of long use (Nos 12 and 30, Illus 27).

8.3.2.3 Thomas Banks

Thomas Banks was a son of William Banks. Four small narrow-necked bowls marked 'TB' (Illus 28) are datable typologically to *c* 1660–80 and may be assigned to the period after his father's death, when he emerged as an independent maker.



Illus 27 Basal stamps on clay tobacco pipes by William Banks, *c* 17th century (© Dennis Gallagher)

8.3.2.4 William Young

Young is first recorded as a pipemaker in Edinburgh in 1653 and he died in 1670. His pipes are of a distinctly bulbous form. He used a basal stamp that is a detailed variant on the triple-towered arms of the burgh of Edinburgh, with six examples in the present assemblage showing signs of wear of the die, but No. 37 (unstratified; SF56) still exhibits the fine detail of the masonry (No. 37, Illus 28).

8.3.2.5 Patrick Crawford

Fifteen pipes marked 'PC' (Nos 48, 52 and 53, Illus 28) are the work of Patrick Crawford, recorded as a maker in Edinburgh between 1671 and 1696. His business was large enough to enable him to supply pipes for the ill-fated expedition to found the Scottish colony at Darien. Some of the bowls have forms that are generally dated typologically to *c* 1660–80, and are possibly early examples of his work, but examples from Darien, found together with much larger bowls, demonstrate the possible longevity of forms. Crawford pipes have a variety of basal stamp styles, ranging from a castle with flanking letters, influenced by the marks of the Edinburgh hammermen (Nos 48 and 52), to a simple three-letter form, both evidenced on examples from New Waverley (No. 53).

8.3.2.6 Other Edinburgh pipes

While the above makers are well documented, others are less so and there is less certainty about identifying their products and assigning date ranges. A large bowl marked 'RS' (No. 56, Illus 28) is of a much less frequent form than those of Crawford,

indicating a much smaller scale of manufacture. There is a comparable large bowl with a fairly upright form, of late 17th-/early 18th-century date, from Edinburgh Castle (Gallagher 1997: 179, no. 50) and more forward-leaning forms from the Edinburgh Canongate backlands (Gallagher 2013: 25–6). A bowl marked 'A/M' (or possibly 'AW') is an uncommon find. Davey (1997: 96–7) has suggested that a similar pipe from St Andrews was a product of William Arthur of Edinburgh. A further example was recovered from the Holyrood Parliament site (Gallagher 2010: 55 and 56, fig 1.33). The bowl marked 'A/A' is an upright form similar to that of the 'RS' bowl. The maker of the 'A/A' bowl is tentatively identified as Alexander Aiken. Pipemakers named Aiken have been recorded both in Glasgow and in Edinburgh, but the present pipe may be a product of Alexander Aiken who was married in Edinburgh in 1680 (Paton 1905: 11).

All recorded mouthpieces have simple rounded ends formed in the mould. There is one secondary mouthpiece, from Context [003], where the broken end of a burnished stem has been carefully carved to produce a rounded terminal.

8.3.2.7 Dutch-style pipes

Dutch imports of pipes were common in Scotland during the first half of the 17th century, but the interruption of trade during the wars with the Dutch republic, in particular that of 1665–7, together with the imposition of an import duty on pipes in 1661, limited the number of Dutch pipes entering southern Scotland (*RPS* 1661/1/122). The home industry was thus able to expand. Most of the imports at New Waverley were of low quality, for example No. 76 (Illus 29), a bowl with a moulded rose decoration – variants of this design are found throughout Scotland. Davey (1992: 280–1) identified over 50 examples of this design, and examples continue to be found in Scottish assemblages, for example Holyrood (Gallagher 2010: 57 and fig. 139, no. 107) and Stirling Castle (Gallagher & Ewart 2015: fig 14.24, nos 7–13). A stem fragment of a Jonah pipe (No. 79) is more unusual (Illus 29); the complete pipe would be in the form of Jonah being swallowed by the monster, the scales being part of the latter's body (Duco 1987: 92). There is a similar fragment from Scalloway Castle, Shetland (Davey 1992: 281). One stem fragment (No. 77) is decorated with two fleur-de-lys stamps (Illus 29).

Illus 28 Basal stamps on clay tobacco pipes by Thomas Banks, William Young and Patrick Crawford, *c* 17th century, and a basal stamp marked RS, *c* late 17th/early 18th century (© Dennis Gallagher)


76


79


77


83


84


87

Illus 29 Clay tobacco pipes of Dutch style and English style, *c* 17th century (© Dennis Gallagher)

Again, this style of decoration is commonly found among Dutch imports into Scotland, but in this case it is indicative of a higher quality of pipe, as extra work was required during production to apply the stamps.

8.3.2.8 English-style pipes

The assemblage included 11 spurred bowls, a form not associated with Edinburgh pipemakers (Illus 29, Nos 83, 84 and 87). These are unmarked, so there is no direct indication of place of manufacture though the form is generally associated with English pipes. They vary in the degree of finish, some with a high burnish being a better quality of pipe. While it is possible that an Edinburgh maker produced an atypical form, pipes of high quality normally would carry a basal mark based on the city's arms, the sign of an accredited manufacturer. They occur in small numbers in other Scottish assemblages and are likely to be imports rather than Scottish products. Other examples were found in Edinburgh on the site of the Scottish Parliament (Gallagher 2010: 55 and 58, fig 1.40).

The pipes date from between 1640 and 1660 and may be associated with the Cromwellian occupation of Edinburgh – Cromwell's army was quartered in

the Canongate from September 1650 until 1660. These English-style pipes, whether made by Scottish makers or imported, may be taken as evidence of that occupation. The smoking habits of the English soldiers is well attested in the Scottish propaganda writings relating to the invasion, for example at Castleton, Roxburgh, where it was said that they burned the church communion table and, 'lighted their tobacco pipes' with the Books of Session (Burn 1829: 177).

8.3.3 Catalogue of illustrated pipes

8.3.3.1 William Banks

▸ 12
Heeled bowl, bottered, milled and finely burnished, mould-imparted W/B with recut B, small castle-style basal stamp; William Banks, 1640–60; Context [092] (SF219).

▸ 13
High-quality heeled bowl, bottered, milled and burnished, mould-imparted W/B (former partly obscured by burnishing), portcullis-style basal stamp; William Banks, 1650–60; Context [003B] (SF140).

▸ 14
Heeled bowl, bottered, milled and burnished, mould-imparted W/B (former partly obscured by burnishing), portcullis-style basal stamp; William Banks, 1640–60; Context [003B] (SF140).

▸ 17
High-quality heeled bowl, bottered, partly milled and burnished, mould-imparted W/B and small castle-style basal stamp; William Banks, 1640–60; Context [003] (SF02).

▸ 23
Heeled bowl and stem fragment, bottered, milled and highly burnished, mould-imparted W/B and portcullis-style basal stamp; William Banks, 1650–70; Context [003] (SF06).

▸ 28
Heeled bowl, bottered and milled, mould-imparted W/B with only partial letter B; William Banks, 1650–70; Context [092B] (SF148).

▸ 30
Base and stem fragment, mould-imparted W/B with evidence of recutting of the W, portcullis-style basal stamp; William Banks, 1650–70; Context [092] (SF309).

8.3.3.2 Thomas Banks

▸ 32
Slender heeled bowl, bottered, milled and burnished, mould-imparted T/B and small basal stamp of simplified portcullis; 1660–80; Context [003] (SF202).

