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1 Pepys 1665.

‘Great fears of the sickness here in the City … God preserve us all …’[1] A Plague Burial Ground in Leith, 1645: an archaeological excavation at St Mary’s (Leith) RC Primary School, Leith Links, Edinburgh

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1. ABSTRACT

In 2016, Wardell Armstrong undertook an archaeological excavation at St Mary's (Leith) RC Primary School, Edinburgh. The archaeological excavation revealed four phases of activity; Phases 1 and 2 comprised coffined and uncoffined human burials. The lack of infectious pathognomic skeletal lesions, the dating of the finds, the dendrochronological analysis of the coffin wood and technological data, along with the known historic land-use of the area, all indicate that the burial ground relates to the 1645 outbreak of plague in Leith. Dendrochronological analysis revealed a *terminus post quem* felling date of *c* 1640 for the coffin wood, while analysis of the coffins' manufacture revealed hasty construction methods. Phase 3 comprised a series of waste disposal pits of 19th-century date. Phase 4 comprised levelling deposits, which were likely associated with the construction of the school and the demolition of the 19th-century smallpox hospital located to the north of the site.

A total of 81 individuals were interred at the site. Adults represent 68.3% while non-adults represent 31.7%. All age groups were present except neonates. Artefacts including keys, coins, sewing kits and combs were recovered. That the bodies were interred seemingly fully clothed and the corpses not rifled prior to burial strongly indicates a fear of the diseased corpse. The presence of everyday items on the bodies may also indicate a more sudden death outside the sick bed, possibly indicating the occurrence of septicaemic plague.

Frequent occupation and attrition-related skeletal and dental pathologies indicate lives characterised by poverty and toil. Strontium analysis revealed that almost all individuals were local to Leith; several individuals had rosary or paternoster beads, indicating a likely Catholic affiliation, which would have been risky given that the pro-Presbyterian Covenant was signed in Leith in 1638. In contrast to older children, the younger children were interred in coffins, indicating differing views on the treatment of the body.

2. INTRODUCTION

In 2016, Wardell Armstrong was commissioned to undertake an archaeological excavation in the grounds of St Mary's (Leith), 30 Links Garden, Leith, Edinburgh (NGR: NT 27750 75980) in advance of the construction of a new two-classroom building. An archaeological evaluation was undertaken prior to the excavation, in which coffins were discovered. A single area measuring 286.71m^2 was excavated, broadly equating to the footprint of the proposed new classrooms (WA 2016: 1).

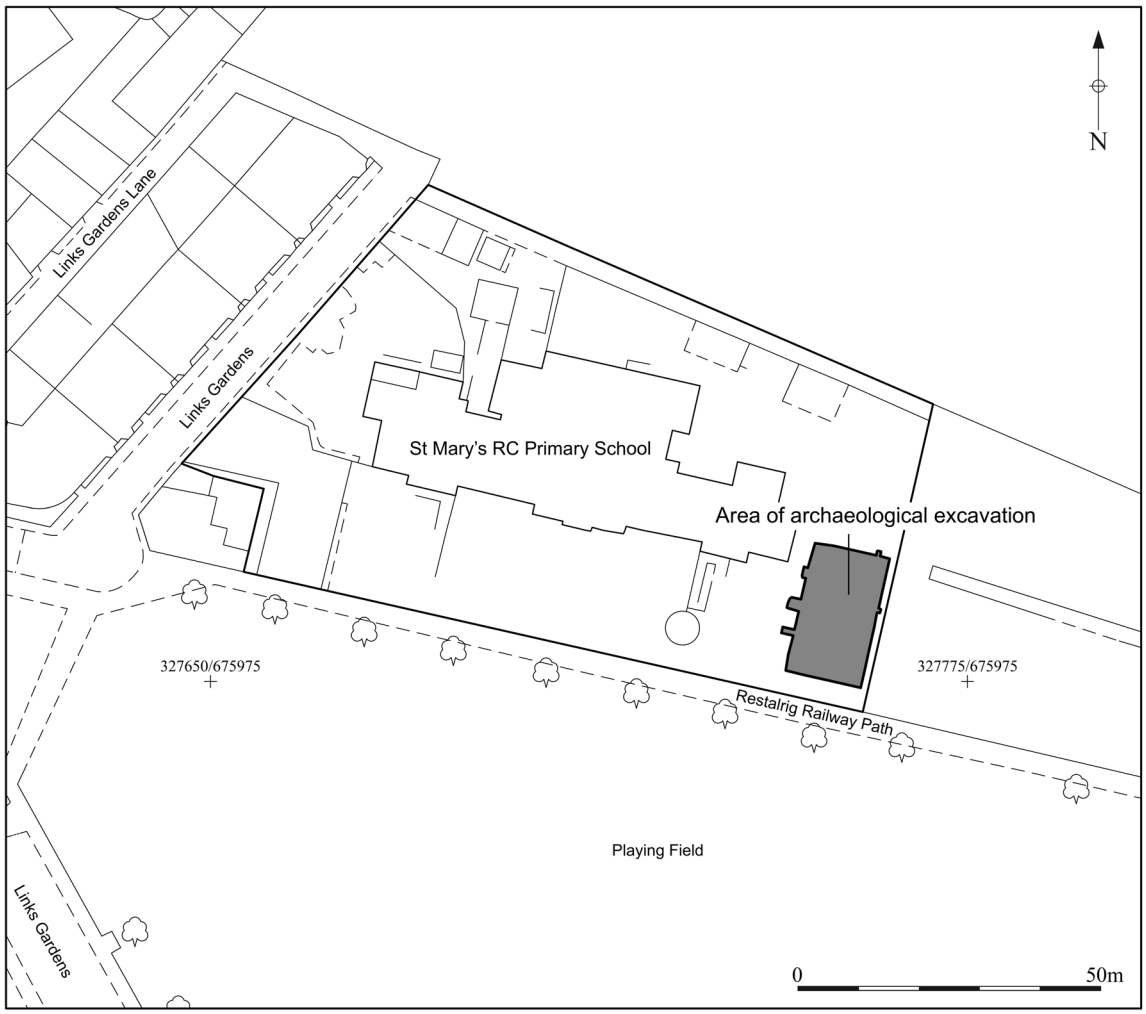
The archaeological excavation revealed coffined and shrouded human burials and burial pits. A total of 81 separate interments were recorded from the excavation area, with the remains of 71 individuals recovered. Artefacts retrieved from the bodies revealed an early to mid-17th-century date for the interments, and documentary evidence, along with scientific and technological data, points to the burials being associated with the 1645 outbreak of plague in Leith (Campbell 1827: 145). A number of these coffins were disturbed by square pits, located in the centre of the site. These pits contained early to mid-19th-century artefactual material. While their function remains unclear, it is possible that they were used by ropery and sailcloth manufacturers, located to the north of the site (Ainslie 1804). By the late 19th century a wooden smallpox hospital had been established to the north of the site, and by 1905 a second structure had been established to the east of the smallpox hospital, which went out of use in *c* 1912. St Mary's (Leith), then known as the Links School, was established at the site by 1931.

3. LOCATION, GEOLOGY AND BACKGROUND

Leith is now a district situated in the north of the city of Edinburgh, on the coast of the Firth of Forth and positioned at the mouth of the Water of Leith, though before 1920 it was an independent burgh. Leith is Edinburgh's port; it is characterised by its extensive port facilities and is heavily industrialised along its coast. The site, St Mary's (Leith), is located just inland from the coastal strip in the area known as South Leith, on the north side of Leith Links (Illus 1). Initially an area of sand dunes, Leith Links was later an early golf course and is now a public park (Illus 2).

The solid geology of the area comprises Gullane Formation sedimentary rock of the Strathclyde group type, which are predominantly sandstones, interbedded with siltstones, mudstones, limestones, ironstones, coals and seatearth. This bedrock is overlain by Flandrian raised marine sand and gravel deposits (British Geological Survey (BGS) 2019). The superficial deposits at the site also consisted of an overlying layer of wind-blown sand. Such material would have been attractive for digging graves. Although within a sand matrix the burials

Illus 1 Site location © Wardell Armstrong LLP



Illus 2 Location of the archaeological excavation © Wardell Armstrong LLP

were deposited at or below the existing water table, which ensured good conditions for the preservation of wood and some other organics. Conditions for the survival of human bone were variable across the site, but generally poor.

One of the earliest records of Leith is found in exchequer rolls produced during the reign of David I (1124–53) approving the construction of the Abbey of Holyrood in 1128, and also detailing Leith's emerging role as an important trading centre, notably for cattle, fish and cereal crops (Russell 1922). By the 13th century, two distinctly administered halves had emerged to the settlement, north and south, with the north governed by the Abbot of Holyrood, and the south by the Lairds of Restalrig (Russell 1922: 9). The Links area lay to the south of the southern part of historic Leith. Between 1548 and 1560 Leith was fortified by its French garrison with *trace italienne* defences encircling the town (Paton and Cook 2016). These were built under the instruction of Mary of Guise, with the seat of government temporarily being transferred from Edinburgh to Leith.

In the 16th century, the Links area lay outside the town defences to the east. Consequently, they formed an important part of the siege of Leith in 1559–60 as demonstrated by contemporary accounts and a map held at Petworth House, Sussex (Steer 1961; Harris 1991; Paton and Cook 2016). The Links have been the subject of some past archaeological research into the siege (Pollard 2008). Previous archaeological works have uncovered the earthworks of Somerset's and Pelham's batteries as well as below-ground evidence of siege works.

The 17th century was a time of political, social and economic upheaval in Leith; the district witnessed several periods of famine in the early 17th century, with four recorded episodes of famine between 1620

and 1625 (Mitchinson 2002: 291–3). The strongly pro-Presbyterian Covenant petition was signed by the population of Leith in early 1638, which was both anti-Laudian Anglicanism and anti-Catholic in sentiment (Henderson 1937: 167). The plague epidemic swept through Leith in 1645, commencing in April and ending in the autumn months, with smaller episodes of the outbreak occurring in the following months (Russell 1922). As a consequence of the overwhelming number of deceased, bodies were buried along the Leith Links. The warmer weather of the summer months would likely have increased the spread of the disease, and the outbreak didn't peter out until some time in 1646. The plague epidemic decimated the population of Leith, killing over 50% of the population in the southern district alone (Electric Scotland (ES) online 2019: XXV). The civil wars of the 1640s and 1650s led to the fortifications of Leith being modified and extended (ibid).

Map regression analysis indicates that the area of the site may have been associated with the property of the Williamson and Gavin's ropery by 1822 (Thomson 1822). The area that forms part of the eastern boundary of the site is marked as drying grounds on the 1895 Second Edition Ordnance Survey map; it is likely that this was for drying hemp after the fibres had been separated through retting, the dried hemp then being used in rope manufacture.

A later 19th-century smallpox hospital was established directly north of the site. The development area impinges upon the site of a building associated with the wooden hospital that was erected between 1894 and 1905. There was a quoiting ground to the immediate east of this building range (OS One-Inch Scotland (2nd edition) Edinburgh Hills 1885–1900). This structure may also have been an insubstantial structure, and had certainly been demolished along with the wooden smallpox hospital by 1912 (OS One-Inch Scotland (3rd edition) Edinburgh Hills 1903–12). By 1931, St Mary's (Leith), then known as the Links School, had been established and the development area from then on was part of a playground (OS 1:25,000 Maps of Great Britain (1937–61) Edinburgh).

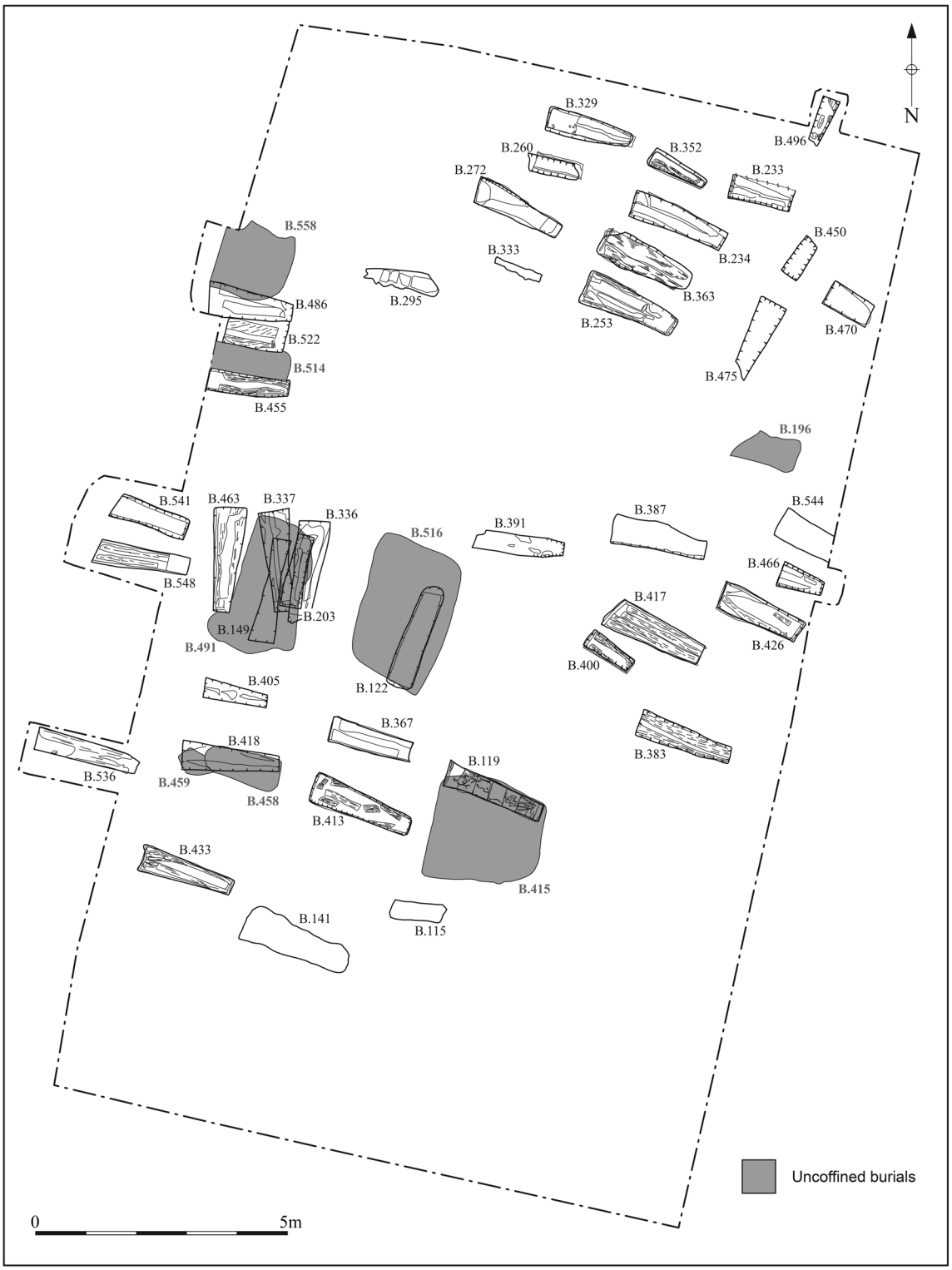
4. THE EXCAVATION: THE BURIALS

The archaeological excavation was undertaken at St Mary's (Leith) because of the results of a previous evaluation. The evaluation had been carried out primarily because of the possibility of remains linked to the siege of Leith. The evaluation identified burials in coffins. The subsequent excavation was intended to clarify the nature and context of these burials, which were not contained within a known consecrated burial ground. The excavation's principal research question was thus focused on why the burials were on the Links. Three potential scenarios were postulated for the burials: they related to the siege of Leith in 1560; they related to the 1645 plague outbreak; or they related to the late 19th-century smallpox hospital.

The excavation revealed coffined and shrouded human burials, burial pits and non-funerary-related rectangular and square pits (Illus 3). Four phases of activity were evident on the site, with the human remains relating to Phases 1 and 2. Phase 1 consisted of burial pits. Phase 2 consisted of east–west-aligned coffined burials with a sub-phase, Phase 2a, featuring north–south-aligned coffined burials (WA 2016: 11–22).

Archaeological activity in Phase 1 was represented by burial pits. Artefacts retrieved from the bodies in Phase 1 included coins dating to the reigns of James VI (1566–1625) and Charles I (1625–49). Activity in Phase 2 was represented by east–west- and north–south-aligned coffined and uncoffined burials (Illus 4). Phases 1, 2a and 2b all relate to the mid-17th century (ie 1645–6); the Phase 2 burials are highly likely to comprise later burials within this time frame (potentially the autumn or winter months of 1645 as opposed to the spring months of 1645).

Illus 3 Overall plan of the archaeological features – all phases © Wardell Armstrong LLP



Illus 4 Plan of the burials © Wardell Armstrong LLP

5. THE HUMAN REMAINS AND THE CEMETERY DEMOGRAPHIC PROFILE

A total of 81 individuals were interred at the site, including 71 articulated human skeletons, five sets of disarticulated human remains (Sk133, Sk144, Sk165, C306, C310), three coffins with no human remains (Coffins C116, C171 and C273), and two coffins that were left in situ on the site due to their location (Table 1).

The completeness of the skeleton and the surface preservation of the bones was recorded using Brickley and McKinley's grading system (Brickley and McKinley 2004: 16, figure 7.1-7). Age estimation of adults relied on the analysis of dental attrition (Anderson et al 1976; Brothwell 1981: 72; White & Folkens 2005: 346; Lovejoy et al 1985a & 1985b) and the analysis of the auricular surfaces of the ilium, where available (Lovejoy et al 1985b; Buckberry & Chamberlain 2002; White & Folkens 2005: 358). It was necessary to rely on the grading of dental attrition for many of the human skeletal remains as in many instances the *os coxae* had not survived the waterlogged burial environment. It was not possible to use sternal rib end or pubic sympheseal analysis for age estimation. Non-adult age estimation relied upon epiphyseal fusion stages from standards published in Scheuer & Black and Schaefer et al (Scheuer & Black 2000, 2004; Schaefer et al 2009) as well as dental development and eruption stages (Gustafson & Koch 1974).

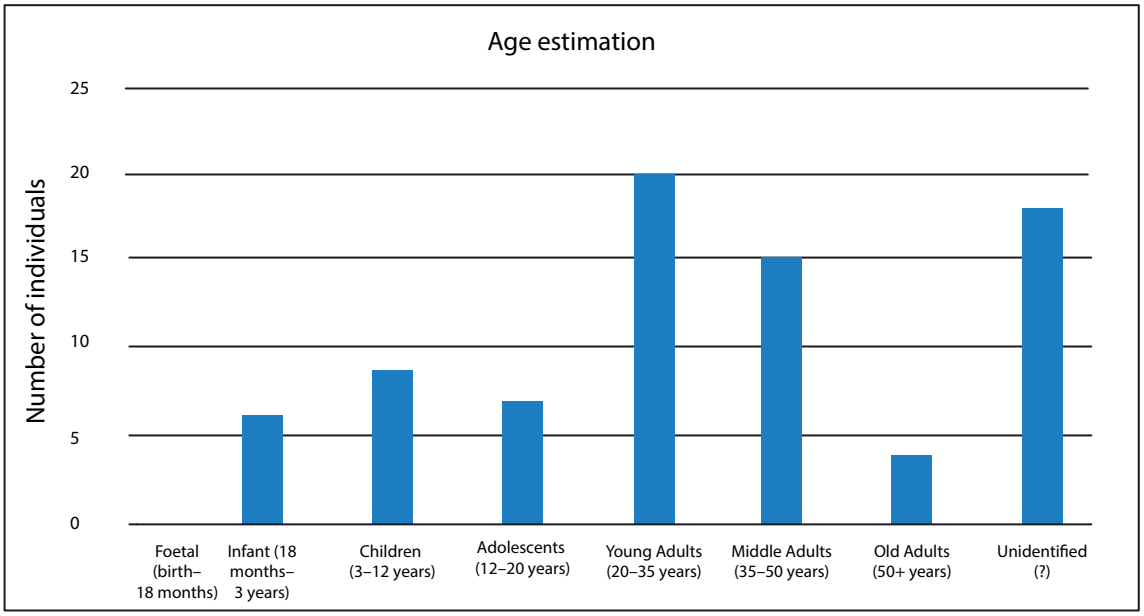
Sex determination of adults was analysed using standards published in Brothwell, Ubelaker, Bass and Mays; sex determination of non-adults was not carried out due to continuous osteon remodelling and rapid skeletal growth (Brothwell 1981; Ubelaker 1989; Mays 1998; Mays 2010; Bass 1987; Bass 1995). Cranial and post-cranial non-metric and metric traits were recorded (Trotter & Gleser 1958; Berry & Berry 1967; Trotter 1970; Howells 1973; Finnegan 1978) as well as unusual entheseal changes and pathological conditions for both dentition and bone (van Beek 1983; Hawkey & Merbs 1995: 326; Roberts & Manchester 2010; Davis et al 2013; Henderson et al 2016).

The preservation of the human skeletal remains was very poor in the main; the waterlogged burial environment had a detrimental impact on the human remains, damaging all aspects of the bone. The damage caused to the cortical bone surfaces had a negative impact on sex determination, age estimation, stature estimation and examinations for pathological conditions. Most of the human bone was graded either Very Poor or Poor (Brickley and McKinley 2004: 16, figure 7.1-7). The completeness of the skeletons ranged from 5% to 75%.

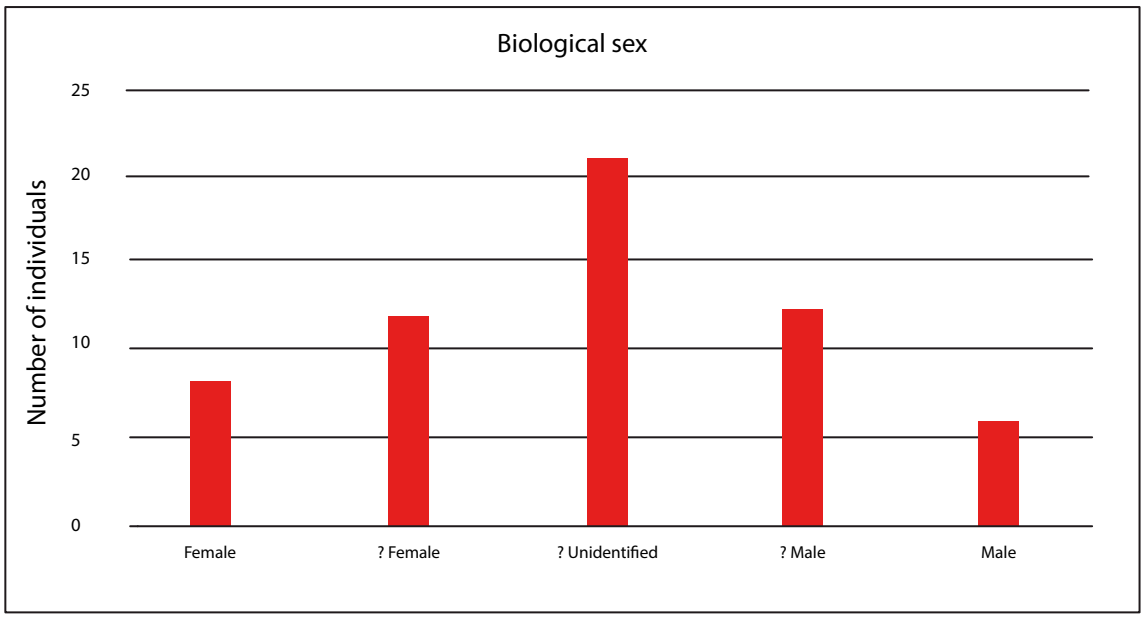
Adults represent 68.3% of the cemetery population while non-adults (including sub-adults) represent 31.7% of the population (Illus 5). It was necessary to assign broad age categories due to the poor condition of the human remains. Adult individuals were defined by the presence of complete dental eruption and complete epiphyseal limb bone fusion centres (Ruff et al 2012: 603). Non-adult individuals were defined by the presence of incomplete dental eruption and incomplete epiphyseal fusion centres. Young Adults (20–35 years) are the largest age group at 25.3%, closely followed by Middle Adults (35–50 years, 18.9%), Unidentified (22.7%) and Children (3–12 years) (11.3%). Adolescents/Sub-adults (12–20 years) make up 8.8% of the assemblage and Infants (18 months–3 years) make up 7.5%. Old Adults (50+ years) make up 5% of the assemblage. There were no neonatal individuals (birth–18 months). Over a fifth of the burials could not be assigned an age due to poor preservation.

