

9. THE ARTEFACT EVIDENCE: NEW STREET GASWORKS

9.1 Introduction

Large quantities of artefacts were found during excavations at the New Street Gasworks site, including metal, wood and stone fittings, fixtures and tools; painted architectural mouldings; a refractory ceramic retort and window glass fragments relating to the dismantled Gasworks complex; leather shoes; worked bone and metal dress accessories and personal objects discarded or lost by the employees of the Gasworks; and glass bottles, tableware and ceramics that can be related to the general occupation of the area both pre-dating and during the operation of the site.

Interpreting the significance of individual objects is problematic. The above-ground structures were dismantled and demolished during the early 20th century, and the area was levelled to make way for the construction of a bus depot. Most of the artefacts were recovered either from demolition or levelling deposits, which infilled basement rooms, passages, furnaces and other features. This process of demolition and levelling has resulted in considerable mixing and dispersal of material across the excavated area and it has been impossible in most instances to stratigraphically relate individual objects to particular buildings or features across the site.

Due to the large quantity of material recovered, the assemblage will be discussed by material type, highlighting items of particular significance that can be confidently related to the pre-Gasworks occupation of the Canongate and objects associated with the workings of the Gasworks itself. Individual catalogue descriptions are presented for illustrated items only; full catalogues and specialist reports which discuss the various components of the assemblage are presented in the site archive.

9.2 The architectural plasterwork

Diana Sproat

9.2.1 Introduction

Two fragments of architectural plasterwork (SF100 and SF101) were recovered from an unstratified deposit relating to the levelling of the Gasworks complex (Illus 83).

9.2.2 Analysis and description

The two fragments are contemporary and share the same architectural design and paint colour remains. SF101 is the larger and more complete example of the two, despite obvious wear to the base and rear. Table 1 summarises each piece:

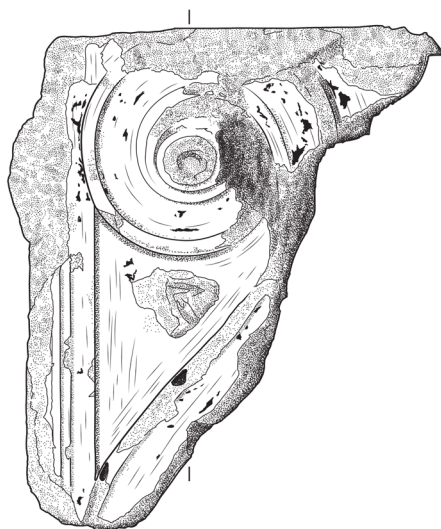
► **SF100.** This fragment survives in a much poorer condition than SF101, with only the thicker upper part of the moulding surviving. The surfaces are covered in an uneven white lime plaster with another darker off-white cream plaster adhered to it with occasional grit fragments (<1mm in size). The outer surface contains the remains of a roundel, 16mm in relief from the main body.

► **SF101.** The rear and insides of this moulding have crumbled away unevenly with the same make-up of white lime plaster and the darker off-white cream plaster as seen in SF100. The moulding to the outer face has largely survived, the roundel at the 'top' of the piece damaged slightly to one side. The 'outer' side of the face has two thin mouldings 11mm in width with an inner square lip of 14mm projected from the main body of the piece by 10mm. The underside of the moulding is very smooth, a shallow S-shape, with the survival of a thin mould to the outer side 10mm in width. It is likely that there was a similar moulding to the inner side, although the surface has not survived.