8.3.3.3 William Young

▸ 37
Highly finished heeled bowl, bottered, milled and burnished, mould-imparted W/Y on damaged based, Y recut, castle basal stamp; William Young, 1650–70; Unstratified (SF56).

8.3.3.4 Patrick Crawford

▸ 48
Large heeled bowl, bottered, milled and burnished, sharp impression of mould-imparted P/C, basal stamp of castle flanked with initials PC; Patrick Crawford, 1680–1710; Context [003] (SF135).

▸ 52
Heeled bowl, base damaged, bottered, milled and highly burnished, mould-imparted P/C and part of a castle-style basal stamp with flanking PC; Patrick Crawford, 1670–1700; unstratified (SF319).

▸ 53
Large heeled bowl, bottered, partially milled and burnished, PCE basal stamp; Patrick Crawford, 1670–1700; Context [003] (SF160).

8.3.3.5 Robert Smith

▸ 56
Large heeled bowl, bottered and burnished but no milling, crude mould-imparted R/S, recut R, deformed portcullis-style basal stamp; possibly Robert Smith, 1670–1720; Context [003] (SF202).

8.3.3.6 Dutch pipes

▸ 76
Heeled bowl, bottered, with moulded rose decoration, Dutch, mid-17th century; Context [003] (SF258).

▸ **77**
Stem fragment with two single fleur-de-lys stamps; Dutch, 1630–60; Context [092B] (SF172).

▸ **79**
Stem fragment with scales in relief, part of a Jonah pipe; Dutch, 1635–50; Context [003] (SF116).

8.3.3.7 Spurred bowls
▸ **83**
One side of a spurred bowl, bottered and burnished; cf London type 9 (Atkinson & Oswald 1969: 178–9), *c* 1640–60; Context [091] (SF144).

▸ **84**
Spurred pipe, bottered, milled and burnished; 1640–60; Context [003B] (SF140).

▸ **87**
Spurred bowl and stem fragment, milled, high burnish; London type 15 (Atkinson & Oswald 1969: 178–9), 1660–80; Context [003] (SF20).

8.4 Appendix 4: The glass assemblage

Dr Hugh Willmott

8.4.1 Introduction

A small assemblage of glass was recovered from the excavation. All the glass is post-medieval in date, mainly deriving from the 17th and 18th centuries. The majority of the assemblage is of very marginal importance (consisting of shards of a minimum of ten wine, beer and ink bottles and a very fragmentary group of 17th- to 19th-century window glass), but it includes a small quantity of significant vessels. A full detailed glass report and catalogue is contained within the site archive.

8.4.2 Vessel glass

Although a minimum number of only seven vessels were recovered from the excavations, several of these are very rarely found in the UK. There are portions of what are likely to be two different goblets with serpentine stems (SF137 & SF145). Such stems were formed using hollow ribbed tubes that were heated and manipulated into a wide variety of exotic shapes, often intentionally imitating serpents, dragons and other fantastical creatures (Willmott 2002: 65–7). Archaeological finds of serpentine-stemmed glasses from the UK are extremely rare – analysis of the largest collection of such stems, from Gracechurch Street, London, confirms their date of manufacture as being in the first half of the 17th century (Willmott 2000). Two bases from similarly dated goblets (SF150 & SF163) were recovered. The quality of their manufacture suggests that they might well have once supported similar serpentine-stemmed or other high-quality goblets. Given this, the presence of at least four high-quality drinking glasses from the site during the earlier 17th century must be seen as significant.

Fragments of two later, 18th-century, glasses were also recovered, both manufactured in the then fashionable lead crystal. A portion of stem and lower bowl from a trumpet-shaped wine glass (SF157) dates to the early decades of the 18th century, while a much more robust 'drawn-stemmed' wine glass (SF100) had become very popular by the mid-18th century, frequently associated with domestic and tavern assemblages alike.

The final vessel (SF162) is represented by a single 'prunt', a decorative blob of glass that would originally have been applied to the external surface of a 17th-century roemer – a capacious glass traditionally used for the consumption of white wine. Although extremely popular in the Low Countries, where they became a distinctive nationalistic symbol during and after the Dutch struggle for independence, they are rarely found in the UK (Willmott 2002: 53–4), so the presence of one in Edinburgh is of note.

8.5 Appendix 5: The metalwork

Dawn McLaren

A full analysis of the metalwork is included within the site archive.

8.5.1 Introduction

The metal assemblage consists of large quantities of iron (Q=179) with a small group of copper alloy objects (Q=11) and a single item of lead. The assemblage is fairly limited in terms of the range of metal objects recovered and most are not closely datable. Iron nails dominate the assemblage; the majority deriving from a series of poorly preserved

coffin burials. A small quantity of copper alloy dress accessories, coins and a fragment of casting waste are also present.

The most significant object among the metal finds is a small copper alloy buckle, found below the waist of an adult skeleton within Grave [065]. It is a type consistent with that used in conjunction with a girdle or waistband and indicates that the deceased was buried fully clothed. Analysis of the leather and textile found preserved on the reverse of the buckle suggest that it was, in this instance, used to fasten the belt of a sporran. The buckle and the material associated with it is considered in detail by Walton Rogers below (Appendix 6). A short fragment of fine iron wire was also recovered from this burial and may represent a fine pin shank. The recovery of dress accessories from this burial is in contrast with the evidence from six other graves at Caltongate, where staining on the bone surfaces from possible copper alloy shroud pins has been observed (Appendix 1). The head of a copper alloy wire-wound headed pin and a small fragment of a possible lead token came from Grave [068].

8.5.2 Iron

As is typical of most urban excavations, the iron assemblage from New Waverley is dominated by iron nails (164) associated with a small quantity of iron objects (15). Iron nails are ubiquitous finds on archaeological excavations, yet examination of their form, condition and size can be useful in determining the category of their original timber fitting (eg structural, internal fixture, furniture, etc). The majority of the nails from New Waverley are coffin nails which were directly associated with the graves discovered in the south-east quadrant of the excavated area. With the exception of the coffin nails and other nail fragments that appear to have infiltrated the graves after the timber coffin lids deteriorated, the only iron object found in association with the burials is a small piece of fine iron wire from Grave [065]. A limited number of fragmentary fittings, household equipment and unidentified incomplete objects came from a layer of redeposited garden soil, Context [003]. A summary of the iron is presented here. A full catalogue is presented in the archive.

8.5.2.1 Nails

Despite the limited range of sizes and forms of nails associated with the coffins, subtle variations exist. This undoubtedly reflects the handmade quality of the nails; although there was an attempt to standardise the form, they are not identical. Nails were recovered from six graves ([033], [063], [065], [068], [082], [089]). The variation in the number of examples associated with each coffin ranges widely: only seven nails were associated with Graves [068] and [089], whereas the coffin from Grave [033] had a total of 33 nails. Wood traces were preserved on the shanks of some of the nails. Examples recovered from other contexts, such as the redeposited garden soil, Context [003], which covers much of the site and pre-dates the cemetery, display a much wider variation in size and form and their condition suggests that most had been removed from their timber fittings prior to incorporation in the surrounding soils. A single intrusive 20th-century nail was also present within Context [003].