Just under two-thirds of the adult skeletal remains could be assigned a biological sex. When pooled, division of the sexes appears fairly equal; female/possibly female individuals comprised 33.8% of the total population and male/possibly male individuals comprised 30.4% of the total adult population. Over a third of the adult population could not be assigned a sex (Illus 6).

In terms of the cemetery demographic, important interpretations can be drawn from comparisons to other medieval and post-medieval cemeteries in Britain. Two types of mortality profiles can be identified with cemetery populations: attritional and catastrophic. The former is a mortality profile derived from natural wastage and is characterised by a high number of infant deaths, a low number of adolescent deaths and a gradual increase in mortality (Gowland & Chamberlain 2005: 146). The catastrophic palaeodemographic profile is characterised by a short-term mortality crisis as a consequence of disease, war, massacre and famine



Illus 5 Age estimation © Wardell Armstrong LLP



Illus 6 Sex estimation © Wardell Armstrong LLP

Table 1 Catalogue of human skeletal remains

Skeleton no./ Context no.	Cut no.	Coffin no.	Finds	Alignment	Age (adult/ non-adult)	Refined age	Sex	Height (cm & ft/in)	Measurements (mm) (cranial)	Pathologies (bone)	Pathologies (dentition)
133	132	–	–	Disartic.	Adult?	–	–	–	–	–	–
144	119	–	–	Disartic.	?	–	–	–	–	–	–
127	122	123	SFs 1–7 & 69, Fe nails <5>	N–S	Adult	40+ yrs	?	165.79–169.15 (5ft 5–5ft 6)	–	Periosteal new bone – occipital fragment	Caries on occlusal surface of LM^2, slight calculus
150	141	142	None	E–W	Adult	–	?F	–	–	–	–
151	119	121	SF8, Fe nail	E–W	Non-adult	10–12 yrs	?	–	–	–	–
165	164	–	–	Disartic.	Adult	–	–	–	–	–	–
166	149	147	SFs 68 & 73, Fe nails	N–S	Adult	–	?	–	–	Porotic hyperostosis on cranium, kidney stone <22>	Slight calculus, LEH on 4 teeth
210	203	204	None	N–S	Non-adult	6 yrs	?	–	–	–	LEH on 3 teeth
221	196	–	SF9, Fe nail	E–W	Adult	–	?	175.13–179.21 (5ft 7–5ft 8)	–	Pronounced *Linea aspera* & platymeria	–
271	260	261	None	E–W	Non-adult	2–3 yrs	?	–	–	–	–
279	234	240	None	E–W	Adult	20–30 yrs	?M	179.25 (5ft 8)	–	–	LEH on 10 max teeth, large caries on RM^2, slight calculus on 6 teeth; mandible: slight calculus on all dentition, LEH on 3 teeth
284	253	237	None	E–W	Adult	25–35 yrs	?M	–	–	Exostoses on cost-clav lig; porotic hyperostosis on cranial vault	Periodontal disease on mandible, slight calculus on 15 teeth; LEH on 9 teeth including mand incisors, max PMs and max canine
306 (C no.)	305	–	None	Disartic.	Adult	–	–	–	–	–	–
310 (C no.)	303	–	None	Disartic.	Adult	–	–	–	–	–	–

Table 1 *cont*

Skeleton no./ Context no.	Cut no.	Coffin no.	Finds	Alignment	Age (adult/ non-adult)	Refined age	Sex	Height (cm & ft/in)	Measurements (mm) (cranial)	Pathologies (bone)	Pathologies (dentition)
318	233	300	None	E–W	Non-adult	4 yrs	?	–	–	–	LEH on all max incisors plus 2 mand incisors
351	336	339	None	N–S	Adult	17–25 yrs	?	–	–	–	–
356	352	354	None	E–W	Non-adult	18 mths–3 yrs	?	–	–	Body non-existent	24 teeth; notches on occlusal incisors (normal variant), possible LEH on incisors
361	329	330	None	E–W	Adult	25–35 yrs	?	162.78–167.31 (5ft 3–5ft 4)	–	–	Slight calculus on M_2, LEH exhibited on 4 teeth
365	363	364	SFs 10 & 11, Fe nails	E–W	Adult	50+ yrs	M	183.57 (6ft)	–	Healed fracture to R clavicular shaft; osteophytic changes on L vert, rugose pitting at *Biceps brachii*, acetabular pitting (osteophytic changes), destructive lesion in posterior navicular – gout?, R patella – osteophytic changes	Heavy calculus & periodontal disease on mand teeth, large caries on occlusal surface of RM_1; heavy calculus on M^2 and canine
382	337	380	None	N–S	Adult	25–35 yrs	?	–	–	Hydatid casing	Mandible: all present and correct; moderate calculus on incisors, slight calculus on canines & molars; LEH on 2 incisors, both canines and PM_1s

Table 1 *cont*

Skeleton no./ Context no.	Cut no.	Coffin no.	Finds	Alignment	Age (adult/ non-adult)	Refined age	Sex	Height (cm & ft/in)	Measurements (mm) (cranial)	Pathologies (bone)	Pathologies (dentition)
389	372	374	SF62 wooden rosary/paternoster beads <117>	E–W	Adult	27–35 yrs	M	181.53 (5ft 11)	–	A chap with many pathologies; grade 1 osteophytic lipping on 5 T, 2 L & 2 C vert; high % of Schmorl's Nodes on T vert – largely on inferior surface but 4 T vertebrae display nodes on both surfaces; large depression at site of deltoid on L humerus – possible soft tissue injury; wormian bones	LEH on all incisors and PM_1; maxillary dentition: all except LM^3; slight to moderate calculus on incisors, no caries, minor periodontal disease. Mand dentition: all except M_3s; slight calculus, no caries, minor periodontal disease; individual would have had an overbite
396	391	392	None	E–W	Adult	33–45 yrs	?M	–	–	–	Slight calculus on 5 max teeth
397	367	369	None	E–W	Adult	20–29 yrs	F	–	–	Wormian bones, tumour on R mastoid process – mastoid osteoma	Very slight calculus, minor periodontal disease – teeth in quite good condition
399	383	398	None	E–W	Adult	50–60 yrs	F	–	–	None observed – bone preservation too poor	AMTL on tiny mandible; no dentition; likely quite an elderly individual
402	400	401	None	E–W	Non-adult	18 months–2 yrs	–	–	–	None	None
409	417	394	None	E–W	Adult	42–45 yrs	F	157.84cm (5ft 2)	–	None observed	PM^2 & M^2; mand dentition: LEH on 5 teeth (incisors & canine); slight calculus on molars and incisors; heavy calculus on max teeth

Table 1 *cont*

Skeleton no./ Context no.	Cut no.	Coffin no.	Finds	Alignment	Age (adult/ non-adult)	Refined age	Sex	Height (cm & ft/in)	Measurements (mm) (cranial)	Pathologies (bone)	Pathologies (dentition)
411	405	407	None	E–W	Non-adult	10–12 yrs	–	–	–	–	LEH evident on all max incisors, 2 mand incisors & max L canine
422	413	423	None	E–W	Adult	30–35 yrs	F	160.31cm (5ft 3)	–	Potential kidney stone, hydatid cyst; potential destructive lesion on posterior surface of T10 vert – beginnings of TB?; heavy exostoses at both *Biceps brachii* sites on radii	Slight calculus on 7 max teeth and 4 mand teeth, some AMTL at site RM_1
430	491 [pit]	–	SFs 12 & 13: Fe key plus 3 coins in corrosion	N–S	Adult	45–55 yrs	?M	–	–	None observed	Extensive periodontal disease on mand dentition, slight calculus on 4 max & 3 mand teeth, very heavy wear
432	426	424	None	E–W	Adult	18–22 yrs	?F	147.96cm (4ft 10)	–	Mand torus present	Very slight calculus on mand dentition (teeth include all L side teeth from LI_1)
435	433	434	None	E–W	Adult	45–55 yrs	M	183.57cm (6ft)	–	None observed	Heavy calculus on max teeth, heavy calculus on mand teeth, caries on M_2 and M^3
438	418	420	None	E–W	Adult	24–30 yrs	?F	152.90–158.33cm (5ft–5ft 2)	–	Scurvy on cranium? Very thick cranial vault, very thin cortical bone	LEH on 7 mand teeth
439	415 [pit]	–	None	N–S	Sub-adult	16–20 yrs	?	–	–	None observed	LEH on mand incisors; deciduous max & molars present

Table 1 *cont*

Skeleton no./ Context no.	Cut no.	Coffin no.	Finds	Alignment	Age (adult/ non-adult)	Refined age	Sex	Height (cm & ft/in)	Measurements (mm) (cranial)	Pathologies (bone)	Pathologies (dentition)
440	415 [pit]	–	SFs 43 & 44 leather boots with wooden soles	E–W (cranium at E end)	Adult	–	?	Fem L: 403mm; 153. 6–157.2cm (5ft–5ft 1)	–	None observed	None
441	415 [pit]	–	SF60 wooden bead <60>	E–W (cranium at E end)	Sub-adult	15–17 yrs	?	–	–	Lesions & pitting in 3 C vert – possibly infection	None
442	415 [pit]	–	None	E–W	Adult	44–47 yrs	?M	161.79cm (5ft 3)	–	Periosteal infection on lateral distal R humerus, slight osteophytic changes on T vertebrae, Schmorl's Nodes on 3 T vert	Slight to moderate calculus on molars, caries on LPM^2, periodontal disease evident on mandible; very heavy wear on mand canines & incisors (posterior/ lingual)
443	415 [pit]	–	Leather from torso	E–W	Adult	45 yrs+	?M	–	–	None observed	AMTL on mandible, caries on LPM_2
449 & 529 (cranium)	516 [pit]	–	None	E–W	Adult	45–55 yrs	?M	–	ZZ: 44.64	Heavy *Linea aspera* & *Soleal line* entheseal changes on both fems & tibs	Heavy calculus evident on: mand incisors, all premolars and R canine; abscess on LM_1; caries on LM_1; heavy calculus on all left max dentition; periodontal disease evident on both max & mand dentition
453	450	454	SF14 (Fe nail)	N–S	Non-adult	4–6 yrs	?	–	–	–	LEH on 2 incisors
460	458	–	None	E–W	Adult	18–22 yrs	?	–	–	–	–
461	459	–	None	–	Non-adult	6–7 yrs	–	–	–	–	None

Table 1 *cont*

Skeleton no./ Context no.	Cut no.	Coffin no.	Finds	Alignment	Age (adult/ non-adult)	Refined age	Sex	Height (cm & ft/in)	Measurements (mm) (cranial)	Pathologies (bone)	Pathologies (dentition)
462	463	446	None	N–S	Adult	40–50 yrs	?F	–	–	–	Caries on M_2, heavy calculus on mand teeth, slight calculus on max teeth
472	470	471	None	E–W	Adult	45–55 yrs	?	–	–	–	None
477	415 [pit]	–	None	E–W	Adult	40–50 yrs	?F	160.31cm (5ft 3)	–	Fusion of acetabulum & L prox fem head	Moderate calculus on 8 teeth, slight calculus on 6 max teeth, LEH on 3 incisors
478	415 [pit]	–	None	NE–SW in pit	Adult	40–45 yrs	?F	160.13cm (5ft 3)	–	Schmorl's Node on T9, lesion in T10	Moderate calculus on all mand molars; LEH on 2 mand incisors
479	415 [pit]	–	None	E–W	Sub-adult	14–16 yrs	?	–	–	–	Very healthy teeth
480	415 [pit]	–	None	E–W	Adult	24–30 yrs	?M	–	–	Destructive lesion in glenoid fossa portion – tuberculosis?	Moderate calculus on max molars (×3)
481	415 [pit]	–	Leather; SF70 sewing kit; SF66 wood pommel top	E–W	Non-adult	11–12 yrs	–	–	–	None observed	Note: eruption of LPM_1 not quite complete
482	415 [pit]	–	SF41 leather & woollen shroud material	SW–NE in pit	Adult	30–40 yrs	?F	157.05cm (5ft 1)	–	Lesion on external cranial vault, possible PH?	Heavy calculus on mand dentition; periodontal disease

Table 1 *cont*

Skeleton no./ Context no.	Cut no.	Coffin no.	Finds	Alignment	Age (adult/ non-adult)	Refined age	Sex	Height (cm & ft/in)	Measurements (mm) (cranial)	Pathologies (bone)	Pathologies (dentition)
483	415 [pit]	–	SF42 pin from R scap; SF63 wood lice comb; woollen shroud material, SF61 wooden beads <265>	SW–NE in pit	Adult	24–25 yrs	F	152.30cm (4ft 11)	–	Matching bony nodules on conoid tubercules (clavicles): natural bone formation (clavicle not fused, under 26 yrs; wear on R max molars = 24–30 yrs; evidence of shroud and clothing on virtually all bones	Heavy wear on all dentition, slight calculus on mand dentition; evidence of periodontal disease on both max and mand dentition
484	415 [pit]	–	Woollen shroud material <258>	SW–NE in pit	Adult	20–24yrs	?F	149.9cm (4ft 11)	–	Medial squatting facet on L talus	AMTL on LM_1; moderate calculus on mand teeth
485	455	457	None	E–W	Sub-adult	*c* 13 yrs	?	–	–	None observed	–
487	475	488	None	N–S	Adult	35–45 yrs	?	–	–	None observed	Moderate calculus on mand molars
493	491 [pit]	–	Shroud material	E–W in pit	Adult	30–35 yrs	F	157.84cm (5ft 2) L femur = 420mm	–	Lesions on cranial vault possibly associated with porotic hyperostosis	Moderate calculus on M_1, M_2 & LPM_1; caries on LM^2; slight calculus on LPM_2, moderate calculus on L mand canine
494	491 [pit]	–	Shroud material; SF71 CuA brooch	Roughly E–W in pit	Adult	35–40 yrs	?F	157.23cm (5ft 1); left tibia = 330mm & left fem prox head = 42.77mm Ø	–	–	Heavy calculus on M_1 & LPM_1; moderate calculus on PM_1 & LI_1
495	491 [pit]	–	Shroud material	N–S	Sub-adult	16–20 yrs	?M	–	–	–	–

Table 1 *cont*

Skeleton no./ Context no.	Cut no.	Coffin no.	Finds	Alignment	Age (adult/ non-adult)	Refined age	Sex	Height (cm & ft/in)	Measurements (mm) (cranial)	Pathologies (bone)	Pathologies (dentition)
498	496	497	None	N–S	Non-adult	12–24 months (2 yrs)	–	–	–	–	Possible LEH on mand incisors
501	486	489	None	E–W	Adult	–	?M	179.21cm (5ft 10)	–	–	–
502	466	468	None	E–W	Adult	–	M	R fem L: 470mm; R fem prox hd: 45.61mm, L fem prox hd: 46.08mm; Height = 174.57cm (5ft 8)	–	–	–
506	514	–	SFs15–40: 25 silver coins dating to Charles I 1637–42; leather purse/corded fragments plus partial clasp and attached bead; SF58 Fe tack/ hobnail; also woollen shroud material from <255>	E–W	Adult	20–24 yrs	?	–	–	–	LEH on 4 max teeth and on M_1 and both canines
508	486?	–	None	Disartic.	Sub-adult	<19 yrs	?	–	–	–	–
511	558	–	None	–	Adult	–	?F	156.35cm (5ft 1)	–	Possible periosteal infection on R tibia	–

Table 1 *cont*

Skeleton no./ Context no.	Cut no.	Coffin no.	Finds	Alignment	Age (adult/ non-adult)	Refined age	Sex	Height (cm & ft/in)	Measurements (mm) (cranial)	Pathologies (bone)	Pathologies (dentition)
512	558	–	SF64 wooden lice comb & coins dating to James VI (florins 1567–1625); SFs48–55 – this group includes Fe handle & leather cord – purse fragments; leather/coarse fabric shroud material	E–W	Adult	–	?M	R tibia L = 380mm: 173.89cm (5ft 8)	–	Hydatid casing (tapeworm) in <312>; wormian bones; heavy exostoses on lateral distal R hum – is this a soft-tissue injury?	–
517	516	–	None	E–W	Non-adult	–	–	–	–	–	–
518 (legs) & 531 (cranium)	516 [pit]	–	None	E–W	Adult	18–22 yrs	M	Left tib = 400mm; 183.57cm (6ft)	RB^1: 27.93; ZZ 38.01; H_1: 28.25	None observed	Heavy calculus on mand incisors, canines & both PM^1s; moderate to heavy calculus on max incisors, canines, PM^1s and PM^2s; LEH on mand and max incisors
519 (legs) & cranium (532)	516 [pit]	–	None	E–W	Adult	17–22 yrs	M	Right tib = 420mm, 183.33cm (6ft)	–	Wormian bones	LEH on max incisors, both canines & LPM^1; minor calculus on all mand incisors
520 (legs) & 530 (cranium)	516	–	None	E–W	Non-adult	6–7 yrs	–	–	–	Lesions on parietal possibly associated with scurvy	LEH on max incisors

Table 1 *cont*

Skeleton no./ Context no.	Cut no.	Coffin no.	Finds	Alignment	Age (adult/ non-adult)	Refined age	Sex	Height (cm & ft/in)	Measurements (mm) (cranial)	Pathologies (bone)	Pathologies (dentition)
525	522	524	SF65, <294>, wooden bead, woollen shroud material from <294>; 3 × beads from <292>	E–W	Adult	40–45 yrs	M	Fem hd: 47.54mm; no height	Gonion: 67°; RB[1]: 33; ML: 110; ZZ: 44; GoGo: 90; Gnathion: 56; Infradental: 53.11; H_1: 32.89; Mentale (L): 75.7; Mentale (R): 73.5	Mand torus present	Moderate calculus on mand incisors, canines and PMs; heavy calculus on LM_1 & M_2 (mand); large caries on RM_1 (mesial)
527 & 535 (legs)	516 [pit]	–	None	E–W	Non-adult	5–7 yrs	–	–	–	–	LEH on 2 deciduous mand incisors & both permanent M_1s (not quite erupted)
528 & 534 (legs)	516 [pit]	–	SF45 Fe attached to bone	E–W	Sub-adult	12–15 yrs	–	–	–	–	Slight calculus on 5 mand dentition; pronounced mesial marginal ridge on upper L canine; LEH on max canines, max incisors, mand M_1s and 3 mand incisors
538	415	–	–	Disartic., no orientation (located N of Coffin C374)	Adult	–	F	Fem hd: 40.17mm	–	–	No dentition

Table 1 *cont*

Skeleton no./ Context no.	Cut no.	Coffin no.	Finds	Alignment	Age (adult/ non-adult)	Refined age	Sex	Height (cm & ft/in)	Measurements (mm) (cranial)	Pathologies (bone)	Pathologies (dentition)
550	536	540	SFs 46 & 47 Fe coffin nails	E–W	Adult	45–55+ yrs	?	R tib L = 400mm (177.53–183.57cm 5ft 8–6ft)	–	–	Slight calculus on max incisors
551	541	542	None	E–W	Adult	–	?F	Limb bones not 100% complete	–	–	–
552	548	547	None	E–W	Adult	–	?	L fem L = 410mm & R tib L = 330mm, H = 156.06–160.33cm (5ft 1–5ft 2)	–	–	LEH on 5 mand teeth
556	558	–	–	NW–SE	Adult	<30 yrs	F	L fem = 450mm, L tib = 340mm; H = 163.01cm (5ft 4)		–	–
557	558	–	SF56 coin?	E–W	Adult	50+ yrs	?F	–	–	–	–

(Margerison & Knüsel 2002: 134); all age groups are affected, with an emphasis on Children and Young Adults. Excavations at the mid-14th-century plague burial site of the Royal Mint, London, produced over 1,000 skeletons, of which 600 were available for analysis (ibid: 136). The skeletons were contained within burial trenches and grave rows, and a mix of all sexes and ages were represented with no noticeable segregation of individuals (ibid). The burial methods were well organised and the bodies were interred with care; there were many juvenile individuals and very few Young Adults. The Royal Mint cemetery generally fits with a catastrophic palaeodemographic profile, as does the death assemblage from St Mary's (Leith), although there is a distinct difference in the quantity of burials (n = 81 at St Mary's (Leith) as opposed to over 1,000 at the Royal Mint); all sexes and ages are represented at both with no discrimination of burial selection criteria. A disease like the plague was indiscriminate in its nature and bodies needed to be buried as quickly as possible, regardless of age, sex or social status (Ziegler 1969: 137; Hollingsworth et al 1971: 171). Well-organised and respectful burial methods are also visible in both cemeteries, although some at St Mary's (Leith) do indicate a lack of care. Juvenile individuals are frequent in both populations, although a high proportion of Young Adults are represented at St Mary's (Leith), which is more typical of a catastrophic palaeodemographic profile (Margerison & Knüsel 2002: 141).

Another London cemetery site with a catastrophic demographic profile is St Botolph-without-Bishopsgate. The death assemblage has a high prevalence of Non-adult individuals, which does match the catastrophic model, although the authors argue that no one age group is particularly susceptible to the plague and that the severity of the outbreak would be influenced by environmental factors and social customs (Hollingsworth et al 1971: 131). Similarly, the mortality profile for a 17th-century plague cemetery in Venice matches the catastrophic demographic model; the plague of 1630 wiped out a third of the population of Venice and a high proportion of Non-adults and Young Adults are represented; a histogram from this burial site shows a cluster of deaths aged from 0 to 25 years (Ell 1989: 128). Over 59% of the victims were women and, interestingly, this figure includes a high number of pregnant women. A likely cause for this is a lowered immunological state due to the suppression of T-cell immunity (ibid: 136). This type of immunity is especially important in combating plague, and an individual with a low quantity of T cells has less chance of surviving a disease epidemic (Wake, Morita & Wake 1978: 1045–52).

In contrast, some comparisons can be drawn to cemetery populations with an attritional profile. Excavations at the 12th–16th-century urban site St Helen-on-the-Wall, York, revealed a minimum of 1,044 individuals (ibid: 137). In common with a catastrophic cemetery profile, all ages and sexes were represented with no discriminate burial selection criteria. However, there was a high proportion of Middle-aged Adults (35–45 years) in comparison to a high proportion of Young Adults, the latter being more typical of a catastrophic cemetery profile (ibid). The palaeodemographic model for St Helen-on-the-Wall generally fits the attritional mortality profile of a population originating from a poor, medieval urban parish (ie gradual mortality increase and high numbers of infants), as opposed to a catastrophic cemetery profile, in which a short-term mortality crisis is evident, with the disease epidemic targeting Young Adults and Children. Similarly, an attritional mortality profile is evident with the death assemblage at Blackgate Cemetery, London, ie a more even representation of age categories (Gowland & Chamberlain 2005: 152).