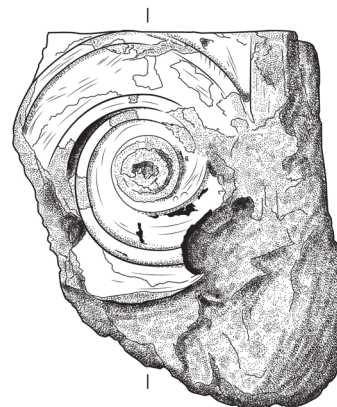
Table 1 Properties of architectural mouldings, SF100 and SF101

SF no.	Weight	Surviving length	Surviving width	Surviving height
100	1,792.82g/1.793kg	210mm	165mm	90mm
101	3,230.30g/3.23kg	270mm	215mm	100mm

101



100



Illus 83 Moulded architectural plasterwork, SF100 and SF101

9.2.3 Discussion

The shape and design of the mouldings suggest that these were most probably two console brackets supporting a pediment over a doorway; they are of a typical 19th-century design for this type of feature. The outer surface of the moulding is defined by a roundel design at the top, approximately 135mm in diameter, set in a roughly triangular raised moulding, the fine outer detailing of which can still be seen on SF101.

They would have been placed with the roundel

pattern at the top with the curve to the outside of the doorway, the rear side of the moulding attached to the wall. The underside of the brackets here are relatively plain, with only a thin bead moulding still visible on the left side of the base of SF101.

It is likely the pieces are made up of lime plaster or gypsum plaster, which gives it its distinct white colour. The fragments of paintwork on the mouldings suggest at least four paint schemes throughout their lifespan, including a light beige, dark beige, light red and (the uppermost layer) a dark brown.

9.2.4 Conclusions

The decorative moulded plaster probably formed a pair of console brackets supporting a pediment over a doorway. Their design suggests that they may have come from an office building rather than an industrial building associated with the Gasworks. However, decorative elements to industrial buildings were not uncommon in the late 18th and early 19th century and so it is possible that the fragments belong to a building associated with the industrial process or, at least, an ancillary building.

9.3. The ceramic retort

Ian West

9.3.1 Evolution of gas retorts

The very earliest retorts were made of cast iron but the high temperature in the furnace caused them to deteriorate over time, often giving an operational life of a year or less. Retorts made from fireclay (ceramic retorts) were first tried in the 1820s and found to be cheaper to make and more long-lasting (up to three years, provided they were not subject to frequent temperature cycling), but they tended to be more



Illus 84 Retort bench with eight retorts, Fakenham Gas Works



Illus 85 Drawing horizontal retorts, South Metropolitan Gasworks, c late 19th century

porous than cast iron. The early gasworks relied on the pressure created by heating the coal to force the gas through the rest of the plant and out into the pipe network, so the significant positive pressure in the retorts caused gas to leak into the furnace from ceramic retorts, which limited their adoption. By around 1850, most larger gasworks introduced steam-power pumps, known as exhausters, to suck gas through the plant, so the pressure in the retorts was no longer elevated. This allowed ceramic retorts to become almost universal, except for small private gasworks which did not use exhausters.

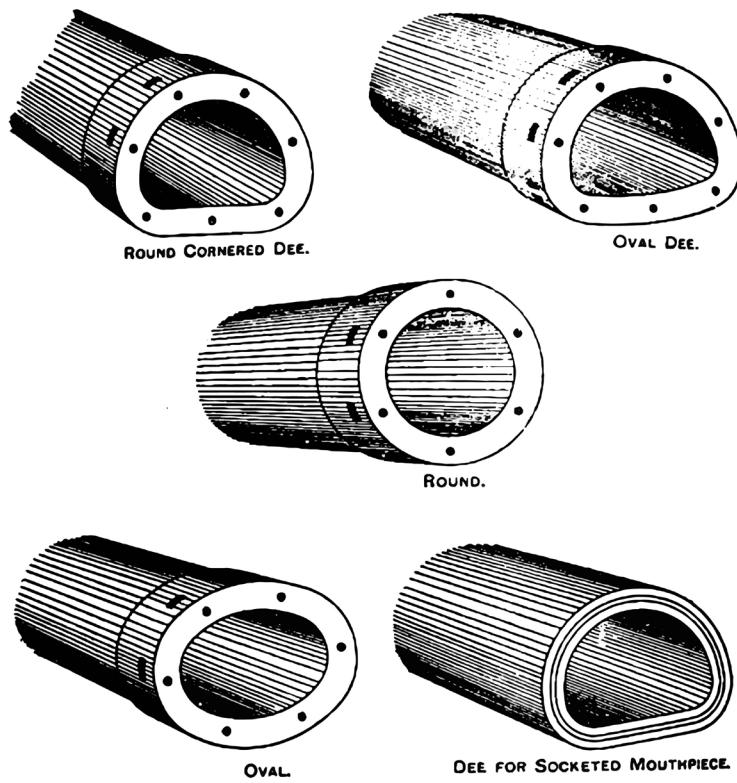
Most small and medium-sized gasworks continued to use horizontal retorts throughout their operating lives, filled ('charged') and emptied ('drawn') by hand. The retorts were usually arranged in groups of between three and nine, at varying heights within the furnace, an arrangement known as a retort bench (Illus 84).