The quantity of nails recovered within graves associated with coffin burials can fluctuate widely, at times influenced by their varying survival, which can be caused by micro-environments within cemetery soils, as well as by their differential use in coffin construction (Boyd 1989: 118; McCullagh 2006: 25). Instances of only one or two nails present within medieval grave fills at the nearby sites of St Giles' and Holyrood may be the product of differential survival or the effects of the extensive reworking of cemetery soils (Bain 1999: 1053; Franklin 2019: 48; Roy 2019: 15), whereas the five coffins examined from St Giles' during the 1980s and 1990s all produced a large number of nails, ranging from 24 to 60 in each example (Collard, et al 2006: 20). It has been shown that variations in nail use during coffin construction can be based on a combination of skill, necessity and availability, with lower quantities of nails required in proportion to the number of carpentered joints and wooden dowels used in fabrication; coffins could range from only having around a half-dozen nails used to secure the coffin lid, to a potential overuse of nails that may have been required to make up for a lack of carpentry skill or to allow for additional strength requirements needed for the coffin's occupant (Collard et al 2006: 20; McCullagh 2006: 25). The variation of coffin nails per grave from New Waverley reflects these

patterns, with the graves with lower quantities of nails potentially indicating varying survival rates or a differentiation in nail use in coffin construction compared with the larger number of nails (33) recovered from Grave [033].

Two fragmentary horseshoe nails are also present within residual contexts. Both have relatively short, tapering square-sectioned shanks with damaged expanded rectangular-sectioned heads, similar to those from medieval and late medieval contexts in London (Clark 1995: 86–8, fig 66).

8.5.2.2 Objects

Only 15 iron objects are present; most are incomplete and none are closely datable. The most significant item is a short fragment of fine iron wire, only 1.5mm in diameter, which was recovered from Grave [065]; the same grave where a small copper alloy buckle and textile remains were found. It is possible that this wire represents the fine shank of a pin, a fitting or embellishment of the garments of the deceased or even a hair ornament.

The other iron objects from the site are fragmentary and, in some instances, such as the hooked terminal from an unidentified object, so little of the object survives that it is impossible to identify either the original form and function of the item or its date. Where form and function can be determined, the objects consist of fittings, including a loop-headed spike, perforated sheet and strap fragments, and a damaged pinned hinge. Household equipment is also present in the form of a handle fragment and a handle or window-latch fragment. The majority of these objects were recovered from the redeposited garden soil, Context [003], which was cut by the burials and pre-dates the construction of the Poorhouse. A small number of potentially more recent items, such as a fragment of iron grate, also came from this context, indicating modern contamination or disturbance.

8.5.3 Copper alloy

The copper alloy objects consist of a small group of post-medieval dress accessories which include a buckle associated with textile (SF64; reported by Walton Rogers in Appendix 6), a button and at least one pin fragment. Two coins are also present, both found within a layer of redeposited garden soil, Context [003], which covered the excavated area. The original surfaces of the coins have degraded post-deposition, but in terms of size one is consistent with a Charles I or II turner (early 17th century), while another is a much smaller clipped coin that may be a late 15th-century 'black farthing' (Holmes 1998). A fragment of copper alloy casting waste; a cap or rivet of unknown purpose; a tack; and sheet fragments from an unidentified object also came from this context. This report presents a summary and catalogue of illustrated items only. A full catalogue is in the archive.

The small asymmetric double-looped buckle (SF64, Illus 30a and 30b) with traces of an iron pin is the most significant of the metal objects recovered during the excavation. It was found below the waist,

Illus 30a The copper alloy buckle (obverse face) and textile (SF64)

Illus 30b The copper alloy buckle (reverse face) and textile (SF64)

near the left hip of an adult skeleton within the poorly preserved remains of a wooden coffin. Also from this grave was a fragment of fine iron wire (SF112). The presence of these items indicates that the deceased was buried in clothing rather than a shroud, which usually involved the removal of clothing (Bain 1999: 1061).

A small spherical head from a wire-wound headed pin came from Grave [068], confirming the use of copper alloy shroud pins. Wire-wound headed pins have a long currency of use from the 16th to 19th centuries, but typochronological studies have demonstrated that their form and size changed through time (Caple 1992; 2006). Early examples are typically long, with fairly thick drawn-wire shanks and simple heads formed by twisting fine wire around the end of the pin shank. As the fabric that these pins were used to fasten became finer, the shanks of the pins became shorter and finer. There was also an attempt to disguise the joins of the wound-wire heads with later examples having spherical crimped heads (Caple 2006: 129, fig 3.7). The pin head from New Waverley shows some attempt at crimping, suggesting it is a late example and could fit within Caple's type B classification, where the spiral head wire has been partially compressed to grip the shaft, which was in use from the 16th century (Caple 2006: 129). Although no pins survived within the other graves at New Waverley, green staining on the bone surfaces of six individuals was noted during osteological analysis (Appendix 1), implying the former presence of shroud pins.

Although very damaged, a small hollow domed button was also recovered. It did not come from a secure context but its form is consistent with examples of 18th-century date (Bailey 2004: 77–8).

8.6 Appendix 6: Organic remains associated with the copper alloy buckle

Penelope Walton Rogers and Dawn McLaren

A complex arrangement of organic materials was recovered associated with a copper alloy buckle (SF64). A double-thickness leather strap was found threaded through the buckle; on the back are loose folds of wool textile, together with black organic material resembling human tissue, and sandwiched between the strap and the textile were the remains of an animal skin (pelt or hide). The buckle and the layering of organic remains suggest a clothed, rather than shrouded, body, and overall the assemblage is interpreted as a buckled hair purse, lying against a body wearing a wool garment. A full record of the artefact and the research undertaken is contained within the site archive.

8.6.1 The animal skin

A dense layer of fibres lies against the front and back of the central bar of the buckle. They are relatively short, but cannot be measured because they curve around the buckle bar. A sample viewed under magnification proved the layer to be a combination of fine fibres with pigmentation varying from light to dense. Wide and continuous medullas (central channels) were present on most fibres, although they were absent or narrow and interrupted on the fine fibres. Cross-sections were compressed oval. The cuticular scale pattern was irregular mosaic with near, smooth and sometimes rippled margins. These features are characteristic of calf hair (Appleyard 1978: 6–7, 48–50). A sub-sample sent to Dr Phil Greaves at Microtex for double-blind testing was identified as 'cattle hair – possibly calf' (Microtex 2014). Black specks towards the root end of the fibres indicate where the skin of the hide has decayed away. The buckle appears to have been attached to the outer face of the calf hide.

8.6.2 The strap

A leather strap, 11–12mm wide, runs across the front of the bar and disappears behind the rear of the frame. It has two layers, each approximately 2mm thick (this is not lamination, the leather surface being visible in both cases). No grain pattern was visible to allow species identification. The end of the top layer of the strap has been distressed in antiquity and it is possible that the second layer represents a repair. Although the strap has been threaded through the buckle, it does not appear to engage with the buckle-pin, which points backwards towards the rear edge.

8.6.3 The textile

On the back of the buckle there are loose folds of a textile woven in 2/2 twill, yarn S-spun in both

directions, 14–16 × 12–14 threads per cm. A separate fragment of the same material was preserved nearby. Transmitted-light microscopy of the fibres showed them to have lost much of their scale pattern, but where visible it was irregular mosaic with smooth near margins and can be identified as sheep's wool. No colour was preserved, although this may have resulted from deterioration of the fibre. The textile is slightly matted in places, probably from wear rather than deliberate soft-finishing.