Only 14 cranial metric measurements could be taken from the entire human remains assemblage (Table 1). This data is likely to be statistically unviable for any significant osteoarchaeological analyses or interpretations. Post-cranial metrics to calculate stature did provide useful information on the biological profile of the cemetery demographic. Measurements were only taken of complete adult limb bones. When pooled, Female and possibly Female Adult individuals had a height range of 147.96–163.01cm, giving an average height of 155.48cm (5 foot 1). In-situ limb bone measurements were taken from Female Adult Sk551 but were deemed unsuitable for use due to their incompleteness. Male and possibly Male Adult individuals had a height range of 161.79–183.57cm, giving an average height of 172.68cm (5 foot 7 inches).

A recent study conducted on cemetery sites in London focused on developmental stress markers,

stature and sex of populations before the 1348 Black Death (Early Pre-Black Death 1000–1200 AD and Late Pre-Black Death 1200–1250 AD) and Post-Black Death (1350–1540 AD) (DeWitte 2018). It revealed that stature in male individuals decreased before the Black Death and increased afterwards; stature in female individuals decreased after the Black Death (ibid). The study concluded that a number of factors (including the disease epidemic) may influence these trends, including differences between how males and females respond to stressors, effects of nutrition (or lack of it) during puberty and a disproportionate dietary access to males in the aftermath of the Black Death (ibid). It was likely to have been a similar scenario with the population in Leith during the 17th century; multiple factors (including the disease outbreak) will have contributed towards stunted heights in individuals, including lack of food and the prevalence of other diseases.

Several pathological conditions were recorded on both adult and non-adult skeletons, including instances of metabolic disease, trauma, joint diseases and infectious diseases. Porotic hyperostosis (visible on the outer table of the cranial vault) was observed in four adults Sk166, Sk284, Sk482 and Sk493. Chronic iron deficiency through diet and mineral malabsorption as well as diarrheal disease and intestinal parasites is thought to have been the cause of conditions such as porotic hyperostosis and cribra orbitalia (Walker et al 2009: 109). Recent haematological studies, however, have concluded that iron deficiency cannot sustain the huge red blood cell production that is the cause of the marrow expansion which causes these lesions; it is suggested that haemolytic and megaloblastic anaemias are instead responsible for the cause of porotic hyperostosis. Interestingly, small hydatid cyst tapeworm cases were recorded from thorax and pelvic samples from three other individuals Sk382, Sk422 and Sk512. Although the tapeworm cases were from different individuals, parasitic infection may be one possible contributing factor towards porotic hyperostosis in this cemetery population.

Evidence of scurvy in the form of abnormal bone porosity and reactive woven bone formation was observed in the axial and appendicular skeletons of two individuals, Young Child Sk520 and Young Adult Sk438. This disease is brought about by Vitamin C deficiency, a mineral essential for the absorption of iron, for immunological defence and for the maintenance and formation of body tissues such as collagen, an important protein component in connective tissues such as cartilage and bone (Roberts & Manchester 2010: 235). A deficiency of Vitamin C causes bleeding into the skin and through to the periosteum (Geber & Murphy 2012: 512–24). The manifestations of scurvy on the skeleton are the consequence of vascular responses to bleeding, or haemorrhaging of the periosteum and connective tissues; symptoms would have included bleeding, swollen gums and gingivitis, weakness and acute muscle pain, swelling of the lower extremities, vertigo, faintness and hyperkeratosis (ibid). Scorbutic changes in the form of porotic lesions were observed in the orbits and cranium (left sphenoid wing) of Child Sk520; porous bone formation of the posterior surface of the maxilla and severe periodontal disease were recorded in Young Adult Sk438, both of which are recognised clinical traits of the disease (Weize Prinzo 1999).

A possible instance of gouty arthritis was observed in tarsal bones of Old Adult Male Sk365. The disease is characterised by a high level of blood uric acid caused by an excess of uric acid production; urate crystals appear in the synovial fluids of joints and lead to inflammation and erosion of cartilage and bone (Ortner 2003: 583; Swinson et al 2010: 135). The joints affected are mainly the feet, hands, wrists, elbows and knees, causing immobility in the weight-bearing limbs. Gouty arthritis targets the larger tarsal joints and osseous manifestations of the condition include overhanging, erosive bony lesions. The condition also tends to affect joints asymmetrically. Overhanging erosive lesions were observed in the proximal left metatarsals Nos 1–3 and proximal and distal right metatarsals Nos 1–4 of Old Adult Male Sk365. An extremely painful condition, the joints would have been red and swollen; in modern society, multiple factors are associated with its onset, including excessive alcohol intake, a fatty and/or protein-rich diet, diabetes and heart disease (Roberts & Manchester 2010: 162). It is worth noting that the only instance of trauma that was observed was a healed fracture to the right clavicle of the same individual, Sk365, possibly caused by a crushing injury or a fall.

Several instances of periosteal new bone formation were recorded; porous woven bone was recorded on

the endocranium (left parietal) of Sk127 and lamellar striated new bone was observed on the proximal humeral shaft of individual Sk442. Individual Sk511 (Young Adult Female) had periosteal new bone formation on the right tibia. The new bone formation appeared to be porous woven bone, perhaps indicative of a leg ulcer. Periosteal new bone formation can be caused by infections and/or non-specific inflammation caused by ulcers or injuries; the condition manifests as fine pitting, longitudinal striations and eventually new growth in the form of plaque formations (Resnick & Niwayama 1995: 4435).

Evidence of tuberculosis in the form of destructive lesions on thoracic vertebrae and on the scapular glenoid fossa were observed in two individuals, Female Adult Sk422 and Young Male Adult Sk480. Tuberculosis is a bacterial infection (*Mycobacterium tuberculosis*) which primarily affects the lungs, although it also affects the glands, nervous system and bones. The bacteria target particular bones, including vertebrae, the sacrum and pelvis. A severe case of spinal tuberculosis can result in the collapse (kyphosis) of the spine caused by the destruction of the vertebral bodies (Roberts & Manchester 2010: 189).

Osteoarthritis of the articular facets and vertebral osteophytosis were observed in Male Adults Sk365 and Sk389. There would have been a higher prevalence of osteoarthritis but this analysis was hindered by the poor preservation of the bone. The vertebrae affected by degenerative joint disease in Sk365 included all lumbar and thoracic vertebrae (Grades 2 and 3) (Brothwell 1981: 150) with cervical vertebrae Nos 3–7 affected (Grades 1 and 2) (ibid). Vertebrae affected by osteophytic changes in Sk389 comprised all of the lumbar vertebrae (Grade 2) and thoracic vertebrae (Grade 2) with cervical vertebrae Nos 5–7 affected at Grade 0–1 (ibid).

Pronounced entheseal changes were recorded in several individuals, including Adult Sk221 and Adult Males Sk365, Sk389, Sk422 and Sk449/529. Pronounced entheseal changes were recorded on the femora, tibiae and radii; platymeria (unusual broadening of the femur) was observed in Adult Sk221, which was possibly caused by squatting or from repeated physical strain on the weight-bearing limbs during childhood and early adolescence (ibid: 88). Pronounced entheseal changes may be occupation-related, which could be suggestive of a physically demanding lifestyle. The formation and development of entheseal changes on the bone, however, is also highly dependent on age, sex, height and body mass, and all factors must be taken into consideration with entheseal change analyses (Henderson & Cardoso 2013: 127). In this instance, it is more prevalent in male individuals; sex and a larger body mass may account for these entheseal changes.

Schmorl's Nodes were recorded in several individuals, including Adult Males Sk389, Sk442 and Adult Female Sk478. Schmorl's Nodes are associated with the degeneration of the intervertebral discs; the disc contents exert pressure onto the vertebral bodies, causing small, regular, oval lesions/herniations in the superior and inferior vertebral bodies (Roberts & Manchester 2010: 140). According to Waldron (Waldron 2009: 45), Schmorl's Nodes are more common in individuals who participate in heavy, physical/manual work, imposing greater stress on the lower spine. Adult Male Sk389 had a high prevalence of Schmorl's Nodes, totalling five cervical vertebral nodes (two on the superior surface and three on the inferior surface), 15 thoracic nodes (eight on the superior surface and seven on the inferior surface) and nine lumbar nodes (including four on the superior surface and five on the inferior surface). Adult Male Sk389 also had a soft-tissue injury. A high quantity of Schmorl's Nodes on an adult of this age (27–35 years) living in a poor urban district such as South Leith in the 17th century is not surprising and, similarly to entheseal changes, factors such as sex and body mass can have an impact on the development of Schmorl's Nodes. Several studies have shown that Schmorl's Nodes affect Male Adults more frequently than Female Adults (Plomp, Roberts & Strand Viðarsdóttir 2012: 572; Üstündağ 2009: 695).

Kidney stones (*nephrolithiasis*) were recovered from pelvic and thorax samples from Adult Sk166 and Adult Female Sk422. Waste products in the blood can form crystals that collect inside the kidneys and eventually turn into stones. They tend to form if the individual is not drinking enough fluids.

The prevalence of caries was low for this cemetery population and caries were only observed in six adults. Dental calculus was observed in under half the cemetery population (30 out of 74, *c* 40%) and

periodontal disease was recorded in five individuals via methods used by Tomczyk et al (2017), including the degree of root exposure and dental calculus among others (Tomczyk et al 2017: 206). Of interest is the unusually high percentage of individuals with linear enamel hypoplasia ('LEH', Table 1). Twenty-two individuals (15 adults, seven non-adults) had hypoplastic lines visible on the mandibular and maxillary dentition, located primarily on the incisors and canines. Such developmental defects in the tooth are formed in response to growth arrest in the immature individual, the predominant causes of which are believed to include periods of physiological trauma, including illness, nutritional stress (such as famine) or a possible weaning deficiency (Larsen 1997: 45).

The pathological evidence suggests that many of the plague victims buried in this part of Seafield in the mid-17th century had lives characterised by poverty and toil. Lack of wealth may be indicated by the lack of caries as sugar was clearly not a common occurrence in the diet. Nutritional deficiencies resulted in poor health and stunted growth, and skeletal evidence indicated hard, heavy work. This chimes with the historical evidence, which indicates that South Leith was the poorer of the two parts of Leith. If the victims buried at St Mary's (Leith) had not succumbed to plague, there was an abundance of other diseases evident to shorten the lives of individuals. Poor sanitation, squalid and cramped living conditions and the presence of vermin would all have facilitated disease in South Leith. It is important to note that the spread of plague would have been exacerbated by close living quarters in both rural and urban populations (Gummer 2009: 242). Life expectancy in the 17th century was historically short because of episodes of famine, disease and warfare and this would certainly have been the case with this cemetery population (Gittings 1999: 147).

The devastating impact of the 1645 outbreak of plague can be seen with the burial methods used at St Mary's (Leith); while some individuals appeared to have been simply thrown into a burial pit (indicating a lack of care), others were afforded a more decent burial with their interment in simple wooden coffins.

6. COFFIN MANUFACTURE

Anne Crone

The species of 28% of the coffin components have been identified as Scots pine (*Pinus sylvestris*); all of the other components were coniferous so it is assumed that they were all Scots pine too. All the coffins have been manufactured from mill-sawn boards; saw-marks lying at right-angles to the edges are visible on many of them. Their construction appears to have followed a standard design, so the three most complete coffins, C142, C374 and C398, have been recorded in detail as representative of this design (Table 2).

6.1 Coffin C142

The surviving components of Coffin C142 consist of both side boards, head and foot boards, eight slats from the base, and the lid. The coffin was 1.98m long and was 0.22m high at the feet, increasing to 0.28m at a point 0.28m from the head. At this point the bases of the side boards had been cut at a sloping angle so that the height at the head end of the coffin is reduced to *c* 0.20m. Presumably, this angled base provided support for the head.

The base slats were on average 0.26m in length (measured along the length of coffin), except for Base 8 which was only 90mm long. They narrowed in width from 0.63m at the head to 0.37m at the foot. Many of them were tapered in width from one edge to the other, the sides shaped quite irregularly; this is most pronounced on Base 6, one side of which has been roughly chopped to shape with an axe (Illus 7.1).

Some of the base slats have shallow, narrow bevels on the external faces of the outer edges, pierced by a pair of nail-holes; others, however, display no shaping of the outer edges at all, and there are no nail-holes visible on Base 1. Presumably, the bevelling was done to reduce the width of the board at the point where it was going to be nailed to the side boards.

The head board is 0.53–0.57m wide so it must have been nailed onto the surface of Base 1, which is 60mm wide. However, it is too decayed to see any fixings. Nail-holes are visible on one edge of the foot board so the sides must have been nailed on either side of the foot board. The tops of both the head board and foot board are decayed so the original shape cannot be determined. Most of the original length of the lid survives but only 0.28m of the width survives. It has been fashioned from a board only 10mm thick so it is possible that it was made up of several boards, only one of which has survived. The boards in this coffin are quite variable in their thickness, from 30mm for the head and foot ends, to only 9mm for some of the base slats.

6.2 Coffin C374

This was the best-preserved of the coffins. The surviving components consist of both side boards, head and foot boards, and nine slats from the base, as well as three fragments of the lid. The overall length of the coffin was 2.07m by 0.27m high at the feet increasing to 0.29m from the head end. From this point the bases of the side boards had been cut at a sloping angle, as had been done in Coffin C142, so that the height at the very end of the coffin had reduced to 0.20m.

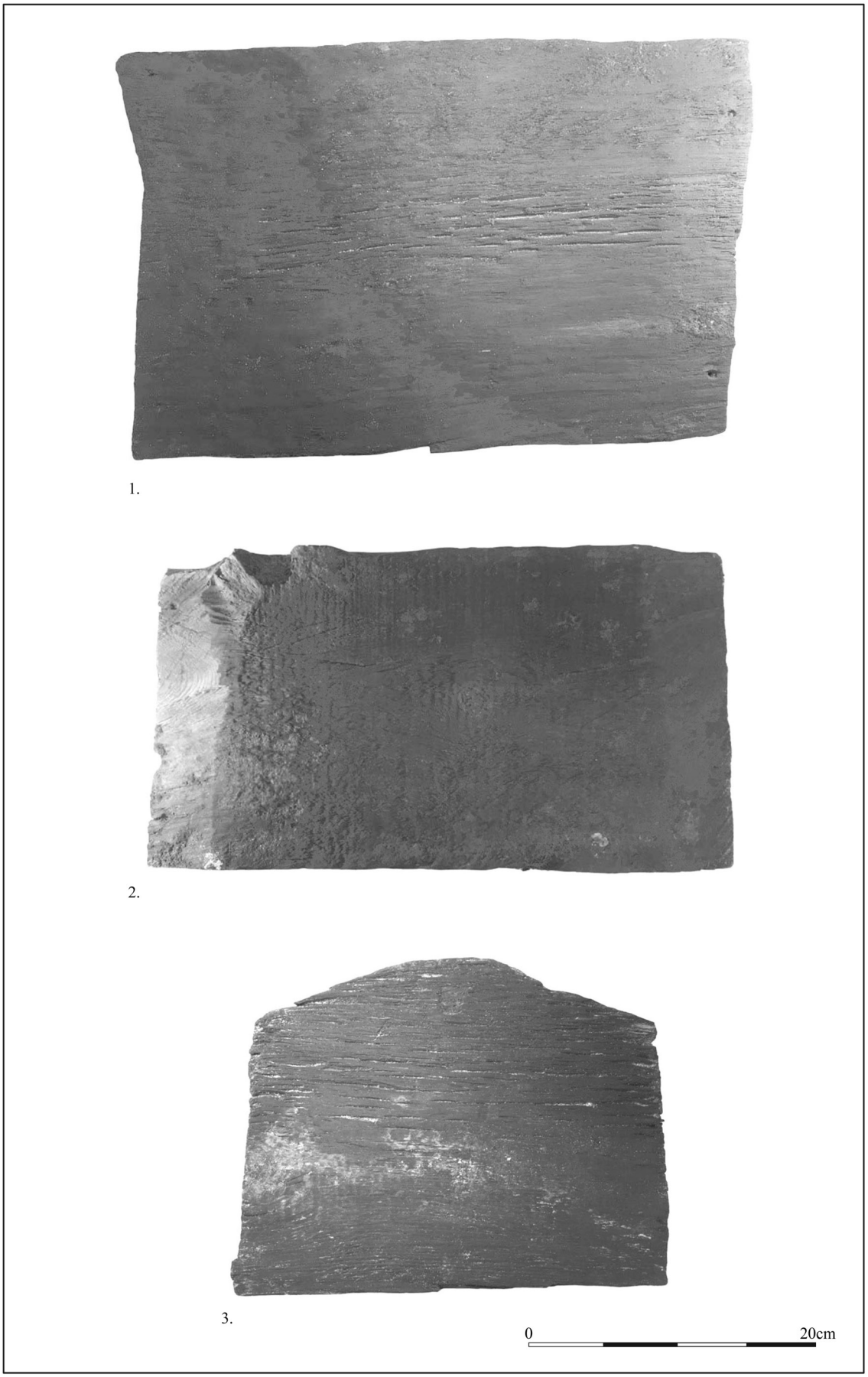
The base slats were on average 0.245m in length and narrowed in width from 0.54m at the head to 0.35m at the feet. They were rectangular, unlike those in the other two coffins. They are between 20mm and 30mm in thickness, except for Base 9, which is very different from all the other base plates in that it is only 98mm in length and 11mm thick; it has a single axe facet at one end and looks very like a small barrel stave that has been reused in the coffin.

The ends of the side boards had been bevelled on their external faces and so had the outer edges of each of the basal slats. The bevelled edges had been axe-dressed, often leaving the bevel with a wavy edge (Illus 7.2). All of the bevelled edges were pierced by a pair of nail-holes roughly placed towards the end of each edge, with corresponding nail-holes irregularly placed along the basal edge of each side board. Both ends had single nail-holes in each edge approximately 0.08m above the base.

Both the head board and foot board were house-shaped, ie with a central peak, so the coffin would have had a central ridge along its length. Only fragments of the coffin lid survived and none of these retained original edges so it is not possible to determine whether it had been fashioned from one or more boards of pine, but the peaked shape of the end boards suggests that it would have been a composite lid. The fragments were very thin, 7mm

Table 2 Measurements of coffin components

Context	Component	Length (m)	Width (cm)	Thickness (mm)	Height (cm)
142	N side	1.98	/	30	28
142	S side	1.97	/	30	23
142	Head end	/	53–57	22	15 +
142	Foot end	/	29	25	24
142	Base 1	27	59–63	22	
142	Base 2	24	58	22	
142	Base 3	24	53–56	19	
142	Base 4	27	49–53	20	
142	Base 5	26	45–47.5	9	
142	Base 6	28	40–44.5	9	
142	Base 7	28	36–40	11	
142	Base 8	9	37	30	
142	Lid	1.98	28 +	10	
374	N side	2.07	/	35	21
374	S side	2.06	/	20	21
374	Head end	/	48.7	30	29
374	Foot end	/	29.5	30	27
374	Base 1	26	54	20	
374	Base 2	25	51.5	20	
374	Base 3	26	50	25	
374	Base 4	26	45	21	
374	Base 5	26	47.5	20	
374	Base 6	22	43.5	22	
374	Base 7	24	41	30	
374	Base 8	21.5	37	24	
374	Base 9	9.8	35	11	
398	Right side	2.08	/	26	26
398	Left side		/	23	24
398	Head board a	/	54	21	7
398	Head board b	/	52.5	25	21
398	Foot board	/	29–30.5	25	25.2
398	Base 1	28	57–59	10	
398	Base 2	28	54–56	11	
398	Base 3	27.5	51	15	
398	Base 4	26	47–50	10	
398	Base 5	25	43–46	11	
398	Base 6	25	41.5–43	10	
398	Base 7	25	38.5–41	11	
398	Base 8	23	36–38.5	11	



Illus 7 Coffin manufacture: 1) C142, Base 6; 2) C374, Base 7; 3) C398, foot board © Wardell Armstrong LLP

on average. Some of the fragments appeared to be curved along one edge; this could have formed a lip over the coffin but the alignment of the ring-pattern suggests that this curvature had occurred as the wood decomposed.

6.3 Coffin C398

The surviving components of this coffin consist of both side boards, head and foot boards, and eight slats from the base. The lid has not survived. The coffin was 2.08m long and the base slats narrow from 0.59m at the head end to 0.36m at the foot end. The base slats are all flat, without the bevels seen on the other coffins, and all are pierced along either side by a pair of nail-holes. They all taper slightly along their length to form the classic coffin shape, and they reduce in length from 0.28m at the head to 0.23m at the foot.

The foot board is the most complete surviving example (Illus 7.3). It is 0.25m high, with a domed top and sides which slope gently to the top. The head board consists of two components but there is no indication as to how they were fixed together. A single nail-hole in the bottom edge of the lower head board corresponding to a single nail-hole in Base 1 indicates that this is how these two components were fixed together. Together the head board would have been 0.28m in height. The tops of the side boards are decayed so their original height is incomplete. They both have wide bevels at either end. They do not display the sloping base at the head end seen on the other two coffins.

The position of the nail-holes along the edges of the components indicates that the head and foot boards were nailed to the inner faces of the side boards, so that they were contained within the side boards, and then the base slats were nailed onto the edges of the side boards. Each base slat was secured by two nails, although the positioning was often quite irregular, while the head and foot boards appear to have been secured to the base slats by a single centrally placed nail, and to the side boards by a single nail positioned just above the base. There may have been other nail-holes which have disappeared with the decayed wood. Relatively thick boards, between 23mm and 26mm thick, were used for the four sides of the coffin, while the base slats were much thinner, between 10mm and 11mm thick.

6.4 Summary

The three coffins described above conform to a standard design and all vary very little in size (Table 3). However, there are other noticeable variations between them. There are differences in the way they were manufactured; rectangular, straight-sided slats were used for the base of Coffin C374, while they were neatly tapered in Coffin C142. The edges of the boards were not bevelled in Coffin C142 while there were pronounced bevels on the components of Coffin C374. This may relate to the fact that the boards used in Coffin C374 were much thicker and so it was necessary to reduce the thickness of the board at the joint. Differences in the design of the coffin lid are also intimated; the end boards of Coffin C374 were peaked, while the foot board of Coffin C398 was domed.

The other coffin components were scanned for further evidence of manufacture. On the whole, they conformed to the same general design observed in the three coffins described above: single boards for the long sides and multiple short slats for the bases. The thin boards used in the base of Coffin C398 were also observed in other coffins, ie Coffins C240 and C394, while others had the thicker boards used in Coffin C374, ie Coffins C457, C489 and C524, although only a few basal slats survived in these examples.

The composite head board seen in Coffin C398 was also observed in Coffin C240. In this example

Table 3 Overall dimensions of the coffins

Coffin	Length (m)	Height (cm)	Width (cm)	AV basal slat thickness (mm)
142	1.98	22–28	37–63	mixed
374	2.07	21–25	35–54	22
398	2.08	25–28	36–57	11

the two pieces had been clearly dowelled together with conifer dowels 11mm in diameter set towards the outer ends of the board.

In general, the coffins look to have been quickly assembled; the side boards were nailed to the outer edges of the head and foot boards and then the base slats were nailed across the coffin onto the bottom edges of the side boards. No nails survived but the best surviving holes indicate the use of rectangular nails, 3 × 4mm across. The coffins appear to have been plain and unembellished; no evidence of decoration or fixings for coverings to the coffins was observed. That the coffins were assembled quickly suggests the community were manufacturing coffins as quickly as possible in order to cope with a large number of fatalities in a short space of time.