Charging and drawing retorts by hand was an

arduous task, made unpleasant and unhealthy by the heat and fumes in the retort house (Illus 85).

9.3.2 Retort design and manufacture

The earliest cast iron retorts were about 1m in length and circular in section. However, it was discovered that elliptical or, more commonly, D-shaped retorts performed better in extracting gas from the coal and, with a few variants, these shapes remained in use for both iron and ceramic retorts until the end of the coal carbonising era (Illus 86). They were typically 1.5–3m in length and 450–600mm in internal width. Irrespective of the material used for the retorts, the retort mouths, consisting of a hinged or clamped door and a connection for the ascension pipe, were made of cast iron. These were attached to the retort by means of a bolted flange or socket and spigot joint, with the joint sealed with a mixture of fireclay and other materials. The retort mouths, being located outside the furnace, had a

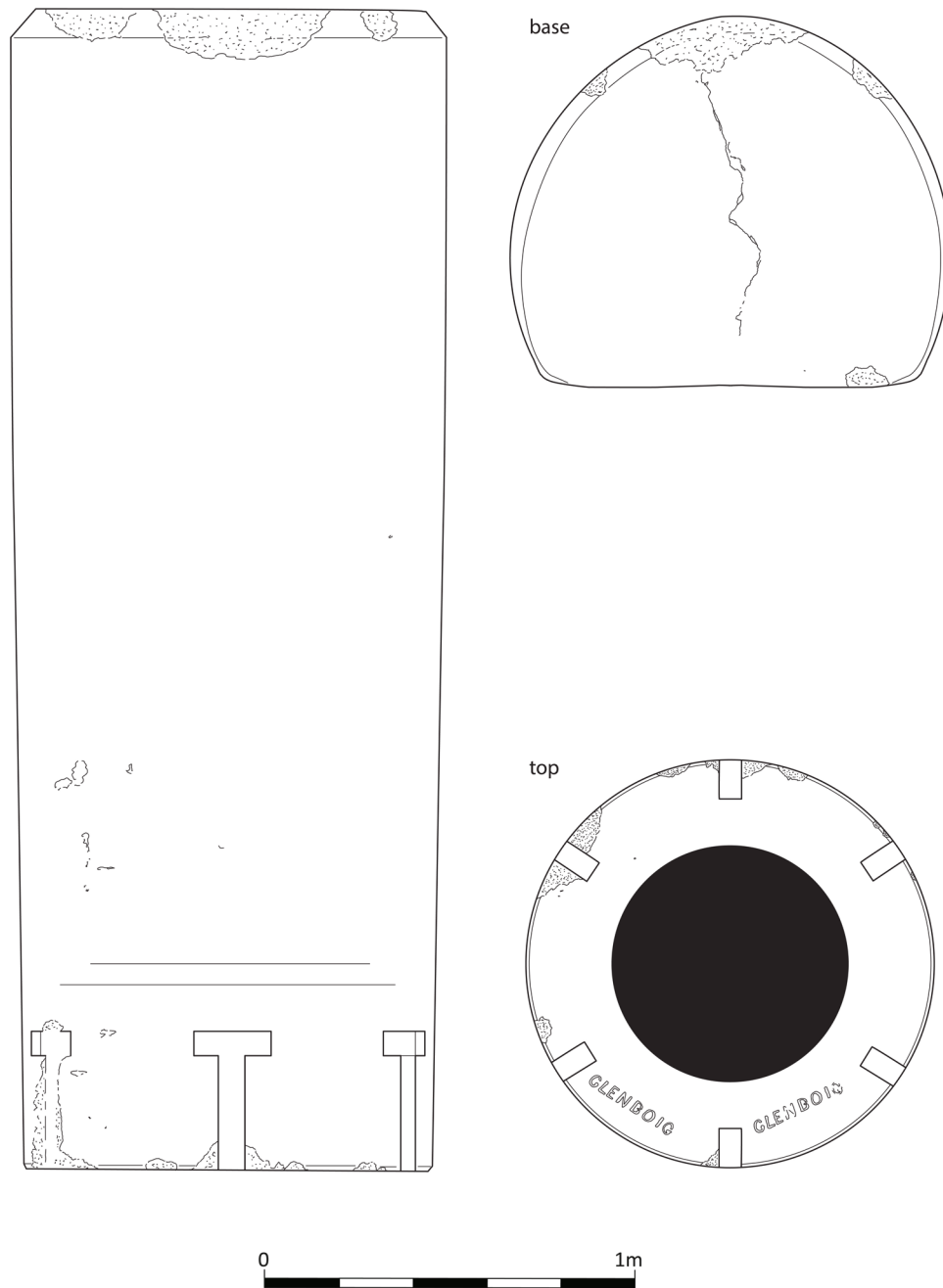


Illus 86 Examples of ceramic retorts (after Hornby 1911)



Illus 87 Ceramic retorts at the abandoned gasworks site at Shaw Lodge Mill, Halifax

Ceramic retort



Illus 88 Intact fireclay retort

much longer life than the retorts, and were reused many times.

Where bolts were used to attach the retorts to the mouths, the ends (which were inside the furnace) experienced deterioration due to the high temperatures and so usually had captive nuts or T-shaped bolt heads to ensure they did