8.6.4 Interpretation

The weave of the textile, 2/2 twill, is a common structure in Scottish post-medieval textiles. It was used for ordinary clothing fabrics, soft-finished for coats and breeches, and without soft-finishing for plaids (Henshall 1954: 21–9; Henshall & Maxwell 1954; Bennett 1977). Twill plaids were often made of combed wool as here, and although the S × S spin of the New Waverley example is unusual, there is a comparable example among the patches on a garment in a 17th-century burial at Dava Moor, Cromdale, Morayshire (Henshall 1954: 23). Most surviving examples are coarser than the piece from New Waverley, but a red plaid with a white line-check found amongst 17th-century tailor's offcuts at Newcastle upon Tyne and interpreted as Scottish in origin, had a similar thread-count of 16 × 14 (Z × Z) per cm (Walton 1983: 221–2). The 2/2 twill tartan trews from Dungiven, Co. Derry, Northern Ireland, of uncertain date but probably before the middle of the 17th century, had a count of 13 × 15 (Z × Z) (Henshall & Seaby 1962: 125–30) and the checked jacket pocket from the early 18th-century grave at Arnish Moor, Lewis, had 14 × 18 (Z × Z) per cm (Bennett 1977: 173). Although not especially fine, this seems to represent the finer end of the scale for this particular fabric-type.

The buckle and the fastening strap are both rather lightweight and they suggest that the item made of calf hide was probably not a heavy garment. The position by the left thigh would suggest, rather, a purse, perhaps carried in a pocket in the manner of the knitted purse on the late 17th-century clothed body from Gunnister, Shetland (Henshall & Maxwell 1954: 38–9). Alternatively, it could have been suspended from a belt, since tied woven belts were known at this period as well as buckled leather ones (Henshall & Maxwell 1954: 35). Early sporrans were reportedly made from leather or skin, especially deerskin and calfskin (Historic UK).

It is not impossible, therefore, that this burial represents an early example of the wearing of the traditional Scottish plaid and sporran. Early sporrans lacked metal embellishment, and it appears that the metal clasps known today were not used until the early 18th century (Telfer Dunbar 1962: 217). With the exception of a short fragment of iron wire, no further metal fittings that might derive from the sporran or its belt were found in the grave, implying that the sporran was a simple leather pouch, gathered at the top by leather thongs. The buckle itself is a distinctive post-medieval type and saw use as a simple belt fastener from the late 16th century to the beginning of the 18th century (Whitehead 1996: 91–2, nos 574 & 575).

8.7 Appendix 7: Miscellaneous artefacts

Dawn McLaren

A detailed catalogue of this material and a detailed assessment is presented in the archive.

8.7.1 Coarse stone

A single worked stone object, a small whetstone (SF149) produced from a short elongated ovoid water-rounded pebble, was recovered from midden-rich Context [092], which pre-dated both the burials and the Poorhouse. One edge is smoothed and slightly dished, with a light sheen resulting from use. The use of a pebble, unmodified prior to use and probably locally sourced, suggests that this was an expedient tool, used lightly and readily discarded. The whetstone itself is not closely datable.

8.7.2 Vitrified material and associated residues

Very small residual quantities of vitrified material and associated residues (373.05g) were recovered during the excavation. The vitrified material comprises five small hammerscale slag spheres, typical residues associated with blacksmithing (Bayley et al 2001: 14). Also present are two small fragments of fuel ash slag (7.4g), a fused, heat-affected, low-density residue that could have been produced in a domestic hearth or during a range of pyrotechnic processes. The slag spheres consist of small spherical droplets

of solidified slag that are produced either during primary iron bloom smithing or welding while forging an iron object (Dungworth & Wilkes 2009). They indicate that ironworking was taking place in the vicinity of the site, but the quantities represented are too small to suggest that this activity was located in the immediate locale of the excavated area. Rather, such small residues could have been easily transported across wide areas, becoming trapped in the folds of garments or on the soles of shoes, and do not represent in situ metalworking activity.

A scatter of unmodified coal and clinker fragments (364.3g), likely to be residues from domestic hearths, came from across the site.

None of this material, either metalworking debris or fuel residues, is closely datable.

8.7.3 Worked bone

A simple disc-shaped bone button was recovered from Context [003], pre-dating the construction of the Poorhouse. The central perforation of the button still houses the broken remains of an iron pin or loop. This type of button was common in the 18th century (Garratt 1994: 112) but the simple form of buttons of this type likely had a longer currency of use.

A lathe-turned handle, with incised concentric decoration around its circumference, is likely to be the handle of a walking cane. The width and depth of the circular-sectioned socket appears too large to have held a whittle tang of a knife or similar tool and its form and length would be consistent with the simple knop head of a walking cane. Although walking canes have a long currency of use, they were particularly popular during the 17th century.

8.8 Appendix 8: The Poorhouse timber foundations – woodworking and dendrochronology

Anne Crone

8.8.1 Introduction

The Canongate Poorhouse was built on a raft of oak planks which had been laid over oak piling inserted in rows into unstable ground. Many of the oak planks were fragmentary, and all displayed evidence of reuse in the form of multiple drilled holes. Only the most complete in terms of their cross-sections were sampled for dendrochronological analysis. In all, eight planks were sampled but of these only seven were fully analysed, as one was young and fast-grown. All of the piles, 60 in total, were recorded; of these, 13 piles displayed evidence for reuse in the form of square-headed iron nails and drilled holes, some still containing wooden pegs. All the piles were assessed for their dendrochronological potential. The number of growth-rings; the presence/absence of bark edge and the condition, ie fragmented or otherwise, was noted. Those with the greatest number of growth-rings and in good condition were selected for analysis; in all, eight of the reused piles and ten of the 'new' piles (ie those displaying no evidence of reuse) were analysed (Table 2).

8.8.2 Woodworking

The planks that formed the horizontal raft were all rift-sawn and varied in thickness from 50mm to 74mm and in width from 290mm to 415mm. There were also seven planks that had been used as piling and which had probably been cut down from larger planks; they were similar in thickness but only half the width. The rest of the piles were roundwood logs varying in diameter from 90mm to 190mm. They had all been sawn, some only on one face, while others had been sawn on all faces, to produce a roughly square or rectangular cross-section. The tips of the piles had been shaped to a central point using an axe.

8.8.3 Dendrochronological analysis

In all, 25 timbers were fully analysed: seven of the horizontal planks; four of the cut-down planks used as piling; and 14 roundwood piles. All the roundwood piles had complete ring-patterns, from pith to bark edge and varied in age from 72 and 109 years (Table 2). The planks had been sawn from larger and generally older timbers; none of them displayed a complete ring-pattern but sequences of 148+ years and 151+ years were present.