7. DENDROCHRONOLOGICAL ANALYSIS

Anne Crone

7.1 Introduction

The ring-patterns of the pine boards used to make the coffins were assessed to determine which the best candidates for dendrochronological analysis were in terms of number of growth-rings, the greater the number usually ensuring greater success in dating (Crone 2008: 26). A mixture of both fast-grown and slow-grown pine was present. The presence of bark edge was also sought because this can provide a precise felling date, however since the boards had all been trimmed square there was little bark edge in evidence. Candidates were selected which would be representative of as many coffins as possible; in all 29 samples from nine coffins were measured, their sequences ranging in number of growth rings from 71 to 239 rings, though the majority retained well over 100 rings (Table 4). The pine boards had all been sawn tangentially across the log so in many cases the growth-rings lay obliquely to the flat surfaces of the boards, making radial measurement difficult.

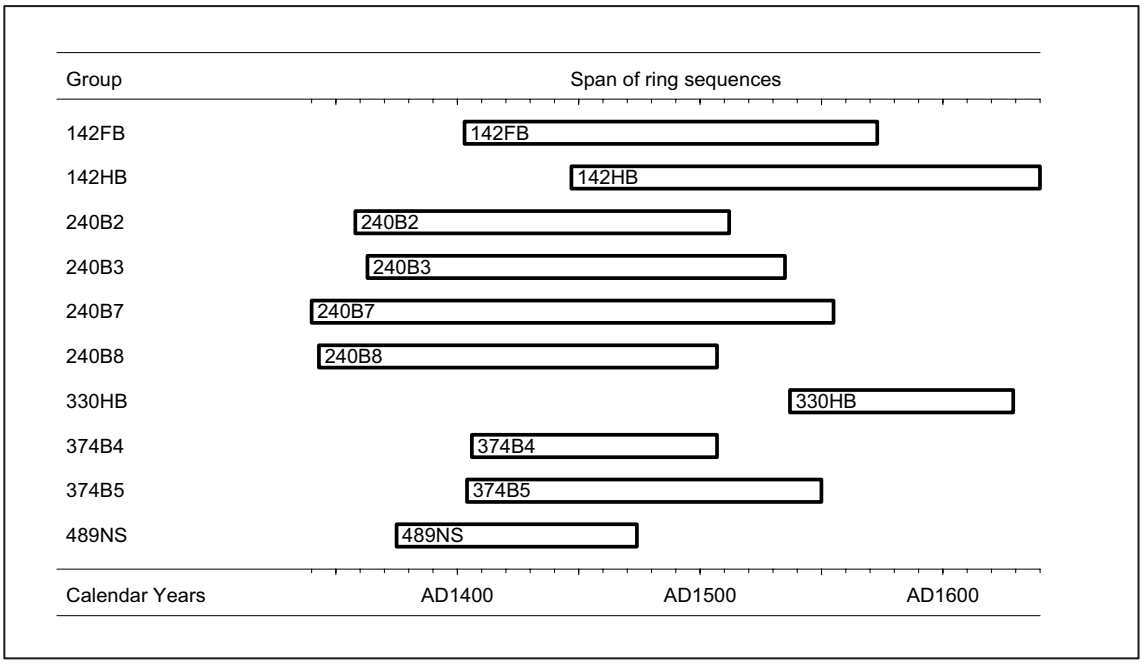
7.2 Methodology

Slices *c* 70–100mm thick were sawn from the selected boards and the sawn edge was then pared using a razor blade to reveal the ring-pattern. The slices were subsequently measured on a Heidenhain measuring table, under a low-power microscope, linked to a PC. Data capture, analysis and plotting were undertaken using the 'Dendro' suite of programs. The program produces 't' values as a measure of the degree of correlation between sequences, and as a general rule of thumb values above 3.5 are considered to be significant, although the length of overlap also has to be taken into account.

Construction of a site chronology usually proceeds in a stepwise fashion; the strongest internally replicated group is used to form the kernel of the site chronology first and then that chronology is compared with the remaining unmatched sequences to find further acceptable statistical and visual matches, which are then incorporated into the site master. The resulting site chronology is then compared against calendrically dated regional and site chronologies to find the position of best match.

7.3 Results

The 29 growth-ring sequences were compared against each other. This produced several groups with strong internal statistical and visual correlations, mainly within coffin groups (Illus 8). For Coffin C142, 142B5 and 142B7 correlated very strongly



Illus 8 Chronological relationships between the components of SMSL×10 © Wardell Armstrong LLP

Table 4 Dendrochronological data

Context	Sample code	Conv	No. rings	Pith	Outer rings
142	HB	CT	194	Y	
142	FB	OT	171		
142	B5	OT	211		
142	B7	OT	239		
240	B2	OT	155		
240	B3	OT	173		
240	B7	CT	216	Y	
240	B8	CT	165		
300	HB	MT	184		
330	HB	MT	93		
374	HB	CT	113		
374	FB	CT	135		
374	B1	CT	106		
374	B3	CT	90		
374	B4	CT	102		
374	B5	OT	147 + 2/3		
374	B7	CT	165		
398	B3	CT	90		
398	B5	CT	147		
398	B6	CT	137		
398	B7	CT	117		
398	B8	CT	128	Y	
398	RS	CT	158	Y	
398	LS	CT	142		
457	FB	CT	145		
489	NS	CT	100		
489	B	CT	207		be
524	B1	MT	71		
524	B2	MT	133 + 1		be?

with each other (t = 7.3) and a mean chronology, 142MN×2, 271 years in length was constructed. For Coffin C240, all the measured components correlated very strongly with each other (Table 5) and a mean chronology 240MN×4, 216 years in length was constructed.

For Coffin C374, 374FB and 374HB produced such a high correlation (t = 14.1) as to indicate that the two boards had been sawn from the same tree and a tree mean, 374RW was constructed. 374B4 and 374B5 also matched well (t = 4.65) and a mean chronology, 374B4_5, 147 years in length was constructed. For Coffin C398, four of the base slats, B5, B6, B7 and B8 correlated very strongly with each other (Table 6), the correlations between three of the slats, B5, B6 and B7, suggesting that they had been sawn from the same tree. A mean chronology 398MN×4, 164 years in length was constructed.

7.4 Discussion

The mean chronologies and the individual sequences were then compared against a suite of dated master pine chronologies from Scotland and northern Europe. Some of the mean chronologies and individual sequences produced low but consistent correlations against some of the dated master chronologies. Consequently, a site chronology SMSL×10 was constructed, 301 years in length, which produced enhanced correlations against the dated master chronologies, dating SMSL×10 to AD 1340–1640 (Table 7).

The chronological relationships between the components of the site chronology, SMSL×10 are shown in Illus 8. Components from Coffins C142, C240, C330, C374 and C489 have been dated. The outermost rings have been trimmed on all the dated sequences so AD 1640 provides a *terminus post quem* for the felling of the timbers, and a *terminus ante quem* for the construction of the coffins. The timber must have been felled after 1641 and taken to Leith, sawn into lengths and turned into coffins within a few years, at most, of felling. The trimming of the boards means that it is not possible to determine chronological relationships between the coffins.

The master chronologies with which SMSL×10 produced the strongest correlations are all based on pine from Norway (Table 7). IMPORT×8 is a master chronology incorporating pine sequences from buildings in Edinburgh, Leith, Stirling and Fife (Crone et al 2017: 30), all of which have been sourced to southern Norway. Norway is therefore the probable source of the pine boards used in the construction of the coffins. This is not unexpected; the trade in boards, or deals as they were known,

Table 5 Statistical correlations within 240MN×4

	Begin	End				
240B8	4	168	*	9.03	8.98	7.47
240B2	19	173	*	*	7.30	5.55
240B3	24	196	*	*	*	7.20
240B7	1	216	*	*	*	*

Table 6 Statistical correlations within 398MN×4

	Begin	End	398B8	398B5	398B6	398B7
398B8	1	128	*	6.28	7.88	6.51
398B5	18	164	*	*	13.64	9.54
398B6	17	153	*	*	*	10.38
398B7	17	133	*	*	*	*

Table 7 Statistical correlations between SMSL×10 and master chronologies from Norway and 'import' chronologies from Scotland

Chronology	@ end-year Location	SMSL×10 1640
IMPORT×8 (AD 1329–1671)	Scottish imports (see text)	7.15
Anne Crone		
NOMK0908 (AD 1121–1863)	W & E Agder, S Norway	6.96
Thomas Bartholin pers comm		
99200010 (AD 871–1986)	SE Norway	5.30
Terje Thun pers comm		
K010301s (AD 1395–1706)	Lower Saxony (Norwegian source)	5.30
Sigrid Wrobel pers comm		
N007m005 (AD 1471–1622)	Bolvaerk, Oslo	4.18
Aoife Daly pers comm		

between Scotland and Norway in the 17th century was vast and well documented (ibid). The lack of heterogeneity in the St Mary's (Leith) assemblage, ie the lack of statistical correlations between the sequences, reflects the multiple sources of timber in the cargoes arriving in Scotland. Pine boards from the same tree or same source did occasionally remain together in the merchants' stockpile, as witnessed by the fact that boards from the same tree and/or source occasionally ended up being incorporated in one coffin, as seen with Coffins C142, C240, C374 and C398.

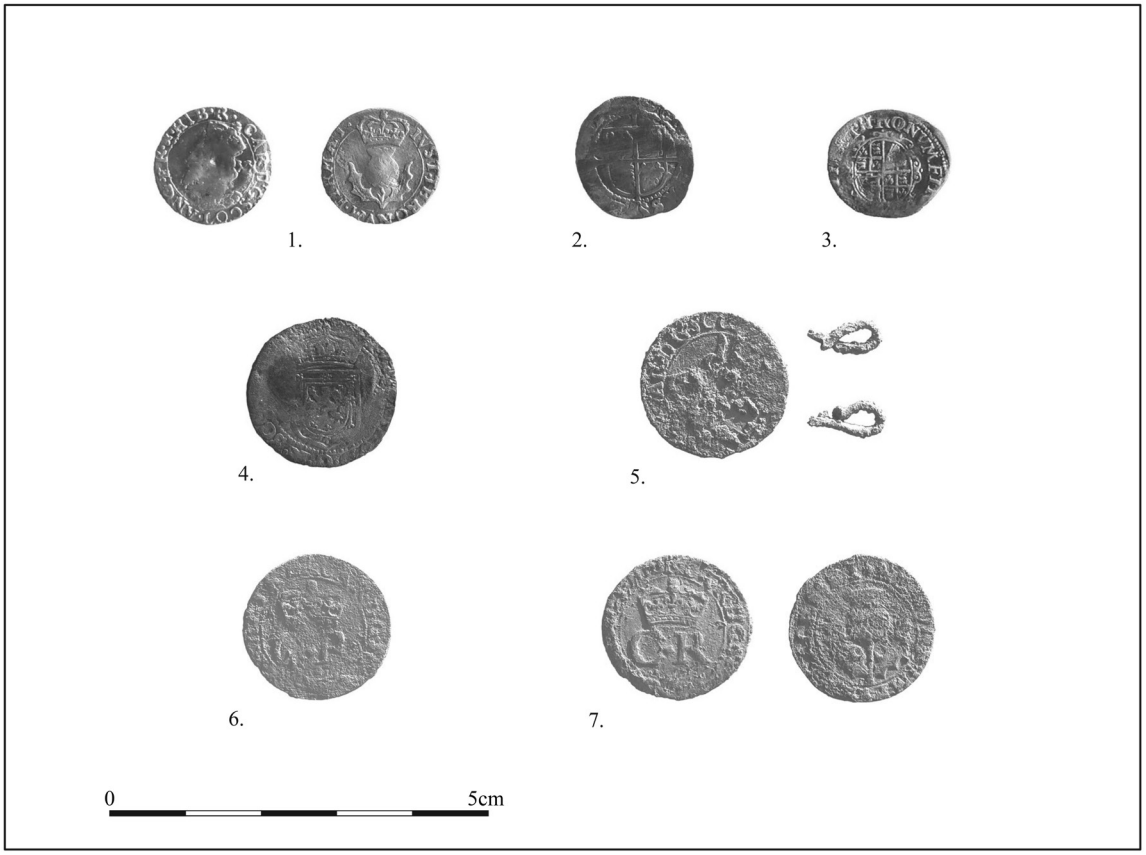
8. RADIOCARBON ANALYSIS

Eight samples of human bone were sent to the CHRONO Centre, Belfast for AMS C14 dating. The samples were taken from the best-preserved human skeletons, including individuals Sk166, Sk365, Sk389, Sk435, Sk409, Sk462, Sk482 and Sk512. Samples were taken from a range of anatomical elements, including femora, carpal phalanges, petrous portions of the mandibular ramus and the metatarsals (UB-No. 32710–32716). None of the eight samples passed the initial nitrogen testing; the poor preservation of the human skeletal remains had a negative impact on the concentration of collagen in the bone, and scientific dating via AMS C14 was not possible.

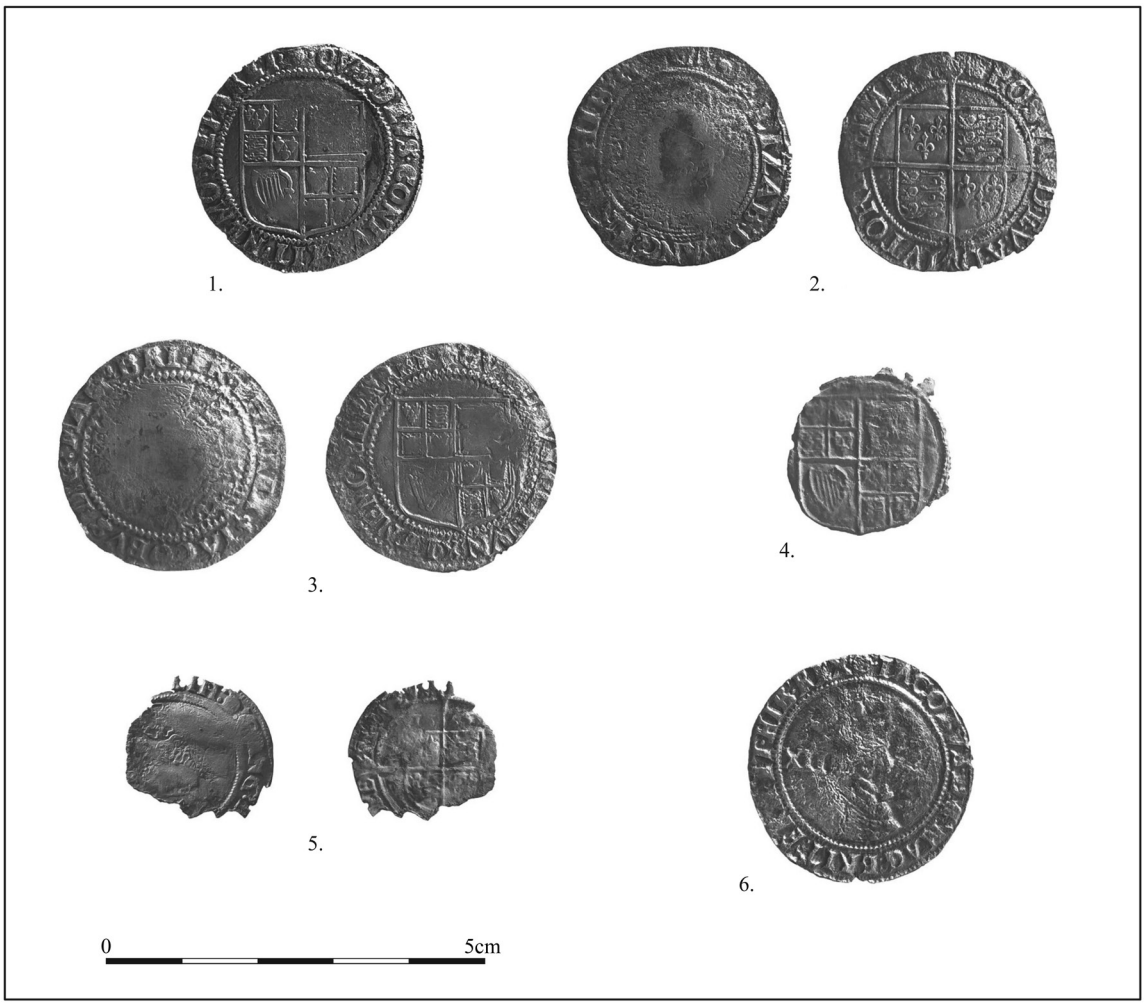
9. THE ARTEFACTS

Megan Stoakley & Anne Crone

A small but significant assemblage of artefacts was recovered with some of the human skeletons (Table 8). The presence of possessions on these individuals provides interesting interpretations of the social context of the burials. Of high significance was the recovery of two sets of coins; Young Adult Sk506 was buried with 25 coins dating to the reigns of Charles I (1625–49) (Nos 1, 3, 6 and 7, Illus 9), James VI (1566–1625) (Nos 4 and 5, Illus 9) and potentially Elizabeth I (1558–1603) (No. 2, a shilling dated to 1578–82, Illus 9) which were contained within a purse, which also had a length of cord with a highly degraded large wooden bead attached to it (SFs15–40). This may have acted as a purse toggle-clasp or it may have been a spacer-bead/end-bead from a rosary or paternoster. Male Adult Sk512 was buried with coins (including florins) dating to the reign of James VI contained within a leather-corded purse (SFs 48–55, Illus 10). Two small copper alloy Charles Turner coins dating to between 1632 and 1639 were recovered from the body of Adult Female Sk482 as well as leather footwear. Adult Sk440 was also wearing a pair of large leather shoes when interred (SFs43 and 44, Illus 11). The interment of artefacts on an individual is not standard practice with Christian burials and the artefacts should not be regarded as grave goods but rather the personal accoutrements of daily life that accompany a fully clothed individual. The sizeable sums in the purses of two individuals, Sk506 and Sk512, suggests that the bodies were not rifled, indicating either an unusual level of honesty and respect on behalf of those doing the burying or fear of the diseased corpse. That money was present on the corpse and that some of the corpses appear to have been fully clothed may suggest that some of the victims died suddenly and not in their sick beds. Such a death may be consistent with some victims dying from plague that had become septicaemic or be characteristic of another disease altogether.



Illus 9 A selection of silver coins recovered with Sk506. Ag: 1) SF15, front and rear; 2) SF16 rear; 3) SF17, rear; 4) SF21, rear. Cu alloy: 5) SFs22–24, rear and two small clasps; 6) SFs25–28, front; 7) SFs30–39, front and rear © Wardell Armstrong LLP



Illus 10 A selection of coins recovered with Sk512. Ag: 1) SF50, rear; 2) SF51, front and rear; 3) SF52, front and rear; 4) SF56a, rear; 5) SF56b, front and rear; 6) SF59, rear © Wardell Armstrong LLP

Other items recovered from the bodies included two wooden lice combs (SF64 and SF63) found on Sk512 and Adult Female Sk483 (Illus 12.1 & 12.2). Small Find 63 is a well-preserved fragment of a double-sided simple comb, fashioned from boxwood (*Buxus sempervirens*) (Crone 2017: 2). A complete end survives; the width is complete at 51mm wide but only 40mm of the original length of the comb survives. The squared end is 4mm wide and the comb has a solid central zone 10mm wide (Egan & Pritchard 1991: figure 243). It is an elongated lozenge-shape in cross-section, tapering from 6mm at mid-point on the central ridge to 1mm at the end of the teeth. The teeth are similar in size on both sides of the comb.

SF64 is a more poorly preserved fragment of a double-sided comb and survives in two fragments. It too has been fashioned from boxwood. Some 80mm of its original length survives, as does 47mm of the original width. The squared end is 6mm wide and the solid central zone is 10mm wide. This example has fine teeth *c* 1mm wide on one side and coarse teeth *c* 2mm wide on the other. The fine teeth are complete and these are 20mm long, suggesting that the original width of the comb would have been *c* 50mm. It is an elongated lozenge-shape in cross-section, tapering from 6mm at mid-point on the central ridge to 1mm at the end of the teeth. The surviving original dimensions of both combs suggest that they were virtually identical in size, presumably the result of standardised manufacture, although they differ in that SF64 has both fine and coarse teeth while SF63 does not (Crone 2017: 2).