The surfaces of the samples were pared using a razor blade and chalk rubbed into the surface to enhance the ring-pattern. The tree-ring sequences were measured on a Heidenhain measuring table, under a low-power microscope. Data capture, analysis and plotting were undertaken using the

Table 2 Dendrochronological and other data for analysed timbers (organised according to type; h plank = horizontal plank; v plank = vertical plank; rw pile = roundwood pile)

SF No.	Context	Length (m)	Radius (mm)	Type	Reuse	Bark edge	Sapwood	No. rings	Average ring-width (mm)	Calendar date
			width × length							
/	144	/	70 × 310	h plank	*	N	9	74	2.01	
/	145	/	68 × 405	h plank	*	N	–	151	1.27	*tpq 1707*
/	146	/	50 × 290	h plank	*	N	4?	89	1.74	
/	148	/	62 × 415	h plank	*	N	–	95	1.48	*tpq 1694*
/	149	/	65 × 310	h plank	*	N	–	117	1.47	
/	150	/	54 × 300	h plank	*	N	–	59	2.14	
/	151	/	80 × 330	h plank	*	N	–	148	1.14	*tpq 1687*
270	156	0.9	63 × 150	v plank	*	N	–	89	1.73	
273	159	/	62 × 162	v plank	*	N	–	101	1.69	
276	162	0.85	62 × 170	v plank	*	N	–	107	1.52	
279	166	1.23	50 × 155	v plank	*	be?	9	73	1.62	
240	189	0.82	65	rw pile		Y	21	88	0.73	
241	185	0.84	70	rw pile		Y	21	86	0.80	
246	191	0.85	65	rw pile	*	Bark	21	82	0.83	
248	196	/	70	rw pile		Y	25	105	0.58	
253	190	1.11	60	rw pile		Y	22	103	0.58	
268	155	0.66	75	rw pile		Y	19	84	0.85	
269	157	0.83	60	rw pile		Y	26	88	0.66	
275	161	1.33	75	rw pile	*	Bark	20	72	1.03	
291	178	0.87	65	rw pile	*	Bark	21	89	0.71	

Table 2 *cont*

SF No.	Context	Length (m)	Radius (mm)	Type	Reuse	Bark edge	Sapwood	No. rings	Average ring-width (mm)	Calendar date
303	207	0.84	70	rw pile		Y	27	95	0.80	
245	188	0.79	55	rw pile	*	Bark	13	95	0.58	
289	171	0.83	75	rw pile		Y	16	109	0.66	
255	194	1.24	95	rw pile		Y	16	85	1.12	
296	179	0.86	60	rw pile		Y	26	92	0.59	

Key:

RE_PL1×3
PILES×10
PILES×2

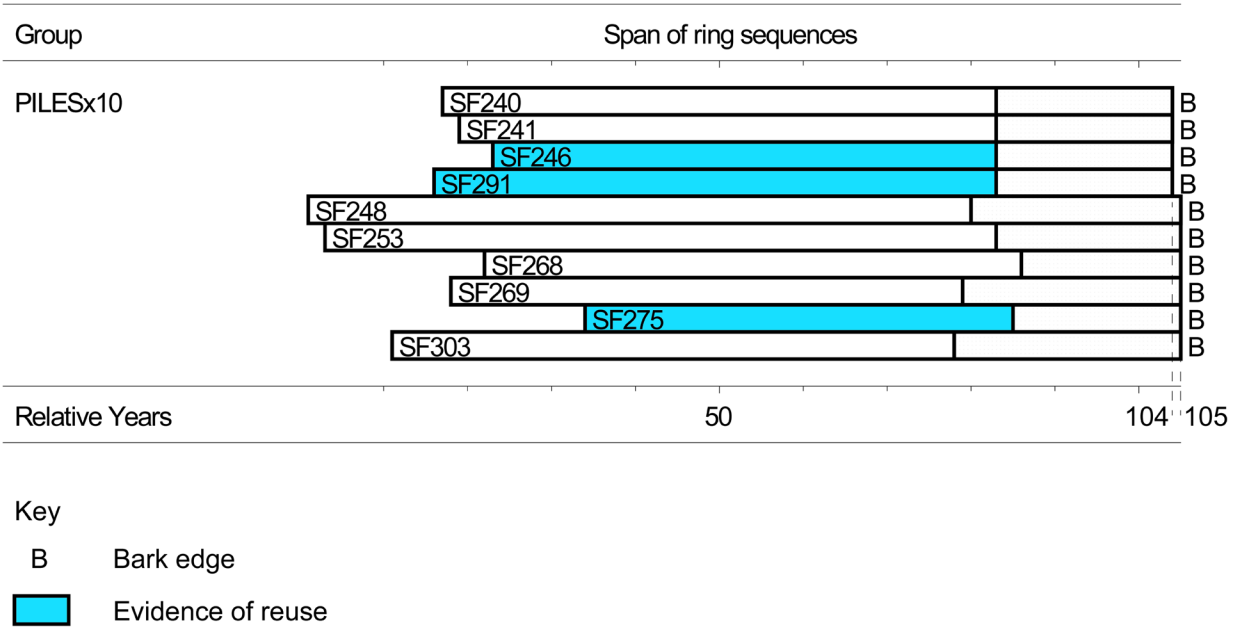
'Dendro' suite of programs (Tyers 1999). The program produces t-values as a measure of the degree of correlation between sequences, and, as a rule of thumb, values above 3.5 are considered to be significant. Visual cross-matching of the graphed tree-ring-width sequences is undertaken to verify any statistical positions of match.

Cross-matching proceeded in a stepwise fashion, using the strongest internally replicated group to form the kernel of a site chronology, and then comparing that chronology with the remaining unmatched sequences to find further acceptable statistical and visual matches. A group of ten roundwood pile samples correlated very strongly with each other (Illus 31; Table 3) and a chronology, PILES×10, 105 years long, was constructed. There were few other internal correlations apart from this core group. Three of the planks used as piling (SF270, SF273 and SF276) compared well together and a chronology, RE_PL1×3, which was 108 years long, was constructed (Illus 32; Table 4). A further two roundwood pile samples (SF245 and SF289) also compared well together (t = 6.77) and these were combined to form a chronology, PILES×2, which was 109 years long (Illus 33).

The two chronologies and all the individual sequences were then compared against various datasets of dated master chronologies from Scotland, England, Ireland and Europe, but this did not produce any significant results. However, comparisons with a dataset of East Coast American chronologies did produce significant and consistent correlations for some of the planks. Although they did not produce any correlations against each other, PL145, PL148 and PL151 all independently match a suite of American site and regional chronologies (Table 5; only the main regional chronologies are listed), and so they were combined to form a site chronology, CGPH×3, 168 years in length and spanning the years AD 1530–1697. CGPH×3 produced a significantly improved correlation against the American chronologies (Table 5), indicating that combining the three sequences had strengthened the local climatic signal.

8.8.3.1 Interpretation

The locations of the American chronologies that provide the strongest correlations with the CGPH×3 chronology suggest that the source of the timber is around the Boston area in eastern Massachusetts (Dan Miles pers comm). The American provenance means that the oak is likely to be American white oak (*Quercus alba*); this is macroscopically and microscopically indistinguishable in most respects from the European pedunculate oak (*Quercus robur*), although it apparently has different structural qualities (Michaux 1853).

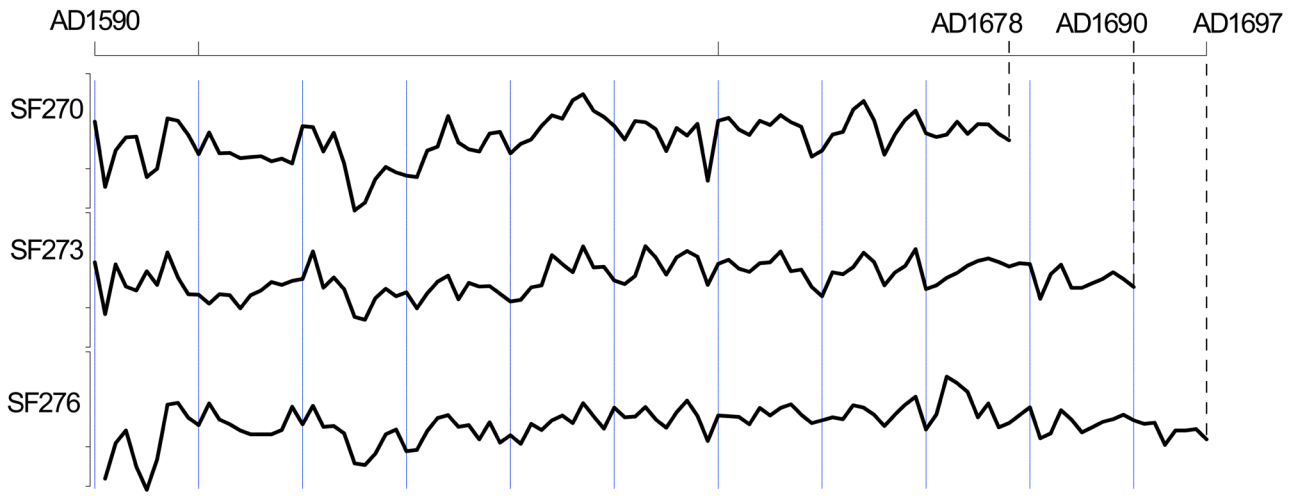


Illus 31 Bar diagram showing the chronological relationships between the timbers in PILES×10

Table 3 Statistical correlations within PILES×10

			SF248	SF253	SF268	SF269	SF275re	SF291re	SF303	SF240	SF241	SF246re
	Starts	Ends										
SF248	1	105	*	7.66	–	3.39	3.14	5.26	3.87	5.72	5.77	6.57
SF253	3	105	*	*	–	4.79	4.63	5.86	4.05	7.15	6.47	5.99
SF268	22	105	*	*	*	3.67	5.03	3.66	3.79	–	3.72	–
SF269	18	105	*	*	*	*	5.46	6.28	7.75	–	5.01	4.67
SF275re	34	105	*	*	*	*	*	5.72	3.21	4.91	6.47	4.51
SF291re	16	104	*	*	*	*	*	*	4.40	6.13	7.23	7.68
SF303	11	105	*	*	*	*	*	*	*	3.46	4.11	3.44
SF240	17	104	*	*	*	*	*	*	*	*	9.68	5.59
SF241	19	104	*	*	*	*	*	*	*	*	*	7.18
SF246re	23	104	*	*	*	*	*	*	*	*	*	*

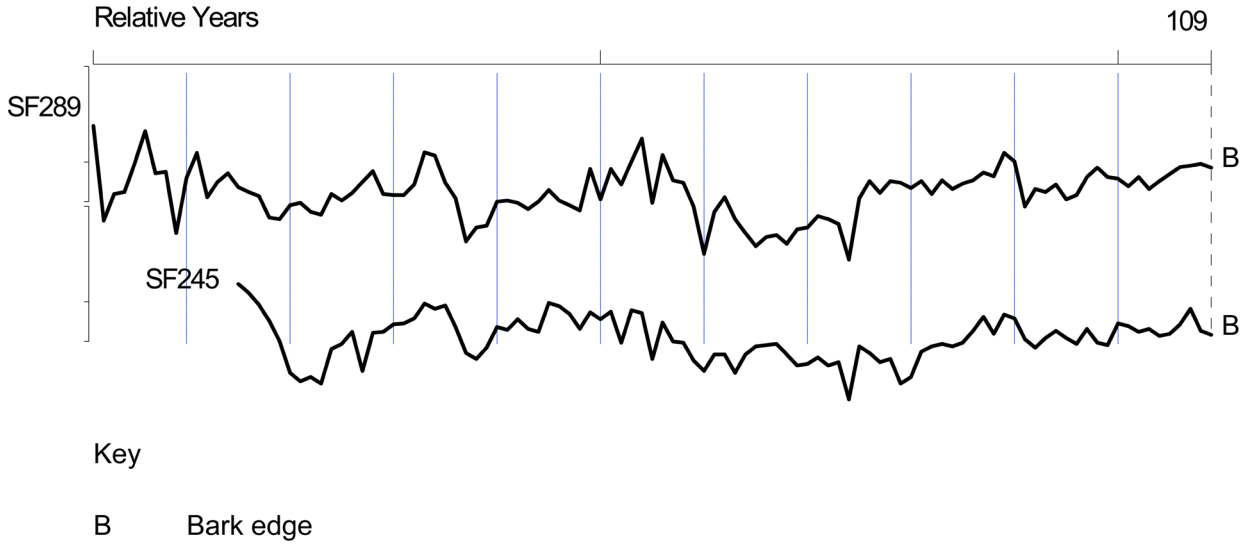
t-values over 3.0 reported



Illus 32 Growth-ring graph showing the visual correlations and chronological relationships between the timbers in RE_PL1×3

Table 4 Statistical correlations within RE_PL1×3

			SF276	SF270	SF273
	Starts	Ends			
SF276	2	108	*	8.12	6.40
SF270	1	89	*	*	6.92
SF273	1	101	*	*	*



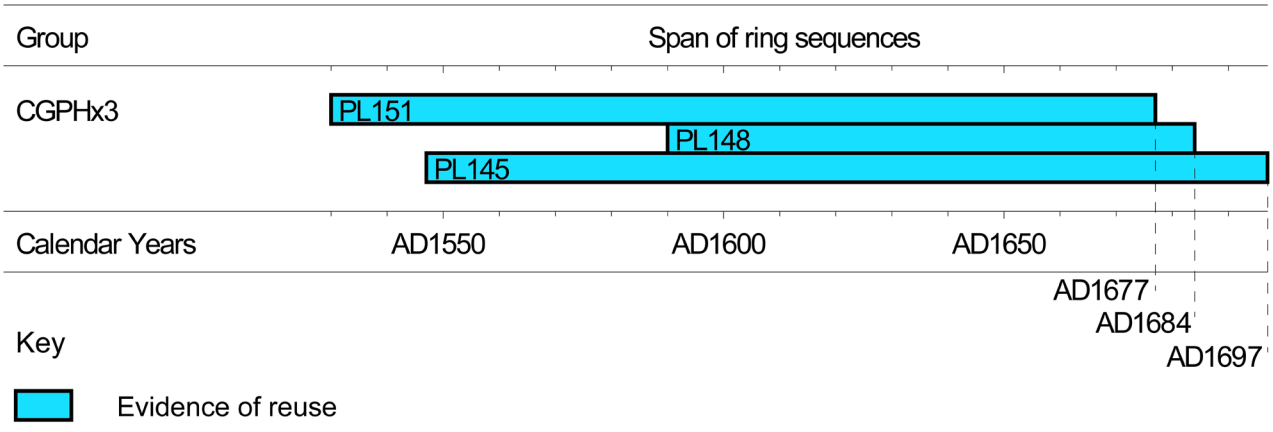
Illus 33 Growth-ring graph showing the visual correlations and chronological relationships between the timbers in PILES×2

Table 5 Statistical correlations between the Canongate Poorhouse timbers and selected American regional and Scottish import chronologies

	PL145	PL148	PL151	CGPH×3
	@ 1697	@ 1684	@ 1677	@ 1697
American oak regional chronologies				
WACHU (AD 1363–1997)	5.70	5.67	6.82	9.60
Mt Wachusett and Boston Area (Columbia pers comm)				
BOSTON02 (AD 1454–1769)	5.36	5.87	6.40	9.20
Boston master chronology 2002 (Miles et al 2002)				
Scottish American import chronologies				
EIGG×5 (AD 1557–1744)	–	4.72	6.38	6.01
Shipwreck – Galmisdale Bay, Eigg (Crone 2016)				
EG17_18b (AD 1608–1808)	–	–	3.92	4.53
Elie Granary, Elie, Fife (Mills 2002)				

The calendar date of the outermost ring of the master chronology has been established as AD 1697 but this provides at most a *terminus post quem* for the felling of the timber, because all the planks have been fully squared and an unknown number of heartwood and sapwood rings have been trimmed off. Synchronicity between the outermost growth-rings on fully squared timbers can sometimes help in gauging how many rings have been lost, because it usually means that the timbers have been trimmed close to the heartwood/sapwood boundary and therefore a rough felling estimate can be applied (cf Crone 2008: 10). However, there is no synchronicity in the outermost rings of the dated planks (Illus 34); there are some 20 years between the outer rings of PL145 and PL151 (Table 2).