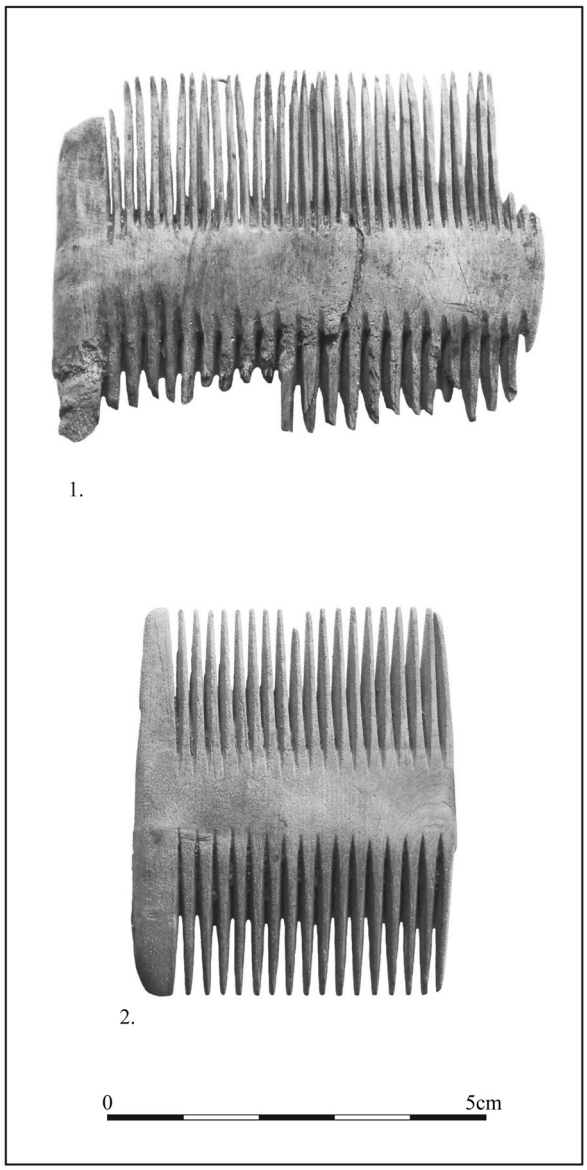
Illus 11 Leather shoe recovered with Sk440: 1) Left upper; 2) Right upper and inner sole; 3) Right outer sole; 4) Left outer sole © Wardell Armstrong LLP

Table 8 Small finds

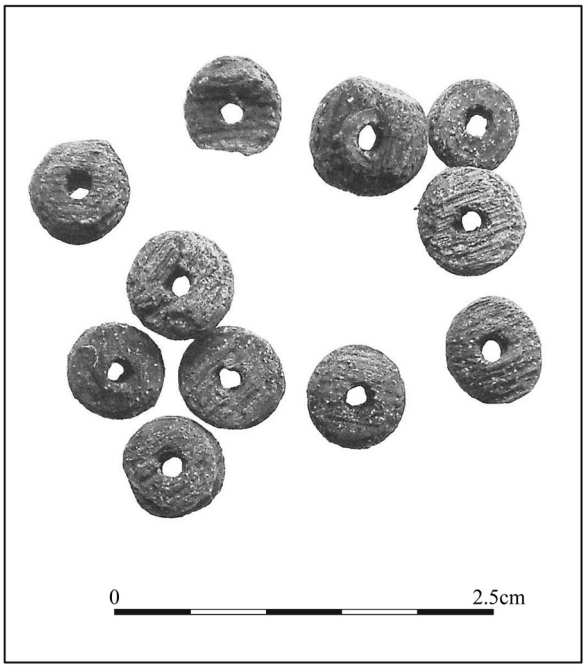
SF no.	Context	Material	Qty	Date	Comments
1	126	Fe	1	17th C	Coffin nail
2	126	Fe	1	17th C	Coffin nail
3	123	Fe	1	17th C	Coffin nail
4	123	Fe	1	17th C	Coffin nail
5	123	Fe	1	17th C	Coffin nail
6	123	Fe	1	17th C	Coffin nail
7	123	Fe	1	17th C	Coffin nail
8	121	Fe	1	17th C	Coffin nail
9	197	Fe	1	17th C	Coffin nail
10	362	Fe	1	17th C	Coffin nail
11	362	Fe	1	17th C	Coffin nail
12	429	Fe	1	17th C	Key
13	429	CuA	3	17th C	Coins
14	451	Fe	1	17th C	Coffin nail
15	507	Ag	1	17th C	Charles I coin, 1637–42, Sk506
16	507	Ag	1	17th C	Coin Sk506
17	507	Ag	1	17th C	Coin Sk506
18 & 19	507	Ag	2	17th C	Coins stuck together Sk506
20	507	Ag	1	17th C	Coin Sk506
21	507	Ag	1	17th C	Coin Sk506
22–24	507	Ag	4	17th C	3 × coins & purse clasp
25–28	507	Ag	4	17th C	Coins stuck together Sk506
29	507	Ag	1	17th C	Coin – thistle Sk506
30–39	507	Ag	10	17th C	Coins stuck together Sk506
40	507	Leather	5+	17th C	Purse fragments, with toggle (or rosary/paternoster bead?)
41	513	Leather	1	17th C	Boot/shoe fragments Sk482
42	513	CuA	1	17th C	Pin from R scap Sk483
43	513	Leather & wood	1	17th C	Shoe Sk440
44	513	Leather & wood	1	17th C	Shoe Sk440
45	534	Fe & bone	1	17th C	Fe attached to bone
46	539	Fe	1	17th C	Coffin nail
47	539	Fe	1	17th C	Coffin nail
48	555	Fe & Ag	4	16th–17th C	Fe key and coins Sk558
49	555	Leather	1	17th C	From purse
50	555	Ag	1	16th–17thC	Coin Sk512
51	555	Ag	1	16th–17thC	Coin Sk512

Table 8 *cont*

SF no.	Context	Material	Qty	Date	Comments
52	555	Ag	1	16th–17thC	Coin Sk512
53	555	Ag	1	16th–17thC	Coin Sk512
54	555	Ag	1	16th–17thC	Coin Sk512
55	555	Leather	1	17th C	Purse fragments
56a & b	556	Ag & Textile	3	17th C	2 partial silver coins with a tiny fragment of textile
57	555	Ag	1	17th C	Coin <49>
58	506	Fe	1	17th C	Hobnail/tack Sk506
59	Sk201	Fe	1	17th C	Coffin nail
60	441	Wood	1	17th C	Bead <161>
61	Sk483	Wood	11	17th C	Beads <265>
62	388	Wood	6	17th C	Beads <117>
63	Sk483	Wood	1	17th C	Comb
64	Sk512	Wood	1	17th C	Comb
65	523 Sk525	Wood	4	17th C	Bead <294> × 1 Beads <292> × 3
66	481	Wood	1	17th C	Object <248>, cap or lid for small needle-case – worn around neck
67	148	Fe	1	17th C	Nail <24>
68	147	Fe	2+	17th C	Nails
69	126	Fe	2+	17th C	Nails <5>
70	Sk481	Leather/wood	1	17th C	Sewing bundle
71	494	CuA	1	17th C	Brooch
72	273	Fe	1	17th C	Nail
73	147	Fe	1	17th C	Nail



Illus 12 Wooden combs: 1) SF64 from Sk512; 2) SF63 from Sk483 © Wardell Armstrong LLP



Illus 13 Example of beads recovered from burials: SF62 from Sk388 © Wardell Armstrong LLP

Boxwood is a very hard, dense, fine-grained wood, highly prized where detailed carving was required and it has been used to make combs since at least the Roman period (Pugsley 2003: 15). In his *Sylva; or a Discourse of Forest Trees* (1664), John Evelyn listed its uses for the engraver, the carver, the mathematical instrument-maker, the pipe-maker, the cabinet-maker and, above all, the comb-maker. The boxwood double-sided combs found in late medieval contexts in London differ little in size and design from those found at St Mary's (Leith), so the combs could have been manufactured in England and sold in Scotland (Egan & Pritchard 1991: 370–6). '*Keames of box trie*' are recorded in the 17th-century document 'Table of the Valuation and prices of merchandise bought within the Realm' (Craigie & Aitken 1963b: 325). Equally, it may also have been manufactured in Scotland. '*Box peces for making of keames*' are mentioned in the Ledger of Andrew Halyburton (1492–1503), Conservator of the Privileges of the Scotch Nation in the Netherlands (Authority of the Lords of the Treasury (1867); Craigie & Aitken 1963a: 385), suggesting that boxwood may have been imported into Scotland via the Netherlands. In 1662, two comb-makers were admitted as burgesses of the city of Edinburgh; it is clear from the record that this was a new trade in the city but it is not stated what material they were using (Marwick 1871: 283). The only other example of a boxwood comb of similar date comes from Carrick Castle, Argyll (Crone 1998).

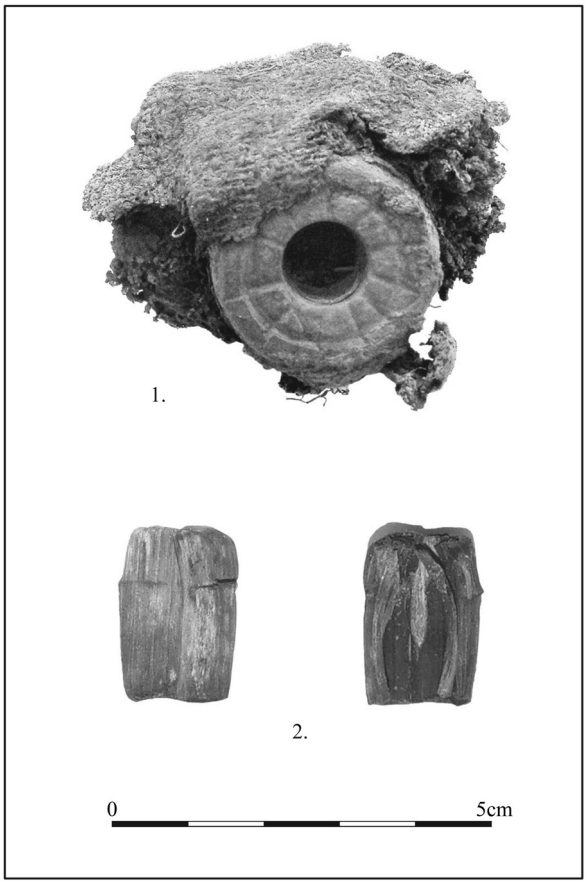
A total of 15 wooden beads were recovered from the bodies of five individuals, including Sub-adult Sk441, Adult Males Sk389 and Sk525, Adult Female Sk483 and Young Adult Sk506. Most of the beads were flat and disc-shaped. The largest single assemblage, the beads in SF62 (Illus 13), varied very little in size, from 5 to 7.5mm in diameter and from 2 to 4mm in thickness; some of this variation may

be ascribed to desiccation. The four beads (SF65) recovered from C523 and environmental samples <292> and <294> were of a more spherical shape and again, varied little in size. SF61a was the largest bead present and was quite cylindrical in shape; it may have been covered in textile. All the beads from SF62 had been made from oak (*Quercus* sp.) in such a way that the grain ran across the bead, ie perpendicular to the axis of the perforation. It is highly likely that these beads, particularly the more rounded examples in SF61a and SF65, came from rosaries or paternosters, which consist mostly of beads of similar size with intermittent large beads such as SF61a; 16th-century rosary or paternoster beads of a similar design were recovered from the *Mary Rose* (Cherryson et al 2012: 37). The disc-shaped beads would be more unusual in a rosary or a paternoster although they may have been spacer beads.

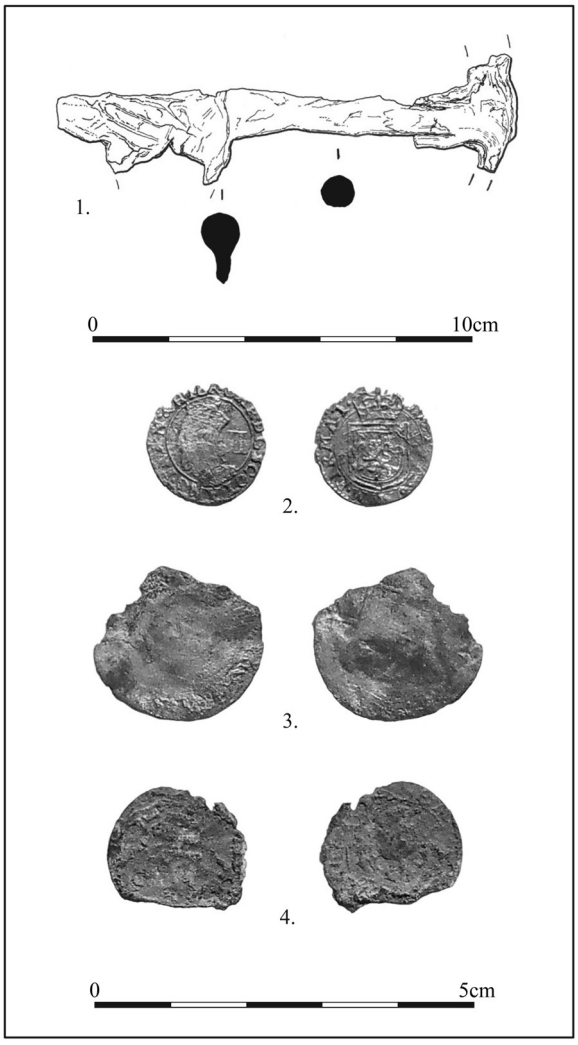
The identification of the beads from this assemblage as either rosary or paternoster beads is fairly certain; the rosary, a devotion in honour of the Virgin Mary, is defined as a string of beads used for the recitation of a set number of specific prayers, including the Apostles' Creed (*Credo*), Our Father (*Pater Noster*), Hail Mary (*Ave Maria*) and Glory Be (*Gloria Patri*) (d'Allemtejo 2003: 1). It is usual for a Catholic rosary to have a crucifix attached to it in the later Renaissance period (ibid; Catholic Answers (CA) online 2018). Paternosters are defined as a set of beads threaded on a cord, and are generally divided into smaller groups with larger spacer beads (gauds) (ibid: 1–2). Paternosters generally had either tassels or a large bead in the place of a crucifix; tassels and beads were more common on rosaries before they were codified in 1569, for example: the Langdale Rosary, dated to AD *c* 1500 (ibid: 2; V&A Museum online 2018). Early rosaries could also have pomanders, scent containers, religious medals and small figures of saints attached to the end of them (Winston-Allen 1997).

Rosaries and paternosters make frequent appearances in Renaissance art, particularly in elite portraits as well as religious paintings (LL online 2018; St Laurentius Church online 2018; Nemores-Nubium online 2018). The large, ornate rosary worn by Mary, Queen of Scots in the 1578 oil painting by Nicholas Hilliard, has five decades with larger gauds and a final gaud bead before a gold crucifix; the decades appear fairly uniform in size and design (National Portrait Gallery online 2018). This opulent rosary is in complete contrast to the examples of the beads recovered from St Mary's (Leith), as the rosary belonging to Mary, Queen of Scots would have been a religious personal confessional accessory to match her regal status, wealth and rank in society. Given the descriptive classifications of the rosary and paternoster, a crucifix might be expected to be associated with a rosary. At Leith, as no evidence was found for anything other than beads, it may be that tasselled paternosters, or simple confessional bead sets, are more likely than rosaries. Preservation conditions on site were such that the survival of these items was only fragmentary and it is possible that no wooden crosses were found because they did not survive.

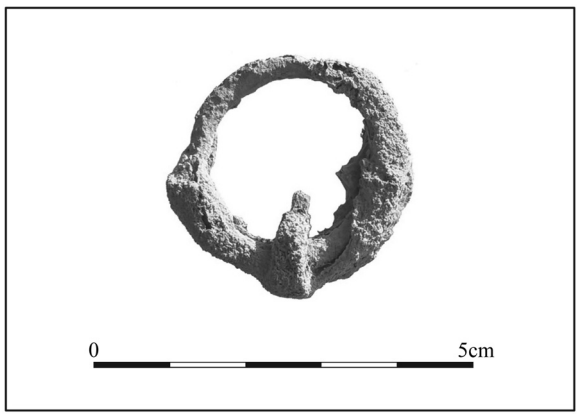
The inclusion of rosary or paternoster beads in graves is unusual but not unknown; their presence has been recorded in a number of cemeteries,



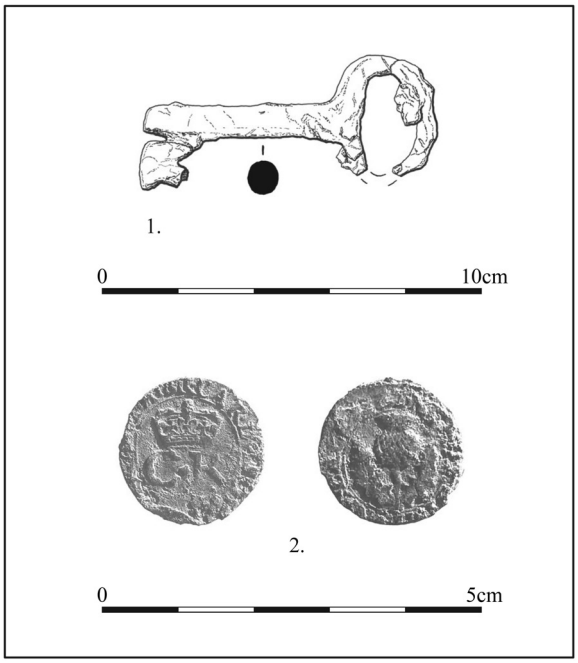
Illus 14 Part of sewing kit recovered with Sk481: 1) SF70, sewing bundle; 2) SF66, cap/lid for needle-case © Wardell Armstrong LLP



Illus 15 SF48, Fe key and coins recovered with Sk558 © Wardell Armstrong LLP



Illus 16 SF71, Cu alloy brooch recovered with Sk494 © Wardell Armstrong LLP



Illus 17 1) SF12, Fe key; 2) SF13, Cu alloy coin recovered with Sk430 © Wardell Armstrong LLP

including St Mary and St Michael Mission in London, Portchester Castle, and the site of a 14th–16th-century Dominican friary in Cork (Cherryson et al 2012: 36–8). The presence of rosary or paternoster beads suggests that some of the buried victims were Catholic in their religious affiliation, which is interesting given that South Leith signed the National Covenant petition in early 1638, a mere two months after it had been drawn up (Currie 1999: 4). This suggests that the town in its religious sympathies, or at least its governing elite, was strongly Presbyterian during the 1640s. It is possible that the beads recovered from St Mary's (Leith) came from simple plain paternoster or confessional bead sets; given the anti-Catholic sentiment in Leith in the 1640s, it may have been far easier for an individual to explain the presence of a set of simple wooden beads on their person, rather than have to reveal their Catholic affiliation.

A sewing bundle (SF70) and a cap/lid (SF66) were recovered from a child aged 11–12 years who was interred in C415 (Illus 14.1 and 14.2). SF66 was lathe-turned from a billet of poplar (*Populus* sp.); faint concentric grooves can be seen on the top of the head and also inside the head. The object is 24mm high and has a distinct head and shaft. It was hollowed out, leaving walls 2mm thick around the

shaft. The grain of the wood, which lies parallel with the shaft, has split on one side and it has collapsed in on itself so it is difficult to determine its original shape, but it was probably oval in cross-section. The head, which is slightly faceted in cross-section, measures 15mm by 29mm across and is 8mm deep. The shaft is 24mm across. On the more complete side, the head projects out from the wall of the shaft by 6mm and is penetrated by a sub-rectangular hole *c* 2mm across. This projection has broken off on the other side and it seems likely that there was a matching hole on that side too. The design of SF66 suggests a cap or lid for an object that was designed to be suspended from the holes penetrating the head, the shaft fitting snugly over a hollow base. It may have been a container designed to be worn around the waist or neck, such as a needle-case for example. A small boxwood barrel containing two teeth was found in an 18th-century grave in Christ Church, Spitalfields (Cox 1996: 117); SF66 may have performed a similar function.

A number of other artefacts were recovered from the interred individuals. Sk558 had an iron key (SF48) and a copper alloy brooch (SF71) was recovered from Female Adult Sk494 (Illus 15 and 16). An iron key and three coins (SF12 and SF13, Illus 17) were recovered from Male Adult Sk430 and a shroud pin was recovered from Young Adult Female Sk483. A common theme with the burial victims is that many, if not all, appeared to be fully clothed, with a large proportion of the uncoffined individuals wrapped in material; coarse woollen wrapping was recovered from individuals Sk443, Sk481, Sk482, Sk483, Sk484, Sk493, Sk494, Sk495, Sk506, Sk512 and Sk525. One possibility is that, although the woollen material may comprise a crude shroud, it actually comprises clothing; a woollen shawl or cloak was a fundamental item of clothing in the 17th century and it may be that they were buried in their attire.

Some of the objects could have been the property of immigrants, given the town's status as a port. The origins of any Catholics in the town may have been outside Leith and the neighbouring districts of Lothian. In order to answer questions regarding the origins of the individuals, strontium isotope analysis was conducted on a sample of human skeletons by Durham University in 2016 to 2017, with tests specifically targeting individuals interred with artefacts or who exhibited unusual skeletal pathologies.

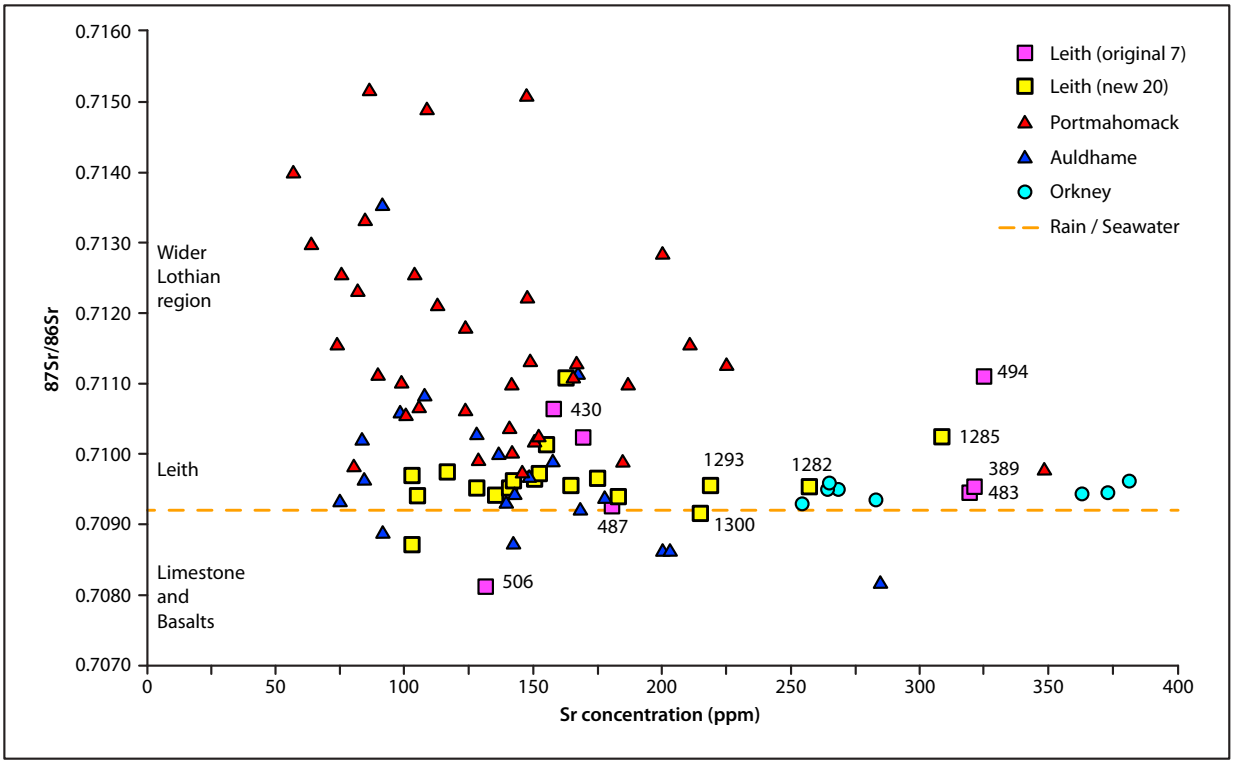
10. STRONTIUM ISOTOPE ANALYSIS

Megan Stoakley, Janet Montgomery, Mandy Jay, Jo Peterkin & Geoff Nowell

A total of 27 primary or secondary maxillary and mandibular molars were used for the strontium isotopic analysis (Sample Nos 710–16, 1281–1300). Leith is located in a region of Palaeozoic sandstones, mudstones, silts of the Strathclyde group (bottom) overlain by marine sands and gravels. In the wider Lothian region however, the geology is heterogeneous, with basalts, lavas and limestones and sandstones of Devonian/Silurian age. Many of these rocks are overlain by Quaternary Diamacton till and glacial sands and gravels. The predicted Sr isotope biosphere range for Leith is 0.7090–0.710 (Evans et al 2010). However, within the wider Lothian region Sr biosphere values range from 0.7080 up to 0.7130. In the Highlands, there is a greater range of Sr biosphere values as a result of the Tertiary volcanic province on the west coast and older and granitic terrains, so the range here may vary from ~0.7060 to 0.7200.

The majority of those from Leith fall within, or very close to, the biosphere range for the site (Illus 18). Those which do not are: Sk430, Sk494, Sk506, Sk127 (No. 1281) and Sk493 (No. 1295). Of these, two have a low Sr isotope ratio characteristic of origins in a region of limestone and three have higher Sr isotopes which can also be found in the wider Lothian region. The majority of the values cluster closely with those obtained from Auldhame, which provides additional evidence that they are consistent with local origins (Lamb et al 2012).

The data for Leith is compared to another east coast medieval population from Portmahomack on the Moray Firth (Carver et al 2016). As would be expected for a site close to the Highlands, individuals at Portmahomack have a much wider range of Sr isotopes than at Leith, with none below 0.7092, and are likely to include those from inland regions of the Highlands, where values above 0.7130 are found; this interpretation is also possible for one individual from Auldhame. It should also be noted that a combination of Sr isotope ratios of around 0.7092 and just above and a high Sr concentration above *c* 200 ppm, observed in individuals Sk389, Sk483, Sk494, Sk279 (No. 1282), Sk409 (No. 1285), Sk483 (No. 1293) and Sk532 (No. 1300), are not characteristic of east coast or inland populations,



Illus 18 Strontium analysis © Wardell Armstrong LLP

although high concentrations are more often found in Scotland than England.