The problem of estimating missing rings for American white oak is further compounded by the lack of any accurate sapwood estimates for this species that might allow the addition of a minimum number of sapwood rings to the date of the outermost ring, as can be done routinely in Europe (Miles 2005). Field observation suggests that the number of sapwood rings is broadly similar to that of English oak (Dan Miles pers comm). A sapwood estimate of 10–46 rings is used throughout the UK (English Heritage 1998: 11) and the application of the minimum number would give a *terminus post*



Illus 34 Bar diagram showing the chronological relationships between the timbers in CGPH×3

quem date of AD 1707. Allowing for an unknown number of missing heartwood rings, the most precise statement that can be made is that the timber was probably felled some time in the first half of the 18th century.

8.8.4 Discussion

The Canongate Poorhouse was established between 1761 and 1762. Oak has rarely been found in constructions of 18th-century date in Scotland (see below), hence the importance of analysing the assemblage, not so much to obtain an exact date for construction of the Poorhouse as to expand chronological coverage into the early modern era.

The presence of reused timbers had raised the possibility that there could be several felling phases represented within the assemblage, which is why examples of both reused and 'new' piles were selected for analysis. However, it is clear from the chronological relationships within one of the site chronologies, PILES×10, which incorporates both reused and 'new' timbers (Illus 31; Table 2), that all the timber was felled over the course of only two years (in Rel Yr 104 and Rel Yr 105), so it is most likely that all of the timber used in the foundation was reused. The timber therefore pre-dates the construction of the Poorhouse by some undetermined number of years and came from a building built after AD 1707, and some time in the first half of the 18th century.

Timber from two different sources was used in the construction of the foundation, planking imported from the American colonies and roundwood that was probably sourced locally.

8.8.4.1 American oak

Although only three planks have been successfully dated through correlation with a suite of East Coast American chronologies, it seems most probable that all the planks are American imports; they are similar in overall dimensions and average ring-width even though they do not correlate with each other. This lack of correlation between the dated timbers is characteristic of imported cargoes, made up of timber from multiple sources (Crone & Mills 2013: 343; Crone et al 2017: 30–1).

Oak of American origin in the UK has only begun to be identified by dendrochronology in the last few years. It has been identified in a few buildings in England (Ian Tyers and Martin Bridge pers comm) and in two assemblages of ship timbers in Dublin (Brown 2008; 2009). In Scotland, analysis of timbers from a building called 'The Granary' in Elie, Fife has produced some early 19th-century American oak, while a boat wrecked in Galmisdale Bay, Eigg, was built to a local design using American oak, probably in the late 18th century (Crone 2016).

One of the reasons put forward for the establishment of the colonies that would become known as New England was that they would be able to furnish England with the timber that was in increasingly short supply at home, and very soon after their settlement cargoes of timber began to be shipped, the first crossing the Atlantic in AD 1609 (Albion 1926: 231–3). The focus of this trade was the provision of masts for the British Navy, the American forests producing the huge white pines favoured by naval shipbuilders. From the middle of the 17th century this became a regular cargo across the Atlantic, carried in large purpose-built 'mast ships' (Albion 1926: 237–8). However, the costs of shipping across the Atlantic, together with the higher production costs in the colonies, may have made other timber cargoes prohibitively expensive (Carroll 1973: 86) and while New England was supplying timber products to other parts of the British Empire, very little was making its way to England (Carroll 1973: 94). In addition, the naval shipbuilders had on numerous occasions rejected American oak as not fit for purpose (Albion 1926: 244). Timber was also not a significant part of the trade between Ireland and the American colonies until the 1760s (Truxes 1988: 219–20), although Truxes suggests that this may have been due to the colonies struggling to meet their own domestic demands.

Nonetheless, white oak was clearly being imported into the UK in the 18th century, as the dendrochronological evidence indicates. An advertisement in the *Boston Gazette* in February 1751 describes a cargo of white oak timber destined for Scotland or Ireland, while there are archival records referring to a cargo of American oak plank at Deptford in 1768 (NA ADM106/1164/66, 75, 82 & 87). Very little research has been undertaken into the early trade in non-naval timber products between America and Britain to provide a context for these assemblages but the growing tree-ring

dataset will itself provide insights into the nature of this trade, the type of timber being imported and its final destination.

8.8.4.2 Locally sourced oak

None of the roundwood piles could be dated and therefore their source cannot be identified. However, it is highly unlikely that they would have been imported from America; the piles were small, mostly between 110mm and 150mm in diameter (Table 2), and such a high-bulk/low-value cargo would not have justified the expense of a transatlantic journey. The roundwood is more probably native-grown oak. The chronological relationships within PILES×10 indicate that the piles were all felled over the course of two years, while those in PILES×2 were felled in the same year. There was no correlation between the two mean chronologies, suggesting that multiple sources, ie different woodlands, may have been cropped for the piling.

The timber assemblage from the Canongate Poorhouse represents a rare occurrence of the use of oak in building construction in the early modern period in Scotland. Native-grown oak of 18th-century date has been identified by dendrochronology in only two Scottish buildings (Hamilton Palace – Mills pers comm, and Stoneypath Tower, East Lothian – Crone unpublished). There are only three living oak chronologies covering the century: Dalkeith, Midlothian (Mills pers comm); Cadzow, Lanarkshire (Baillie 1977) and Lockwood, Dumfriesshire (Baillie 1977). The PILES×10 chronology is an internally robust, 105-year-long, chronology but the lack of dated chronologies covering the early modern period in Scotland currently hinders its dating.

8.9 Appendix 9: The ecofactual evidence

Jackaline Robertson

Full analysis of the ecofactual evidence is contained within the site archive.

8.9.1 Wood species

Samples of wood extracted from four grave cuts were submitted for species identification. Overall preservation of the wood was poor, especially those fragments present in Contexts [066] and [069]. The surviving wood within these two contexts was almost completely embedded within the sediment and in most instances survived only as a deep stain. The wood fragments from Contexts [017] and [080] were marginally better preserved but were still in poor condition. It was, however, possible to identify the wood from all four contexts as pine (*Pinus* sp). Pine was a common choice in the construction of coffins as it was easily available and affordable.

8.9.2 Animal bone

A total of 2,864 fragments of animal bone (16.2kg) were submitted for analysis from the excavation. The assemblage was collected from a series of midden deposits, buried soils, coffin fills and wall structures. These features were associated with both the cemetery and the Poorhouse, both of which cut or overlay midden material dated to the medieval period. The preservation of the bone ranged from poor to excellent. A large number of fragments were poorly preserved due to burning and were smaller than 10mm. Those fragments collected by hand were noticeably better preserved than those retrieved from the bulk samples. The species identified were horse (12 fragments), cattle (174), sheep/goat (253), pig (9), dog (2), cat (1), rabbit (1), rodent (37), chicken (3), bird (29) and fish (170). A further 803 fragments were described as large mammal, 437 as medium, 5 as small and 928 as indeterminate. Evidence of pathologies and butchery marks was present on a small number of fragments.