Data for medieval individuals from St Thomas' Kirk, Orkney has been included in Illus 18 to illustrate the similarity of Sk389, Sk483, Sk279 (No. 1282), Sk409 (No. 1285), Sk483 (No. 1293) and Sk532 (No. 1300) to coastal or island-dwelling populations in the Northern Isles and the western seaboard of Britain (Toolis 2008). High strontium ppm is not commonly seen in inland and east coast dwellers. Individual Sk494 has a highly unusual combination of ratio and ppm; there are not currently any directly comparable populations in Britain and only a few isolated published individuals with a similar combination, including an Early Bronze Age burial from West Heslerton (Montgomery et al 2005; Parker Pearson et al (forthcoming)) and a Viking-period burial from Masham (Buckberry et al 2014), which are both in Yorkshire. However, there is very limited data for individuals from the inland areas of the Scottish Highlands and this lack of comparative human values may simply be an artefact arising from sampling bias.

To conclude, none of the individuals have the high Sr isotopes that would be indicative of origins in the Highlands and would rule out origins in Lothian. However, it should be acknowledged that the geology and thus range of biosphere Sr isotopes of the Highlands is highly variable. It is therefore possible that individuals from the Highlands may have similar values to those from Lothian. The majority of individuals are consistent with origins in Leith. Individuals Sk506 and Sk127 are consistent with origins in a region of limestone or basalt and individuals Sk430 and Sk493 are consistent with origins in a region of the Palaeozoic rocks, all of which occur in the Lothian region. Several individuals (particularly Sk389, Sk483, Sk279) have an isotopic profile that is characteristic of individuals inhabiting the Northern and Western Isles or western seaboard of Britain, but post-depositional uptake of strontium must be considered. Sk494, a 35–40-year-old woman, falls outside expected values for Lothian and the east coast of Scotland, with only two comparable Sr profiles published to date in Yorkshire, England.

The strontium isotopic data has revealed that it was highly likely that this cemetery population was overwhelmingly derived from local inhabitants but some individuals have an isotopic signature that falls outside Leith, including the western seaboard of Britain and Yorkshire. Regional trade and/or marriage are perhaps responsible for the presence of these individuals in this cemetery population.

It is of considerable importance to note that this cemetery population has a number of Catholic individuals who are local to Leith, including Sk389, Sk441, Sk483, Sk512 and Sk525. The population of Leith signed the National Covenant in 1638, which was both anti-Laudian Anglicanism and anti-Catholic in sentiment (Henderson 1937: 167). Any individual with a Catholic affiliation was taking a considerable risk living in the South Leith parish. If their affiliation was discovered, the consequences ranged from fines to flogging and imprisonment (Miller 2010: 243). If that individual was seen to be actively promoting Catholicism, their actions were potentially punishable by death. According to Miller (ibid: 236), Scottish society in the 17th century was fuelled by anxiety and fear, which is hardly surprising when the population was faced with disease, starvation, religious persecution, war and socio-political upheaval.

Attitudes surrounding fearful religious views and the pestilence are recorded in a poem written by a teacher named Hercules Rollock during the 1585 plague outbreak in Edinburgh. He depicts a once virtuous and prosperous city which has been struck down by divine fury at the foul deeds of the citizens and their exposure to a contagious evil (Jillings 2014: 1). Rollock's interpretation of the plague outbreak as an act incurring the 'wrath of God' was a belief unquestioned in the 17th century. People believed that contagion was a manifestation of evil that would taint citizens both physically and spiritually, corrupting both the body and the soul. Religious views concerning physical and moral corruption are also evident in the writings of Gilbert Skene in *Breve Descriptioun*, in which the author records many figures fleeing the city, including many religious figures and clergymen (ibid: 3). Their act of fleeing exhibited an un-Christian character and charity; they denied the sick and dying both the practical assistance and the spiritual sustenance necessary to avoid a fearful and lonely death (ibid: 3).

11. DISCUSSION

Megan Stoakley & Richard Newman

The burial assemblage recovered from St Mary's (Leith) matches a catastrophic palaeodemographic cemetery profile consistent with individuals succumbing to a disease epidemic, famine or war. In a typical catastrophic cemetery profile, there are higher proportions of Children (3–12 years) and Young Adults (20–35 years), as opposed to an attritional cemetery population, in which all ages and sexes are represented without bias (Wake, Morita & Wake 1978: 1045–52; Gowland & Chamberlain 2005: 152). This is certainly the case at St Mary's (Leith) which shares its deceased population profile with a 17th-century plague cemetery in Venice, Italy. Another later example of a catastrophic post-medieval cemetery population is McDonagh Station, Kilkenny, in which the effects of famine and disease, as in Leith, were clearly evident. Approximately 900 individuals were interred in burial pits at the site during the height of the great famine in Ireland in the 1840s; there were equal numbers of men and women but between 60% and 70% of the inhumations were Children (Cherryson et al 2012: 113).

This is a very high figure in comparison with the individuals from Leith, in which *c* 32% of the individuals were Non-adults. It would be expected that the number of Non-adult individuals in a cemetery population of this nature would be higher; simply the quantity of the burials within the small site area may be an explanation for this. On the other hand, a disease such as bubonic plague did not target a specific demographic group and it was a case of burying the deceased as and when they died regardless of age.

It should be noted that further victims of the 1645 plague epidemic were uncovered in Leith during drainage operations at Wellington Place, *c* 0.6km to the west of the site at St Mary's (Leith). Originally thought to have been the victims of siege of Leith in 1559–60, the sheer quantity of human remains as well as the presence of Female Adults and Non-adults led authorities to conclude that they were instead victims of the 1645 plague outbreak (Robertson 1861–2: 392).

11.1 Plague policy

In a bid to tackle plague epidemics, national and parochial-level plague policies were introduced which comprised two legislative statutes, namely the Rule of the Pestilence (1456) and the letter of James IV (1513) (Jillings 2018: 58). The former was issued at a national level, while the latter was not. The Rule of the Pestilence (1456) contained four clauses, the first of which stated that any person able to support themselves and their household was to confine themselves to their own house. The second rule involved civic obligation in the care of the community while the third and fourth clauses related to practices undertaken during epidemic outbreaks, including the prohibition of burning houses unless conducted without property damage (ie fumigating walls by burning heather) (Ritchie 1948: 694) and the pardoning of clergymen to process throughout their diocese (Jillings 2018: 59–60). The letter of James IV (1513) reiterated and enforced the legislature set out in the Rule of the Pestilence; civic and communal responsibilities of local governments and their citizens were highlighted and that citizens were culpable for the actions of their servants (ibid: 61).

The implementation of quarantine was a rational method of dealing with disease epidemics in England and Scotland throughout the 15th to 18th centuries. It was widely believed that the plague was transmitted as poisonous miasma and through corrupted, contagious pollution (Jones 2016: 110). The treatment of epidemic disease infection through strong odours and the avoidance of touch through quarantine still continued into the late 18th century (Jillings 2018: 63). Whilst strict maritime quarantine policies were brought into effect in urban burghs post-1550, the reinforcement of these policies was hindered by the plague epidemic itself; civic personnel either fled, were laid sick or killed by the disease. There are recorded instances of negligent maritime quarantine incidents and chaotic civil unrest at several Scottish burghs and ports, including St Andrews, Edinburgh (ibid: 126; CMB.7.184v 19 May 1585), Inverness, Fife and Aberdeen (ibid: 127).

When outbreaks of disease such as plague occurred in cities such as Edinburgh, York and London, strict preventative strategies including health restrictions,

curfews and trade constraints were implemented by magistrates (Mullett 1950: 436; Cherryson et al 2012: 112). These restrictions became more severe as epidemic disease outbreaks worsened. Bubonic plague outbreaks occurred in Leith in 1586 and 1587, with many houses in the district and Edinburgh badly affected by the plague (Shrewsbury 1975: 260). There was some doubt as to whether the disease was the pestilence, so eight commissioners were sent to Edinburgh to: ' … visy the deid corpssis for their mair certantie' (Scottish Burgh Records Society 1882: 504; Shrewsbury 1975: 260).

Their visit unfortunately confirmed that the outbreak was bubonic plague. In 1605, plague outbreaks occurred in numerous burghs and towns, including St Andrews, Edinburgh, Leith, Peebles and Roxburgh (Shrewsbury 1975: 288). Several councils brought in restrictive measures; the town council of Peebles brought in a quarantine legislation that decreed that any case of sickness must be reported to the bailies and Glasgow council authorities would impose a fine of £20 on any resident who received any visitor from plague-infected areas, including Lanark, Peebles, Leith, Linlithgow and Edinburgh (Comrie 1932: 219–20).

When the plague outbreak invaded Edinburgh in 1645, a high number of preventative action policies were implemented; Parliament was moved to Stirling and any individual who had contracted plague was to be executed if they attempted to escape (Mullett 1950: 450; Dingwall 1995: 23). Clean bills of health were issued to ships bound for the Spanish port of Cadiz, and quarantine measures were put in place on all ships to ensure that Edinburgh remained plague-free (Jillings 2018: 166; Edinburgh CMB.16.2r (28 Aug 1644); 16.5v (13 Sept 1644)). A similar scenario preventing the migration of infected people into and out of the city is recorded in the *Extracts from the Records of the Burgh of Edinburgh 1403–1528*; one entry, dated 28 March 1498, states:

> … and the parochin of Hailles are infectit with this contagious infirmity of pestilence, quhairfore we charge straitly and commandis … that na manner of personis dwelland within the saidis boundis addrees thame to cum to this toun and enter within the samyn under the payne of deid … (Anon 1869: 72)

Despite this, as with previous epidemics in 1475 and 1504, all individuals who could flee did so as quickly as they could (Carmichael 1997: 62; ES online 2018: XXV). These included physicians, clerics and magistrates, among others (Jillings 2015: 129). Documents of pre-1645 date record execution by hanging for those who were accused of spreading plague in Edinburgh; gibbets were erected in 1585 and the council employed an executioner to carry out hangings. In contrast, gibbets were erected in Aberdeen in 1585 and 1608 but there is no evidence that they were in use (Jillings 2018; Edinburgh CMB.7.183r, CMB.7.186v 10 & 26 May 1585). Two women were sentenced to death by drowning in Edinburgh in October 1530 for potentially spreading plague (Marwick 1871: 42–3; Oram 2006: 20). As the 1645 plague epidemic in Leith worsened, the strict measures heightened and rapid burial of the diseased corpses was necessary in order to try and contain the epidemic; with large swathes of people having abandoned the district earlier on, this left fewer people available to deal with the increasing dead. Punishment for disobeying the health measures was severe and included the burning of property and goods as well as banishment for life; women were branded on the cheek and men had their hands severed (Worling 2010: 3). People, particularly children, were sent to the stocks and whipped; unlucky individuals were hanged for flouting the regulations, of which crimes included escaping enclosure, avoidance of the cleansing process, bringing goods into the city from infected areas and attending rural markets, among others (Jillings 2018: 132; Aberdeen City and Aberdeenshire Archives CA1/1 (ACR.40.811–816 28 Sept 1602; ACR.42.849 19 July 1606; ACR.42.315 14 Aug 1605)).

The consequences of the restrictions and the disease epidemic would also have included food shortages (Bruce 1840: 67) and the likely breakdown of the limited public health and sanitation services that operated in a 17th-century town (ibid). Urbanisation in Scotland rapidly increased during the 16th and 17th centuries, and the number of town-dwellers directly involved in the growth of their dietary staples fell abruptly. Previously valued horticultural, agricultural and domestic organic waste rapidly became a nuisance to citizens and needed to be disposed of quickly (Oram 2011: 2).

The middens and animal dung-heaps were still of value to the burgesses; many burgh councils enforced uncompensated seizure and disposal of the material as well as heavy fines, which in turn forced better management and clearance of the rubbish dumps and dung-heaps (ibid: 12). Many burgh councils met these measures with some resistance during the 16th and 17th centuries; in Leith in 1645, the severely depleted population as a consequence of the plague epidemic would almost certainly have caused waste management and disposal problems, yet another challenge to overcome in the face of a catastrophic disease epidemic.

One document, written by John Hayward in the 17th century, records the desperation of the inhabitants of Leith; the famine reduced many citizens to eating horses, cats, dogs and vermin (Bruce 1840: 67). Outbreaks of different diseases such as cholera, typhus and tuberculosis would also have occurred.

Leith witnessed several periods of famine during the 17th century, including during the 1645 plague. Many in the cemetery population may have had childhoods impacted by malnutrition. The 1620s were a particularly bad period for famine in Scotland, with four recorded episodes between 1620 and 1625 (Mitchinson 2002: 291–3). The physiological stress of malnutrition manifests itself on the skeleton via a number of pathological conditions, including linear enamel hypoplastic lines. In the Leith Links cemetery population, an unusually high number of individuals exhibited linear enamel hypoplasia, indicating at least one, if not several, episodes of malnutritional stress.

The epidemic that swept through Leith in 1645 is referred to by contemporaries as plague or pest but there is no modern medical confirmation that the disease was indeed bubonic plague, with its especially lethal pneumonic and septicaemic variants. The skeletal evidence clearly shows that the epidemic was not a disease that leaves an osteological trace, like tuberculosis, and this is certainly the case with bubonic plague, but such is true of many other epidemic diseases too, like typhus (Cox 1993: 71–9). It was commonly thought that plague was an urban phenomenon during the 16th and 17th centuries (Whyte 1995: 112, 122) and although this view was challenged (Fitch 1987: 33–5), the perception of plague as an urban phenomenon remained through articles previously published by Mullett (Mullett 1950). However, the impact or incidence of disease epidemics was not considered and relied largely upon parish records from burghs and urban centres (Oram 2006: 7). The spread of plague as an urban disease was dismissed at first, although it was stated that epidemics occurring in the pre-1590s were primarily urban (Smout 1977: 151–3; Flinn 1977; Smout 1978: 19–33).

Smout, writing in the late 1960s, claimed that typhus was a likely alternative to disease epidemics in the winter periods of the early 17th century (Smout 1969: 164). Records of the spread of bubonic plague in rural populations are rarer, although this did not signify a decline in the spread of disease within the rural community; legal and socio-economic documentation and archives were more abundant in urban centres (Smout 1978: 19–33; Oram 2006: 8). It is clear that outbreaks of typhus and plague were common to both rural and urban populations during the 14th to 17th centuries (Oram 2006: 8).

While the archaeological evidence does not confirm the nature of the 1645 epidemic disease, it should be noted that contemporaries were not unfamiliar with cases of bubonic plague and some at least should have been able to identify it. Typhus was usually called the fever, whereas bubonic plague was the plague or the pest. Moreover, 19th-century medical observations, at a time when neither public health practices nor medical interventions were greatly advanced on those of the early 17th century, noted death rates from typhus in Leith that were far lower than those recorded for South Leith in 1645 (Stark 1848: 261).

If, as seems most likely, the epidemic of 1645 was indeed bubonic plague, then the incidences of apparent sudden death outside of the sick bed may be an indicator that the extremely lethal septicaemic variant of the disease was prevalent. This plague variant can cause rapid deterioration and sudden death. The death rate in Leith, recorded as being up to half of the population, is indicative of the pneumonic variant also being present. The pneumonic variant transforms the plague from a largely non-contagious disease transmitted by a flea bite, into a contagious disease readily passed from person to person in a similar fashion to influenza. Pneumonic plague can also cause rapid deterioration and sudden death.

The Leith burials reveal evidence of how the diseased bodies were regarded by those charged with their committal. As stated in the ScARF modern panel report: 'The treatment of the body after death, and its commemoration, are important sources of evidence for understanding how the modern self was constructed' (ScARF 2012).

There are a number of different interment methods visible in the Leith cemetery population, including coffined burials, uncoffined burials and shrouded burials in pits. Fear of the diseased corpses would have influenced how the living treated the dead; although the deceased individuals would have been relatives, friends and co-workers, the erroneous fear associated with infection would have overruled any personal relationships. Plague could not be spread from the corpse to the living, but contemporaries were unaware of this. It could, however, be transmitted via fleas in the clothing of the deceased. Fear of the diseased corpse is visible in this excavated cemetery population from Leith. A number of individuals were buried with goods about their person in the form of everyday items such as money, combs, keys and sewing kits, indicating that the bodies were not rifled prior to burial. The quick construction of the coffins and the position of the bodies in the pits would indicate an urgency on the part of the living to dispose of the dead as quickly as possible. This in turn indicates a heightened fear of the diseased corpse on the part of the living. A 19th-century account of the disease outbreak based on the records of South Leith states: 'Many of the dead were buried in the Links, and even now it is not unusual, when the ground is opened, to find bones, and even, it is said, fragments of the blankets or other material in which the bodies were hastily wrapped and buried' (Groome 1882: 492).

Whilst some bodies do appear to have been disposed of in this way, especially in the earliest phase of burial on the site, later burials were in coffins. The number of coffined and shrouded burials of Non-adult individuals equates to an almost equal split; it is interesting to note that most of the younger children (<10 years of age) were interred in coffins. This may reflect differing attitudes towards young children in that society: that the bodies of young children had to be treated more reverently, despite the dread of the plague.

The archaeological evidence presented at this site may contradict some historical accounts. Evidence of reverence and respectful burial practices is presented in this cemetery population, while some historical accounts paint a darker picture. A poem penned by Hercules Rollock, *De Peste Edinburgi,* records the mistreatment of bodies for fear of the diseased corpse: 'The body is committed to the urn … by a hook, through the shortest route and in the dark of night, a corpse-bearer drags it, boldly he thrusts it into a gaping ditch stinking with foul sulphurous vapours' (Jillings 2014: 3).

Whilst there is evidence of hasty burial practices with this cemetery population, most of the burials are coffined. Fear of the contagion would have been rife, although there is evidence of the need for respect for the deceased.

The orientation of the burials appears to fall into two groups, including east–west and north–south alignments. The vast majority of the burials are east–west aligned, as would be expected in a Christian burial cemetery, but there are a minimum of 11 north–south-aligned burials. Why these individuals were buried on a north–south alignment remains unclear, although different religious and/or societal affiliations may be an explanation. Another explanation may have been lack of burial space; it may have been a case of burying them in whatever space was available as normal burial conventions were abandoned. This scenario is also documented in Defoe's *Journal of the Plague Year* (1722) which, although a work of fiction, is based on parish accounts recorded during the plague outbreak of 1665 in London: '… they died in heaps, and were buried by heaps …' (Defoe 1722: 337).

Unsurprisingly, all of the individuals buried with wooden rosary or paternoster beads are aligned east–west. Strontium analysis conducted on 27 of the bodies has revealed a population largely local to Leith, which presents interesting implications when examined in conjunction with the artefacts, particularly the wooden rosary or paternoster beads. That five individuals in this cemetery population had these beads about their person upon interment indicates their affiliation with the Catholic faith; to be overtly practising Catholicism in a heavily anti-Catholic and pro-Covenanter society would have been dangerous, and the individuals would have been forfeit to a range of penalties if caught. That

these individuals exist in this cemetery population shows that not all inhabitants were supporters of the Covenant petition and that they were continuing to practise their faith, in all likelihood secretly, despite the risks of persecution upon discovery.

The wooden beads are of plain design and are likely to have originated from simple confessional religious apparel. Their basic design is reflective perhaps of the lower social status of some of the individuals, as many rosaries and paternosters would have been crafted from more expensive materials such as carved bone and semi-precious/precious stones. The beads could also have originated as a plain set (ie minus crucifix/tassel/end or gaud bead); given the anti-Catholic sentiment in Leith during the 1640s, it is feasible to argue that, if the item was discovered on the individual, it would be far easier to explain away a simple beaded necklace than to admit to the object as a personal confessional necklace.

It is more than likely that the individuals interred in the burial pits were members of the same family; analysis of the biological profiles of individuals from the pits shows a number of Older Adults, Children and Adolescents, which may represent parents and their children, siblings and extended family members, particularly in Pits C415 and C491 (Table 9).

Throughout the 16th and 17th centuries, one way of both containing a disease epidemic and

Table 9 Biological profiles of individuals interred in plague burial pits

Pit	Sk no.	Biological profile
415	439	Adolescent/Adult 16–20 yrs
	440	Adult
	441	Adolescent 15–17 yrs
	442	Male Adult 44–47 yrs
	443	Male Adult 45+ yrs
	477	Female Adult 40–50 yrs
	478	Female Adult 40–50 yrs
	479	Adolescent 14–16 yrs
	480	Male Adult 24–30 yrs
	481	Child 11–12 yrs
	482	Female Adult 30–40 yrs
	483	Female Adult 24–25 yrs
	484	Female Adult 20–24 yrs
491	430	Male Adult 45–55 yrs
	493	Female Adult 30–35 yrs
	494	Female Adult 35–45 yrs
	495	Adolescent 16–20 yrs
516	518 & 531	Male Adult 18–22 yrs
	519 & 532	Male Adult 17–22 yrs
	520 & 530	Child 6–7 yrs
	527 & 535	Child 5–7 yrs
	528 & 534	Child/Adolescent 12–15 yrs
558	511	Female Adult
	512	Male Adult

treating the infected citizens was to create temporary shanty-town settlements on the outskirts of burghs and urban centres (Oram 2006: 18). The earliest recorded instance of this type of settlement is in Aberdeen in 1514 (Smout 1978: 25–6). A document describes an early 17th-century temporary sick camp in Ayr as 'the foull mur' (Pryde 1937: 98, 100, 232). David Aldinstone, in the Register of South Leith Church 1643–60, records that at the height of the 1645 plague outbreak, these temporary camps of wooden huts or 'ludges' were built along the Leith Links (or the burgh muirs in Edinburgh); infected people, including members of entire households, were brought to these huts for treatment in isolation, although ultimately the inevitable outcome was death (Dingwall 2010: 112; Aldinstone (*Register of S. Leith Church 1643–60*)). There is a very strong possibility that this cemetery population was associated with the Leith Links camp.

It is highly likely that, although members of the same family were interred in these pits, the interred individuals were mixed randomly. As stated previously, given the lack of burial space as a consequence of the epidemic, whoever died (be they related or non-related) had to be buried as soon as possible. This is reflected in documents detailing health regulations put in place during the 1665 plague outbreak in London; the Central Board of Health required individuals to be interred within 24 hours of death, wrapped in either cotton or linen cloth (Cherryson et al 2012: 112). Similar measures were enforced in Leith; a 19th-century account records bodies swathed in coarse blankets with blue stripes (Campbell 1827: 147).

12. THE EXCAVATION: THE LATER POST-MEDIEVAL PERIOD

Megan Stoakley & George Haggarty

Archaeological activity in Phase 3 was represented by the cutting of pits (Illus 19). The composition of the fills of pits located in the southern end of the site was virtually identical in every pit and their organisation on the site appeared regulated and ordered (WA 2016: 20). This would indicate that they were backfilled at roughly the same time and their location to the west of the site marked as drying grounds would suggest that they were associated with some sort of industrial activity related to the ropery. Pits located at the northern end of the site (including C185, C187, C189, C199, C214, C216, C223, C225, C238, C242, C257, C269, C280, C282, C444) were much more varied in nature and were more randomly dispersed, which is suggestive of their use as waste or rubbish pits.

Archaeological activity in Phase 4 was represented by layers and levelling deposits (C100, C145, C235, C252, C268 and C294) laid down during the late 19th to early 20th century (Illus 3). The levelling deposits may have been associated with the demolition of the smallpox hospital and the construction of the school in the 1930s.

12.1 The finds from the pits

A total of 729 artefacts, weighing 18,544g, were recovered from the pits (Table 10). The artefacts were in moderate to good condition and displayed little evidence of post-depositional damage. These finds relate solely to the pits of later post-medieval date.