The preservation of the bone ranged from mostly poor/adequate to occasionally good/excellent. Most of those fragments described as poorly preserved had been modified by soil containments, which had resulted in their becoming badly stained, or by reacting with metal artefacts such as coffin nails.

Of the 2,864 fragments, 1,506 were recovered from the post-medieval garden soil/midden Context [003] which preceded the burials. The Kirkyard Accounts record earth and sand being imported onto the site during the mid-18th century – consequently, the possibility that at least some of the material within [003] was derived from elsewhere cannot be discounted. The remainder of the assemblage was spread throughout the remaining garden soils, midden deposits, coffin fills and modern rubble in much smaller quantities. Many of the activities on the site, such as grave and foundation digging,

involved ground disturbance, which will have resulted in a degree of mixing.

It was, however, possible to establish some facts concerning the species utilised; the cuts of meat consumed; the age of the main domesticates; and the general health of the animals disposed of at this site. The main domesticates used for food in both the medieval and post-medieval period were cattle, sheep/goat and pig. All three of these species were present. Butchery marks were identified on 107 bones, concentrated in the garden soil/midden Context [003]. Given the numbers present, it appears that lamb/mutton was the most economically important source of meat, followed by beef and, to a much lesser degree, pork. The predominance of sheep/goat is as expected, as this was traditionally viewed as more affordable than either cuts of meat from cattle or pig. The types of bone recovered are also of significance in understanding the status of this site. Low-quality cuts of meat tend to be those which have a low meat value, such as the skull, vertebrae and foot bones. High-quality cuts of meat are normally the humerus, radius/ulna, femur and tibia. The cuts of meat from the sheep/goat include both high- and low-quality meat-bearing bones from a range of both young and older animals. The cattle bones are dominated by poor cuts of meat, which derived from older animals, while the few pig bones were exclusively from what was typically regarded as poor-quality cuts from young animals.

Pathologies were observed on a single cattle ulna and ten sheep/goat bones, including evidence of possible arthritis and unhealed fractures. Eight of the sheep/goat bones showed signs of bone growth or tumours, which were probably age-related conditions. A loose sheep/goat molar was noticeably malformed along the cusp, and there was an abnormal gap between the second and third molars. The deformities affecting the teeth could have been genetic traits but are more likely due to poor diet.

The horse remains numbered 12 fragments concentrated within the garden soil/midden deposit [003] and were derived from at least one individual, older than five years. No evidence of deliberate slaughter for food was found, although dismembering after death for use in industrial processes such as glue-making is likely. No evidence that the dog and cat remains represent slaughter was identified – it is likely that these animals were domestic pets or strays. The rabbit and rodent remains appear intrusive, particularly those rodent remains recovered from the coffin fills.

A total of 32 bird bones were present, concentrated within [003], of which three were identified as chicken. None of these were burnt or displayed signs of butchery. There was, however, evidence of animal-gnawing on a single bird bone fragment. There was no evidence that any of these fragments belonged to wild species. Chicken was a common food source easily available throughout the medieval and post-medieval period.

The fish remains (170 fragments) consisted of ribs, vertebrae and a single otolith. A single fish vertebra was malformed and this condition appears age-related. Four vertebrae were completely calcified, indicating that these originated from cooking and hearth-cleaning waste.

The main domesticates are all typical finds for an urban site in medieval and post-medieval Edinburgh. Lamb/mutton, beef and pork were all eaten but sheep/goat appears to have been the most economically important species. The residual bone evidence for beef and pork are of low-quality cuts of meat, with the beef coming from older animals. This is strong evidence that the status of this site was not particularly high, and the population lacked the financial resources to acquire more expensive cuts of beef and pork. The integrity of the assemblage has been compromised to a degree by post-depositional mixing, including potentially the deposition of soil imported from elsewhere, into the garden soil/midden deposit [003] from which the majority of the animal bone fragments were recovered.

8.9.3 Charred macroplant remains

Twenty-one bulk samples, collected from grave deposits, garden soil, midden fills and wall structures, were analysed. A small assemblage of charred macroplant remains, comprised entirely of cereal caryopses, was recovered from eight contexts.

A total of 28 poorly preserved carbonised cereal remains were recovered from six grave fills and from two midden deposits. The species identified were two bread/club wheat (*Triticum aestivum*-type), four wheat (*Triticum* sp), eight barley (*Hordeum* sp) and 14 cereal caryopses which could not be further identified.

These remains were scattered throughout the samples with no evidence of deliberate or selective disposal. The nine cereal caryopses recovered from garden soil/midden Context [003] are typical finds from a midden deposit and represent in situ deposition. The 19 cereal remains collected from the grave deposits are intrusive and probably accidentally entered these fills when the graves were truncated by the construction of the Poorhouse or by modern foundation and service cuts. These cereal caryopses are all common finds in Edinburgh and likely derived from domestic food waste generated by the inhabitants of the Poorhouse or the surrounding tenements.

8.9.4 Marine shells

An assemblage of 152 marine shells was analysed. Seventeen of the shell fragments were recovered by hand from three contexts, while a further 135 were collected from ten bulk samples. The shell was collected from a range of grave fills, midden/garden soils and wall deposits.

The species identified were the common oyster (*Ostrea edulis* Linnaeus), common periwinkle (*Littorina littorea*), common mussel (*Mytilus edulis* Linnaeus) and cockle (*Cardiidae*). The assemblage was small and highly fragmented, with only ten intact shells recovered. The common oyster was the dominant species present, with six whole shells and 113 fragments recorded. There were a further four intact periwinkles, along with 17 periwinkle fragments, nine pieces of mussel and three of cockle.

The four species are all edible and are common finds from around the Scottish coast (Hayward et al 1996). These species would have been present in the shallow waters surrounding Edinburgh and easily exploited as a food resource. Oysters may grow up to 10cm in length and the two largest from New Waverley were recorded as being between 9cm and 10cm in length.

There was no evidence of deliberate or selective disposal of any of these species within particular features. Instead, this material was recovered along with other domestic food and butchered bone refuse which was probably backfilled into these disturbed deposits, including the graves. This food refuse originated either from the inhabitants of the Poorhouse or from the surrounding tenements, being accidentally reworked into the grave fills during later redevelopment.

8.10 Appendix 10: Radiocarbon dating

Mike Roy

Samples from animal bones were submitted for radiocarbon dating (Table 6). It was hoped that samples from this material might further aid understanding of the chronology of the site. The calibrated age ranges were determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal4).

The samples were derived from a sandy clay bank, Context [112], identified as a potential burgage plot boundary, located approximately 10m from the western side of Old Tolbooth Wynd and stretching from the High Street to Calton Road. The range of dates provided by these two samples covered a relatively broad period, but most likely the bone became incorporated within the boundary feature in the 15th century.

Table 6 Radiocarbon samples

Lab code	Context	Material	Radiocarbon age BP	δ13C (‰)	Calibrated date 68% probability*	Calibrated date 95% probability*
SUERC-58178	112	Cattle incisor	470±30	–21.8‰	AD 1425–1445	AD 1410–1457
SUERC-58179	112	Sheep/ goat humerus	421±30	–21.6‰	AD 1437–1478	AD 1426–1515; 1598–1618

*Where two date ranges occur, this is a result of the calibration plot.