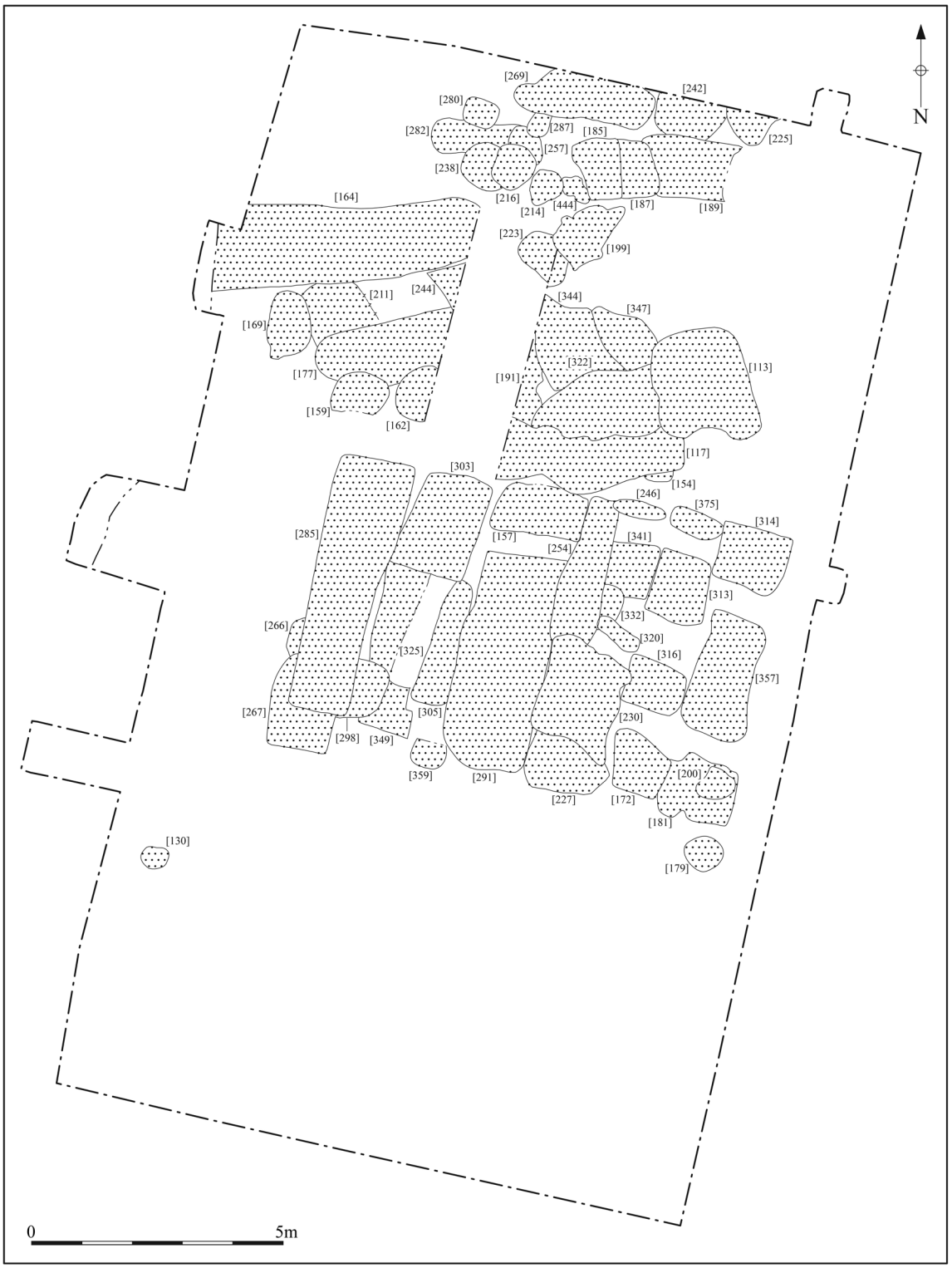
Finds excluding pottery include 29 fragments of clay tobacco pipe, weighing 101g, which date roughly to 1650–1800. Ninety-six fragments of miscellaneous ceramic building material, weighing 9,524g, were recovered from 32 deposits and date from *c* 1890 to 1950. Ninety-six shards of late 19th- to 20th-century beer and wine bottle glass, weighing 1,345g, were recovered along with fragments of late post-medieval to modern iron and lead. Eight fragments of a blue glassy slag, weighing 3,756g, were recovered from six deposits. These fragments have been preliminarily identified as blast furnace waste (Table 10).

12.2 Post-medieval pottery

The few medieval white gritty and post-medieval oxidised ware shards recovered suggest to the author nothing more than background noise and they have little value for future research. The majority of the assemblage is in the form of tiny undecorated creamware and pearlware shards dating in the main from the first quarter of the 19th century (Table 11). Where pearlware shards have been decorated, it's mostly been by the cheapest method, ie common dipped and banded. Where these can be identified, as one might expect they almost certainly derive from local potteries, such as Portobello, Newbigging Musselburgh, Bo'ness and West Pans, all of which at times were exporting wares through Leith. The vast majority of the earlier 19th-century transfer-printed shards are too small for their patterns to be identified. Most of the redware shards have been white slipped internally and they almost certainly derive from dairy bowls; unfortunately these, like the unglazed redware flowerpot shards, cannot be dated.

There are very few shards in the assemblage of the common mid-18th-century ceramic types such as tin-glazed earthenware and white salt-glazed stoneware; which along with the preponderance of earlier 19th-century transfer-printed shards suggests that the pits were filled during the early 19th century. As the pits were dug through sand it is unlikely that they remained open or even in use for very long, consequently it is likely that they date to the early 19th century, when the land was occupied by a rope works. The few later 19th-century shards are in the main either from stoneware bottles used for ink, stove blacking, spirits or ginger beer, with the remainder being Rockingham glazed or standard white earthenware. These Victorian transfer-printed or cut sponge-decorated standard white earthenware shards are almost certainly west coasts imports, as by that time the wares from a number of extremely large Glasgow potteries dominated both the Edinburgh market area and Scotland in general.

There is a total lack of genuine high-status wares such as English or Continental porcelains, while the four shards of Chinese porcelain from C105–5, C173–2 and C183–2 are just what one might expect from a Scottish urban excavation of this period. Given the millions of pieces imported,



Illus 19 Plan of the post-medieval pits © Wardell Armstrong LLP

Table 10 Quantification of finds by material and context

Context	Material	Qty	Wgt (g)	Date	Comments
100	CBM	9	775	PM	Tile frags × 8, brick frag × 1
100	CBM	1	122	Med	Glazed floor tile
102	CBM	1	334	PM	Brick frag
118	CBM	4	1886	PM	Brick frag – 'WHITE …' × 1, roof tile frags × 3
140	CBM	1	4	PM	Tile frags
145	CBM	2	137	PM	Tile frags
145	CBM	3	100	PM	Tile frags
155	CBM	1	2116	PM	Brick frag × 1 '… EHILL'
155	CBM	1	1621	PM	Brick frag – no frog or maker's stamp
156	CBM	2	44	PM	Brick frags
160	CBM	1	31	PM	Brick frag
167	CBM	3	110	PM	Tiles frags
168	CBM	2	16	PM	Brick frags
168	CBM	9	103	PM	Brick frags × 8, tile frag × 1
173	CBM	3	170	PM	Brick frags
176	CBM	1	176	PM	Glazed pipe
176	CBM	1	62	PM	Brick frags
212	CBM	1	56	PM	Brick frag
228	CBM	1	107	PM	Tile frag
232	CBM	2	209	PM	Brick frag × 1, tile frag × 1
235	CBM	4	171	PM	Brick frags
235	CBM	1	2	PM	Brick frag
235	CBM	1	24	PM	Brick frag
239	CBM	1	47	PM	Tile frag
256	CBM	2	66	PM	Tile frags
275	CBM	2	19	PM	Brick frags
283	CBM	1	60	PM	Tile frag
293	CBM	5	73	PM	Brick frags
294	CBM	5	77	PM	Brick frags
304	CBM	1	21	PM	Tile frag
307	CBM	1	175	PM	Brick frag
310	CBM	2	50	PM	Brick frags
312	CBM	1	12	PM	Brick frag
323	CBM	1	128	PM	Brick
342	CBM	2	36	PM	Brick frags
345	CBM	1	57	PM	Tile frag
376	CBM	2	7	PM	Brick frag × 1, tile frag × 1

Table 10 *cont*

Context	Material	Qty	Wgt (g)	Date	Comments
U/S	CBM	3	92	PM	Tile frags
100	Ceramic	3	58	LM?	Internal yellow and green decorated platter × 2.1 × base – burnt
102	Ceramic	2	6	PM	Flowerpot × 1, white earthenware × 1
105	Ceramic	6	63	18th–19th C	Red earthenware × 1, white earthenware, transfer printed × 3, buff earthenware × 1
114	Ceramic	3	24	PM	White earthenware × 2, red earthenware × 1
129	Ceramic	4	20	PM	White earthenware, transfer printed × 2. Glazed red earthenware × 1
131	Ceramic	6	188	PM	Stoneware jar × 1, glazed red earthenware × 1, white earthenware × 4
132	Ceramic	15	182	PM	White earthenware, transfer × 1, Stoneware × 1, red earthenware × 6
133	Ceramic	2	37	PM–20th C	Bottle Tops. LEITCH Edinburgh, JAMES DUNBAR Edinburgh
133	Ceramic	1	102	PM	Buff earthenware – Belfield and Co. pottery
134	Ceramic	5	61	PM	White earthenware × 2, red earthenware × 2, black basaltware × 1
140	Ceramic	1	1	PM	Glazed red earthenware
145	Ceramic	2	29	Med	Dull green external glaze. Rim shard × 1. Reduced fabric
145	Ceramic	1	47	PM	Stoneware jar
145	Ceramic	9	62	PM	White earthenware, transfer printed × 2, red earthenware × 3
145	Ceramic	12	189	PM	Red earthenware × 10, stoneware × 2, including Rhenish? bottle
145	Ceramic	54	240	PM	White earthenware, transfer printed × 19
156	Ceramic	16	64	PM	White earthenware, transfer printed × 5, red earthenware × 2
156	Ceramic	12	44	PM	White earthenware, transfer printed × 2, red earthenware × 7
160	Ceramic	1	1	PM	White earthenware
165	Ceramic	9	33	PM	White earthenware – pot lid '… AIMES & CO …'
165	Ceramic	21	114	PM	White earthenware, transfer printed × 4, red earthenware × 3
167	Ceramic	6	21	PM	White earthenware, transfer printed × 2, red earthenware × 2

Table 10 *cont*

Context	Material	Qty	Wgt (g)	Date	Comments
168	Ceramic	13	41	PM	White earthenware, transfer printed × 1, red earthenware × 7
173	Ceramic	3	17	PM	White earthenware, transfer printed × 1
176	Ceramic	6	39	PM	White earthenware, transfer printed × 1, red earthenware × 2
183	Ceramic	11	59	PM	Red earthenware × 4, white earthenware × 6, white stoneware × 1
186	Ceramic	1	2	PM	Slipware
198	Ceramic	1	2	PM	Red earthenware
212	Ceramic	2	46	Med	Conjoining shards. Dull olive-green external glaze. Reduced fabric
212	Ceramic	4	19	PM	White earthenware, transfer printed × 2, red earthenware × 1
215	Ceramic	1	1	PM	White earthenware
217	Ceramic	1	10	PM	Stoneware jar
218	Ceramic	2	8	PM	Transferware × 1, teapot frag × 1
220	Ceramic	12	114	PM	Refined white earthenware × 7, glazed red earthenware × 4, flowerpot × 1
228	Ceramic	1	1	PM	White earthenware
232	Ceramic	17	87	PM	White earthenware, transfer printed × 3, red earthenware × 3
235	Ceramic	1	57	Med	External olive glaze. Light grey fabric, internal ridges
235	Ceramic	6	35	PM	White earthenware, transfer printed × 3, flowerpot × 1
235	Ceramic	1	5	PM	White earthenware
235	Ceramic	10	134	PM	White earthenware, transfer printed × 2, scalloped edge × 1, red earthenware × 1
235	Ceramic	4	25	PM	Transfer printed × 1, tin-glazed earthenware × 1, white stoneware × 1, red earthenware × 1
239	Ceramic	2	30	PM	Red earthenware × 1, stoneware × 1
250	Ceramic	1	14	PM	Bottle top – LEITCH LTD EDINBURGH RILEY
250	Ceramic	1	1	PM	Transfer printed
256	Ceramic	3	11	PM	Red earthenware × 2, transfer printed × 1
259	Ceramic	1	2	PM	White earthenware
268	Ceramic	2	5	PM	White earthenware
270	Ceramic	2	4	PM	White earthenware, transfer printed × 1

Table 10 *cont*

Context	Material	Qty	Wgt (g)	Date	Comments
275	Ceramic	11	38	PM	White earthenware, transfer printed × 2. Glazed red earthenware × 2
278	Ceramic	12	62	PM	White earthenware × 6, red earthenware × 5, white stoneware × 1
283	Ceramic	10	30	PM	White earthenware, transfer printed × 3, red earthenware × 1, stoneware × 1
288	Ceramic	2	7	PM	White earthenware × 1, red earthenware × 1
293	Ceramic	7	35	PM	White earthenware. Transfer printed × 4
294	Ceramic	27	151	PM	White earthenware, transfer printed × 3, spongeware × 1, red earthenware × 7
304	Ceramic	1	3	Med	External flaking glaze. White fabric
304	Ceramic	2	18	PM	Transfer printed × 1, stoneware × 1
307	Ceramic	7	28	PM	White earthenware, spongeware × 2, red earthenware × 1
310	Ceramic	2	6	PM	White earthenware
310	Ceramic	7	18	PM	White earthenware, transfer printed × 3
315	Ceramic	5	11	PM	White earthenware, transfer printed × 1 – Spode
317	Ceramic	1	10	PM	Transfer printed
319	Ceramic	2	12	PM	Transfer printed × 2
321	Ceramic	2	62	PM	White earthenware × 1, red unglazed earthenware × 1
323	Ceramic	17	196	PM	White earthenware, transfer printed × 6, scalloped edge × 1, stoneware × 2, red earthenware × 3
334	Ceramic	1	3	PM	White earthenware
342	Ceramic	14	68	PM	White earthenware, transfer printed × 3, red earthenware × 4
345	Ceramic	1	3	PM	Transferware × 1
348	Ceramic	4	14	PM	White earthenware, transfer printed × 2, buff earthenware × 1
350	Ceramic	4	19	PM	White earthenware, transfer printed × 2, buff earthenware × 1
376	Ceramic	3	12	PM	White earthenware × 2, red earthenware × 1
U/S	Ceramic	3	6	PM	White earthenware
102	Clay pipe	1	2	PM	Stem
118	Clay pipe	1	1	PM	Stem

Table 10 *cont*

Context	Material	Qty	Wgt (g)	Date	Comments
133	Clay pipe	2	32	PM	Complete 'knobbly' bowl × 1. Stem × 1 – stamped 'D.WILS …', '… MY.FIFE'
145	Clay pipe	1	5	PM	Stem
145	Clay pipe	1	4	PM	Stem
156	Clay pipe	1	6	PM	Stem
168	Clay pipe	1	4	PM	Stem – stamped at tip
176	Clay pipe	1	1	PM	Stem
183	Clay pipe	1	5	PM	Stem
185	Clay pipe	1	2	PM	Bowl frag
198	Clay pipe	1	2	PM	Stem
220	Clay pipe	1	2	PM	Stem
232	Clay pipe	2	7	PM	Stem × 1, bowl frag × 1
235	Clay pipe	1	4	PM	Stem
256	Clay pipe	1	3	PM	Stem
275	Clay pipe	4	7	PM	Stem × 3, bowl frag × 1. Stamped 'DUNCAN', 'LEITH'
294	Clay pipe	1	1	PM	Stem
304	Clay pipe	1	1	PM	Stem
310	Clay pipe	1	3	PM	Stem
315	Clay pipe	1	1	PM	Stem – poss shaping to end
323	Clay pipe	1	2	PM	Stem
350	Clay pipe	1	3	PM	Stem
U/S	Clay pipe	2	3	PM	Stem. Yellow glaze × 1
133	Cu Alloy	1	3	PM	Coin – farthing 1911–25
100	Glass	1	25	PM	Square green bottle base
102	Glass	1	6	PM	Green bottle
129	Glass	1	1	PM	Button – white glass 4 central holes
131	Glass	1	4	PM	Green bottle
145	Glass	1	5	PM	Green glass droplet – waste?
145	Glass	8	207	PM	6 × bottle, 1 × window, 1 × waste. Clear and green
145	Glass	4	128	PM	Clear bottle × 2, green bottle × 2
145	Glass	10	85	PM	Green bottle × 5, clear bottle × 2, clear window × 2, green waste × 1
156	Glass	1	135	PM	Green bottle base
156	Glass	2	3	PM	Clear bottle × 1, clear waste × 1
165	Glass	6	63	PM	2 × clear bottle, 3 × green bottle, 1 × blue waste?
167	Glass	2	3	PM	Clear

Table 10 *cont*

Context	Material	Qty	Wgt (g)	Date	Comments
168	Glass	2	10	PM	Green bottle × 1, clear window × 1
176	Glass	1	1	PM	Green bottle
178	Glass	3	41	PM	Green bottle
183	Glass	4	20	PM	Clear × 2, waste × 2?
198	Glass	1	108	PM	Green bottle base
212	Glass	2	11	PM	Green bottle × 1, clear bottle × 1
220	Glass	3	31	PM	Green bottle × 2, clear bottle × 1
232	Glass	6	43	PM	Clear × 4, green waste × 2
235	Glass	3	32	PM	Clear × 1, green × 2
235	Glass	1	3	PM	Blue glassy slag?
245	Glass	1	1	PM	Button – white domed glass
245	Glass	1	13	PM	Clear bottle base
250	Glass	2	4	PM	Clear window and bottle
270	Glass	7	112	PM	Clear bottle × 5, green bottle × 2
272	Glass	1	51	PM	Waste frag
275	Glass	1	2	PM	Clear window
283	Glass	1	6	PM	Clear bottle
307	Glass	1	2	PM	Clear window
310	Glass	1	6	PM	Green bottle frag
312	Glass	1	1	PM	Green bottle
323	Glass	4	39	PM	Green bottle × 3, clear window × 1
334	Glass	1	2	PM	Green glass droplet – waste?
345	Glass	2	39	PM	Clear bottle frags
348	Glass	1	2	PM	Clear window
U/S	Glass	1	11	PM	Green bottle rim – uneven
102	Fe	1	5	PM	Nail
129	Fe	2	14	PM	Handmade nail × 2
272	Fe	1	81	PM	Corroded iron
310	Fe	2	40	PM	Handmade nail × 2
345	Fe	1	21	PM	Handmade nail
100	Mortar	1	21	PM	Lime mortar
133	Slag	1	13	PM	Blue glassy slag
145	Slag	2	431	PM	Blue glassy slag
168	Slag	1	46	PM	
315	Slag	1	26	PM	
342	Slag	1	12	PM	Blue glassy slag
100	Stone	1	152	PM	Sandstone fragment – possible engraved surface?

Table 10 *cont*

Context	Material	Qty	Wgt (g)	Date	Comments
315	Stone	1	8	PM?	Worked flint?
378	Stone	1	34	PM?	Worked?
Total		667	14,727		

very little in the way of synthesis has been carried out and published on the distribution and use of Chinese export 17th- and 18th-century porcelain in European cities. One of the few exceptions is a paper based on an archaeological excavation carried out on a Copenhagen refuse dump dated 1650–1760, which shows that the majority of the porcelain shards were mass-produced and of lower quality than the documents suggest (Kristensen 2014: 151–81).

One of the more interesting items is a small tile shard in a fabric not previously seen by the author. Over the last few years a number of ICP chemical sourcing projects have been carried out on medieval tiles from Scottish excavations including some thick, unglazed examples used as a hearth, from Burgess Street Leith (Hall & Chenery 2011: 21–7). Thanks to this work and ongoing research we know that a substantial number of medieval and post-medieval tiles were being imported from the Low Countries and that there were also a number of local Scottish kilns in production. Visually this tile doesn't seem to fit into any of these sources, thus it is worthy of being included in a future ICP programme.

The second interesting shard is from the shoulder of a well-thrown dish in a fine buff/pale red fabric with some small sparse rounded quartz and haematite. This shard has much in common with the paste used to produce once-fired German Wesser dishes which are thought to have been imported through Leith as an adjunct to the Baltic timber trade (Gooder 2013: 16). These wares were produced over a very wide area of northern Germany between the rivers Leine and Wesser, in as many as 100 separate kilns (Stephan 2012: 100 Abb. 1). Generally, examples recovered in places such as Amsterdam date them from between 1580 and 1630, with traded examples usually being highly decorated. A map published by Stephan (2012) shows that, outwith mainland Europe and Scandinavia, examples reached Ireland, Iceland, the Orkney Islands and North America, and a large number of sites along England's south and east coasts, but not the Scottish mainland. However, work on recent archaeological excavations carried out in Edinburgh and Canongate have identified 27 examples all occurring in 17th-century contexts (Haggarty 2017; Gooder 2013: 16).

The only other ceramic import is a late 17th-century rim and neck shard with handle scar from a German Frechen salt-glazed stoneware bottle in a light grey fabric. Shards of these vessels are incredibly common from British sites of the period.

Table 11 Detail of post-medieval pottery analysis

Site code	Context	Quantity	Date	Notes
STM-A	102	2	Last ¼ 18th C	Two creamware shards, both frost-damaged and one from the rim of a plate.
STM-A	117	1	17th C	One body shard from just below the rim of a small Scottish post-medieval oxidised ware drug jar, green lead glazed on both surfaces. Not uncommon in the Edinburgh area (see Haggarty & Lawson 2013). A large number have also been identified from Edinburgh Castle.
STM-A	201	2	First ¼ 19th C	One very small thin body shard with traces on a grey transfer print which may be the common fibre pattern. One tiny creamware body shard; not datable.
STM-B	100	5 (and 1 tile)	*c* 1800	One small basal angle shard from a globular medieval cooking pot heavily sooted on its exterior. This shard has been subjected to secondary firing. Two conjoining shards from a wide flanged dish in a buff fabric with abundant very fine mica; upper surface decorated with white trailed slip under patches of green and a clear lead glaze. One shard and a few crumbs from a 24mm-thick mainly reduced floor tile in a finely gritted quartz-rich fabric. Its upper surface is covered in a thick olive-green lead glaze over two incised right-angled lines and part of this surface also shows evidence of very light wear in the form of fine scratches. Verso the tile has been oxidised under traces of a patchy thin glaze. One unglazed redware body shard; flower pot; undatable. One very small brown dipped pearlware body shard with traces of hand-done sgraffito decoration; this type of decoration is associated with the West Pans pottery (Haggarty 2006).
STM-B	105	5	Late 19th C	One abraded tiny polychrome decorated tin-glazed earthenware body shard; Anglo-Dutch; late 17th century. One Rockingham glazed basal angle shard from a Rockingham glazed teapot; late 19th century. One small pearlware rim shard from a teabowl decorated with underglaze hand painting and blown powdered cobalt; English and *c* 1800. One pearlware plate rim shard transfer printed with standard willow. One worn base shard from a thick Chinese porcelain plate with traces of underglaze cobalt painting; undatable.
STM-B	114	2	2nd ¼ 19th C	Two small white slipped redware body shards from a dairy bowl; can't date. One small pearlware saucer body shard decorated with a green band and a small stylised plum-coloured flower.

Table 11 *cont*

Site code	Context	Quantity	Date	Notes
STM-B	129	3	2nd ¼ 19th C	Two blue and white standard willow transfer printed plate shards; second quarter of the 19th century. One small rim shard from a saucer decorated with a blue and white transfer print; probably two temples.
STM-B	131	7	Late 19th/early 20th C	One basal angle shard from a plain globular Rockingham glazed teapot impressed on its base with [BELFIELD & Co] late 19th or early 20th century. This is BELFIELD & Co of Prestonpans, whose Rockingham glazed teapots were in great demand and shards of which are found all over Scotland. One basal angle shard from a large white dipped salt-glazed stoneware bottle. One white slipped redware body shard from a dairy bowl. Four small creamware body shards.
STM-B	134	6	Late 19th C	One unglazed redware body shard from a flower pot; not dated. Two stoneware shards; one rim and one basal angle from a blacking bottle and preserve jar; late 19th century. One standard white earthenware body shard decorated with blue bands; late 19th century. One white slipped redware shard from a dairy bowl; not dated. One rim and shoulder shard with handle scar from a round black basalt teapot with a small lid seating; *c* 1800.
STM-B	140	2	Post-med	One white slipped redware crumb. One small unglazed redware body shard.

Table 11 *cont*

Site code	Context	Quantity	Date	Notes
STM-B	145	82	*c* 1840 (1 × 16th C; 1 × 17th C)	One abraded green glazed Scottish post medieval oxidised ware body shard; the slightly gritty feel might suggest a late 16th-century date. One very small green glazed Scottish post medieval oxidised ware shard; either a rim or edge of a strap handle; probably 17th century. One rim neck and handle scar from a German Frechen salt-glazed stoneware bottle in a light grey fabric; late 17th century. Six blue and white transfer printed shards all of which conjoin to form the profile and handle of a fairly crude fluted cup *c* 1840. Twenty-seven creamware shards from a number of plates and a large bowl; one of the plates has the feather-edged pattern. All late 18th or early 19th century. Nine small blue and white transfer printed shards all from different vessels. Three small pearlware body shards late 18th or early 19th century. Two small cobalt blue underglaze painted shards from a slop bowl and saucer *c* 1800. One mug rim shard decorated in typical Pratt colours *c* 1800. Three small banded pearlware shards decorated with a rouletted band *c* 1810–20; this rouletted decoration has been recorded on pottery excavated on the site of William Reid's Newbigging pottery (Haggarty 2005). Four glazed redware shards; rim base and body from a small crock. Four creamware body shards. One standard white earthenware rim shard from a plate decorated with a grey transfer print; the common fibre pattern which was made by a number of Glasgow potteries. Seven unglazed redware body shards; not dated. Nine lead redware body and strap handle shards from a crock; not dated. One brown salt glazed stoneware rim neck and shoulder shard from a blacking bottle.
STM-B	156	25	2nd ¼ 19th C	Sixteen undecorated creamware and pearlware shards from a number of vessels; a developed foot-rim suggests a date in the second quarter of the 19th century. Two very small pearlware body shards with blue and white transfer printing; second quarter of the 19th century. One undecorated pearlware body shard. Three unglazed redware shards almost certainly from flower pots. Three white slipped redware body shards from dairy bowls.
STM-B	160	1	Post-med	One undecorated pearlware body shard; not dated.

Table 11 *cont*

Site code	Context	Quantity	Date	Notes
STM-B	165	6	Late 19th C	One undecorated buff ware rim shard. One shard from a fairly rare standard white earthenware pot cover with [--AIMS & Co] and part of arms. A complete decorated example is 'Raims & Co./ Cold Cream/of/Roses/Edinburgh York & Liverpool'. Fourteen undecorated standard white earthenware, creamware and pearlware shards. One basal angle shard from a pearlware cup with traces of an internal cobalt blue transfer print and back-stamp; this may be [SPODE] *c* 1800. One basal angle shard from white dipped stoneware bottle; second half 19th century. One rim and neck shard from a salt-glazed blacking bottle; second half of the 19th century.
STM-B	167	13	1st ¼ 19th C	Seven very small blue and white transfer printed shards from as many vessels. One small unglazed redware rim shard from a flower pot; not dated. Five small creamware and pearlware shards; not dated.
STM-B	168	12	Late 18th C–*c* 1800–10	Six white slipped redware body shards from a dairy bowl; not dated. Six small blue and white transfer printed pearlware body shards from as many vessels; *c* 1800–10. One small pearlware body shard decorated underglaze with cobalt blue hand painting (late 18th century).
STM-B	173	3	1760/1770–*c* 1800	Two small undecorated pearlware body shards; badly stained. One Chinese export porcelain body shard from a plate decorated with underglaze cobalt blue painting; Ch'ien Lung, and *c* 1760–70.
STM-B	176	7	Post-med	Seven redware body shards: two from flower pots, two from dairy bowl and two from crocks; not dated.
STM-B	183	10	Mid 18th C–2nd ¼ 19th C	Seven creamware and pearlware body shards some frost-damaged. Two tiny Chinese porcelain saucer shards one with traces of over-glaze decoration; possibly mid-18th century.
STM-B	186	1	*c* 1580–1620	One body shard from the shoulder of a well-thrown dish in a fine buff/pale red fabric with some small sparse rounded quartz and haematite.
STM-B	192	1	2nd ¼ 19th C	One small frost-damaged cobalt blue transfer printed body shard.
STM-B	198	1	Post-med	One white slipped redware body shard from a dairy bowl; not dated.

Table 11 *cont*

Site code	Context	Quantity	Date	Notes
STM-B	212	1	15th C–Victorian	Two conjoining green glazed Scottish post-medieval oxidised ware body shards from a high-fired jug possibly late 15th century or a bit earlier. Two conjoining standard white earthenware shards from the rim of a thick bowl decorated with poor-quality cobalt blue transfer prints and red clobbering; Victorian. Two creamware shards; not dated.
STM-B	215	1	Post-med	One tiny whiteware body shard; not dated.
STM-B	217	1	Victorian	One small salt glazed stoneware shard from what may be a blacking bottle.
STM-B	220	12	Post-med	One unglazed shard from a redware flower pot. Three undecorated creamware body shards. Two conjoining pearlware basal angle shards from a bowl; can't date. Two undecorated pearlware body shards. Four glazed redware body shards. All not dated.
STM-B	228	1	Post-med	One small standard white earthenware body shard.
STM-B	231	2	*c* 1825	One very small basal angle shard from a white slipped redware dairy bowl. One very small pearlware body from a London-shaped bowl decorated with light blue bands between which is a band of brown slip filled Adeney type 134 rouletting (Adeney 2008). A number of shards with this decoration have been recovered from the site of the Bo'ness pottery and are held in the ceramic store of the NMS, accession number (K.2003. 24) (Haggarty 2011).
STM-B	232	20	*c* 1825	Six glazed redware body shards – not dated. One developed pearlware base shard from a slop bowl decorated on its interior with a yellow/red crude stylised hand-painted flower; looks *c* 1825. One developed pearlware base shard from a slop bowl; looks *c* 1825. Eleven undecorated creamware and pearlware shards. One small shard from a bone china saucer with slight traces of a painted gilt band.

Table 11 *cont*

Site code	Context	Quantity	Date	Notes
STM-B	235	17	Late 15th/early 16th C–*c* 1820	One thick green glazed body shard from the shoulder of a large whiteware jug; although there have been a few outliers the vast majority of this fairly crude pottery has been recovered from excavations in Edinburgh and Leith; late 15th or early 16th century. One basal angle shard from a small redware flower pot; not dated. Four pearlware shards from a bowl decorated with underglaze hand-painted flowers; this type of painting is known on shards recovered from excavations carried out on the Portobello kiln site (Haggarty 2008: 63) *c* 1820. Two small blue and white transfer printed pearlware body shards *c* 1820. One abraded tin-glazed earthenware body shard *c* 1750. Four white slipped redware shards from at least two dairy bowls; not dated. One pearlware rim shard from the rim of a cobalt decorated shell-edged plate. Two small thin conjoining body shards from an unknown moulded vessel. One pearlware body shard; not dated.
STM-B	239	2	Post-med	Two unglazed redware body shards from flower pots; not dated.
STM-B	242	13	Early 19th C	Four redware shards from a small white slipped dairy bowl; not dated. Nine small undecorated creamware and pearlware shards; not dated. One pearlware body shard decorated with a blue and white transfer print; common standard willow.
STM-B	247	11	1st ¼ 19th C	Six small shards all with traces of blue and white transfer printing probably from five vessels. One lead glazed redware body shard; not dated. One creamware strap-handle shard; not dated. Two bone china body shards with traces of red painting. One pearlware body shard; not dated. One tiny banded pearlware body shard.
STM-B	250	1	*c* 1800	One small pearlware rim shard from a teabowl decorated in Pratt colours.
STM-B	255	8	Post-med	Five white slipped redware shards from a small crock; one undecorated redware rim shard from a flower pot; one creamware plate shard; one pearlware body shard; all not dated.
STM-B	256	5	1st ¼ 19th C	Three very small pearlware rim shards from three different blue and white transfer printed plates; all first quarter of the 19th century. Two white slipped redware body shards from a dairy bowl; not dated.
STM-B	257	1	Post-med	One tine pearlware plate shard; not dated.
STM-B	268	2	Post-med	Five badly crazed thick creamware body shards; one frost-damaged; not dated.

Table 11 *cont*

Site code	Context	Quantity	Date	Notes
STM-B	270	3	Post-med, probably 1st ¼ 19th C	Three very small banded body shards.
STM-B	275	9	Post-med	Three white slipped redware shards from a dairy bowl; not dated. Six undecorated creamware and pearlware body shards, one frost damaged; not dated.
STM-B	278	14	Possibly late 18th C	Five small creamware body shards; not dated. One small white slipped redware body shard. Three lead glazed redware body shards; not dated. Three white slipped shards from dairy bowls; not dated. One unglazed body shard from a flower pot; not dated. One rolled rim shard from a white salt glazed bowl; *c* 1750–70.
STM-B	281	2	Post-med	Two small abraded creamware body shards, one frost-damaged; not dated.
STM-B	283	11	Victorian 1800–20	Three small blue and white transfer printed pearlware shards from what may be a standard willow plate; *c* 1810–20. Six small creamware shards possibly from a mug; *c* 1800. Two badly abraded white dipped stoneware body shards; look Victorian.
STM-B	288	2	Post-med	Two white slipped shards from dairy bowls; not dated.
STM-B	293	7	1750–75/*c* 1810–20	Three pearlware shards decorated with a blue and white transfer print; standard willow; *c* 1810–20. One shard from the rim of a moulded white salt glazed stoneware plate; *c* 1750–75. Two small conjoining blue and white transfer printed pearlware body shards; *c* 1810–20. One small flow blue transfer printed rim shard; *c* 1810–20.
STM-B	294	29	Late 19th C	Ten white slipped redware shards from at least three dairy bowls; not dated. Fifteen mixed undecorated whiteware shards; not dated. One undecorated bone china body shard; not dated. One standard white earthenware rim shard from a bowl decorated with brown cut sponging; late 19th century. One small standard white earthenware body shard decorated with a brown transfer print; late 19th century. One pearlware basal angle shard from a London-shaped cup with traces of external and internal blue transfer printing; post 1820.
STM-B	304	2	13th/14th C–2nd ¼ 19th C	One small abraded Scottish white gritty ware body shard from a jug covered on its exterior with a thick pale green suspension glaze; 13th or 14th century. One tan-coloured dipped body shard from a large vessel; not dated. One standard white earthenware rim shard from a cup decorated with a light blue standard willow transfer print; 2nd quarter of the 19th century.

Table 11 *cont*

Site code	Context	Quantity	Date	Notes
STM-B	307	8	2nd ¼ 19th C	Six standard white earthenware body shards. One standard white earthenware body shard decorated with blue cut sponging and black painted bands; second half 19th century. One standard white earthenware body shard decorated with vertical and horizontal bands; second half 19th century.
STM-B	310	9	Early 19th C	Four small creamware shards; not dated. One pearlware frost-damaged rim shard from a tan-coloured dipped bowl with a blue band below its rim and traces of a dipped fan. A number of the potteries around the Forth are known to have used the design; early 19th century. Two conjoining pale blue dipped pearlware bowl shards with a brown rim band; early 19th century. Two blue and brown banded shards, one a rolled rim from a bowl; early 19th century.
STM-B	312	12	*c* 1820–5	Six white slipped redware shards from a minimum of two dairy bowls; not dated. Four creamware shards from a minimum of two plates; one bowl early 19th century. One small blue and white transfer printed pearlware plate base shard. One very small pearlware base shard with part of an impressed mark [TR & C]; this is a recorded but fairly rare Thomas Rathbone & Co of Portobello mark which almost certainly dates to *c* 1820–5.
STM-B	315	5	2nd ¼ 19th C	One tiny blue and white transfer printed shard with part of a [SPODE] backstamp; this is a Spode type 2 early mark and probably dates from around 1800. Two standard white earthenware body shards; not dated. One tiny blue and white transfer printed shard; standard willow. One pearlware rim shard decorated with a flow blue transfer print; probably second quarter 19th century.
STM-B	319	2	3rd ¼ 19th C	Two standard white earthenware body shards both with traces of transfer printing; one of the shards has part of an impressed oval stamp; the letters are unreadable but may be part of a known Glasgow mark.

Table 11 *cont*

Site code	Context	Quantity	Date	Notes
STM-B	323	14	*c* 1820	Seven undecorated pearlware shards from a number of different vessels. Four tiny pearlware blue and white transfer printed body shards; possibly Rathbone of Portobello [mega flower border]. One pearlware rim shard from a bowl decorated with underglaze hand-painted flowers; this type of painting is known on shards recovered from excavations carried out on the Portobello kiln site (Haggarty 2008: 63) *c* 1820; same bowl as [Context 235, No. 3]. Two conjoining pearlware shards from the rim of a saucer decorated with a light blue wash and dark blue underglaze trailing foliage painting; this type of decoration is known on shards recovered from excavations carried out on the Portobello kiln site (Haggarty 2008, 63) *c* 1820; one pearlware shell edged rim shard from a plate decorated with a blue painted rim.
STM-B	334	1	Post-med – 1800?	Creamware rim shard from a plate; possibly *c* 1800.
STM-B	345	1	Early 19th C	One stained blue and white transfer printed pearlware body shard.
STM-B	348	4	Early 19th C	Two standard willow-decorated pearlware plate shards; one frost-damaged; early 19th century. One Rockingham glazed body shard; not dated. One creamware body shard; not dated.
STM-B	350	4	Post-med	Four pearlware shards; one frost-damaged; not dated.
STM-B	358	5	1750–70, 1830, possibly 1850+	One small white salt glazed stoneware jar rim shard; *c* 1750–70. One white salt glazed stoneware thick body shard; *c* 1750–70. One tiny brown stoneware body shard possibly from a blackening bottle; looks second half 19th century. Two very small standard white earthenware shards probably from a moulded child's plate; looks *c* 1830–40.
STM-B	376	3	Post-med	One small white slipped redware rim shard from a dairy bowl; not dated. Two very small pearlware shards; not dated.
STM-B	378	7	1st ¼ 19th C	One thick abraded basal angle shard from a large late Scottish jug in an off-white fabric with a pinkish iron-rich surface, which might suggest that it was fired along with redwares. Two Rockingham glazed teapot shards; not dated. Three very small blue and white transfer printed body shards from as many vessels; first quarter 19th century. One pearlware saucer shard moulded and decorated with the common cobalt blue shell edged design; first quarter 19th century. Research in the USA suggests that this long-lived design reached its zenith in 1823.
STM-B	u/s	3	Post-med	Three small stained creamware body shards; one frost-damaged; not dated.

13. ZOOARCHAEOLOGY

A total of 382 ecofactual remains, weighing 17,625g, were recovered during the excavation. This includes a total of 223 animal bones and a total of 159 shells. The condition of the animal bone and shell ranges from moderate to very good.

The shells recovered from the excavation include oysters, mussels, limpets, bivalves and gastropods.

Guidelines adhered to for zooarchaeological analysis include published academic literature (Schmid 1972; Hillson 1992; Serjeantson 1996; Historic England 2014).

A minimum of 29 animals are represented in this assemblage. This includes a minimum of three horses (*Equus* sp.), 11 cattle (*Bos* sp.), 14 sheep (*Ovis* sp.), one pig (*Sus* sp.) and an unidentified small mammal from Deposit C100.

The vast majority of the bones originate from adult animals, although lamb bones were evident in Deposits C100 and C145. Butchery marks were evident on several cow and sheep bones, with chop-marks visible on ribs, tibiae, scapulae and humerae.

Pathology was evident on cow vertebrae recovered from Deposit C100, including osteophytic changes on the vertebral body, and two cervical vertebrae were fused together.

The animal bones and shell recovered from the excavation represent a domestic food waste assemblage with a reliance on cattle and sheep for meat consumption and secondary products such as dairy, wool and leather. Horses were either used for transport or as draught animals; they were likely used for meat consumption towards the end of the animal's life. The presence of marine shells in this assemblage is not surprising given the location of the site; the shellfish would have supplemented domestic food consumption and would have been a readily available trade and a regular source of income to inhabitants. They were recovered along with artefacts of 19th-century date.

14. ARCHAEOBOTANY

Lynne F Gardiner

14.1 Introduction

A total of 321 bulk environmental samples were taken during the excavation at St Mary's (Leith). The majority were taken from the grave pits; therefore, taken for the recovery of human bone. Six samples from non-grave fills were selected for further analysis of their palaeoenvironmental remains; all were from Phase 3.

14.2 Methodology

The bulk environmental samples were processed at Wardell Armstrong LLP with methodology outlined in the original post-excavation assessment (WA 2016: 51).

The plant remains and charcoal were identified to species as far as possible, using published literature and academic texts as well as the author's reference collection (Hather 2000; Schoch et al 2004; Jacomet 2006; Cappers et al 2012; Cappers & Neef 2012; Cappers & Bekker 2013). Nomenclature for plant taxa followed published academic literature (Stace 2010; Cappers & Neef 2012).

14.3 Results

A total of 761 uncharred plant remains were observed in these six samples along with a single charred barley (*Hordeum* sp.) grain. The greatest yield was from environmental sample <4>, C105 fill of Robbing Cut C104 with 382 individual fruits/seeds observed. The smallest yield was from environmental sample <26>, C176 fill of Pit C172 with only three examples of goosefoot (*Chenopodium* sp.) fruits present. The full results can be observed in Table 12. The preservation of all fruits/seeds was good to excellent.

14.4 Discussion

All uncharred plant species observed may be found in waste ground. The presence of shrubs such as red elderberry (*Sambucus racemosa*), elderberry (*S. nigra*), brambles (*Rubus* sp.) and guelder-rose (*Viburnum opulus*) may have suggested that hedgerows were present. However, in consideration with the other species observed, they are more likely to be representative of an overgrown waste area; especially after the pits had gone out of use for their intended purpose.

The presence of the single charred barley grain does not shed any light on crop husbandry practices or diet and is likely to be there by chance.

Table 12 Archaeobotanical results showing count of fruits and seeds

	<>	2	4	26	30	44	80
	Fill	100	105	176	206	232	292
	Cut		104	172	181	230	291
Binomial name	Common name	Waterlain deposit	Fill of robbing Cut [104]	Lower fill of Pit [172]	Fill of Pit [181]	Lower fill of Pit [230]	Upper fill of Pit [291]
Un-charred							
	Daisy family	29				1	
Sambucus racemosa	Red elderberry	47			150		
Sambucus nigra	Elderberry				2		
Rubus sp.	Bramble		11		7		
Viburnum opulus	Guelder rose		12				
Raphanus raphanistrum	Wild radish	2					
Chenopodium sp.	Goosefoots		49	3	2		
Fallopia convolvulus	Black bindweed		251				
Rumex sp.	Docks		10		2	8	
Stellaria media	Common chickweed		49		13	91	16
Carex sp. (bi)	Sedges				5	1	
Charred							
Hordeum sp.	Barley						1
	Totals	78	382	3	181	101	17

15. CONCLUSION

Megan Stoakley & Richard Newman

The initial aim of the archaeological excavation at St Mary's (Leith) was to identify the origins of coffined burials noted in the archaeological evaluation. Three likely contexts were postulated for the burials: the 1560 siege of Leith, the 1645 plague outbreak and the early 20th-century smallpox hospital. Archaeological excavations conducted in 2016 uncovered a total of 81 individuals interred on the site of the school. Dating evidence recovered from the bodies provides an early to mid-17th-century date for the inhumations while detailed analyses conducted on the human remains (including pathological examinations of the remains, dendrochronological analysis on the coffin wood and coffin manufacture technological data) provide overwhelming evidence that the burials are associated with the 1645 plague outbreak in Leith. The cemetery population at St Mary's (Leith) fits a catastrophic palaeodemographic profile, particularly in comparison to similar sites in London.

The plague outbreak of 1645 devastated the community of Leith. The high death toll and the monumental task of burying a huge number of diseased corpses would have caused panic and chaos among an urban population already suffering the stresses of endemic poverty, frequent famine and the uncertainties of the political and religious upheavals of mid-17th-century Scotland (Dunnigan & Ewan 2006: 3; Cullen 2010: 11). Over 56% of the population of South Leith was wiped out (ES online 2018: XXV). Public health measures to contain the pestilence were brutal and oppressive. Historical documents such as the Kirk Session Records document the presence of wooden huts and booths located in Leith Links to accommodate the overwhelming number of sick citizens (Aldinstone (*Register of S. Leith Church 1643–60*). The cemetery was undoubtedly associated with this temporary settlement at Leith Links.

Analysis of the individuals and cemetery demographic data from St Mary's (Leith) reveals that the inhabitants would have had a heightened fear of the diseased corpse; the hasty construction of the coffins, the position of the bodies in the pits and the presence of everyday objects on the bodies would indicate strongly that it was a case of burying the bodies as quickly as possible. It is highly likely that citizens not afflicted by the plague outbreak, or not as badly, were put to work, tasked with clearing streets, cleaning victims' houses and burying the deceased. Despite the clear evidence of hasty burial practices with this cemetery population, it is evident that some of the deceased were buried respectfully and with reverence.

Differing attitudes to the burial of children are evident in this cemetery population; virtually all of the younger children (<10 years of age) were buried in coffins. This evidence shows that the living treated deceased children differently, that there was a need for their reverent and respectful burial despite the fear and dread of the plague.

Strontium isotope analysis revealed a population which was largely local to Leith, and the presence of personal confessional beads (rosary and/or paternoster) on five individuals indicates Catholic affiliations, in a town that had signed the Covenant. There was no evidence from the buried corpses of Leith's role as a port with international connections, but the construction of the coffins from pine derived from Norway suggests a trading connection with that country and probably with its south-western coastal forest area. Other evidence indicates 17th-century connections with the Low Countries and Germany.

Overall the excavation of the plague victims at Leith confirms historical accounts of the use of part of Leith Links as a cemetery for the 1645 plague. The archaeological evidence in part supports historical accounts but in other ways amplifies them, redressing the balance of some of the more sensationalist views. The story of the excavation of the plague victims was completed with their reinterment in a communal grave within Leith municipal cemetery in March 2018. Within the recommittal service a silver baptismal bowl was used which had been gifted to South Leith parish by three burgesses of Leith in 1648, in thanksgiving for their having survived the plague three years previously.

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