not turn when the nuts on the other end were being undone (see 9.8.4 'Internal furnishings associated with gas production' below). When coal gasification plants were demolished, the metal components, including retort mouths, were salvaged for scrap. However, ceramic retorts could not be recycled, particularly as they would

have been contaminated with waste products. In most cases, they would have been broken up and buried. Illus 87 shows a site at Shaw Lodge Mill, Halifax in West Yorkshire where the retorts have simply been left in situ.

9.3.3 The New Street retort

The ceramic retort recovered from the New Street Gasworks is an unusually intact example (Illus 65 & 88). It is D-shaped in section, 580mm wide and 1.57m long externally, with a wall thickness of between 60 and 70mm. These are dimensions typical for horizontal retorts in use from the 1820s until the end of the coal gasification era, although its length is perhaps shorter than the average for a late-19th-century example from a large urban gasworks. The flange at the open end is circular, whereas it was more common for D-shaped retorts to have D-shaped flanges (as shown in Illus 86). It has six T-shaped slots cast into the open end, suggesting that bolts with T-shaped heads were used to attach the retort mouth.

The retort bears the name of the manufacturer, Glenboig (Illus 89). The Glenboig Union Fireclay Company, based in the village of that name east of Glasgow, was a major manufacturer of refractory products from the 1830s. An 1886 press advertisement describes them as manufacturers of ‘Gas retorts of unequalled quality, of every shape and size, with the best settings’ (Scottish Brick History website: Glenboig). The flange is imprinted with the figure ‘5’ which may relate to a size or pattern number.

A brochure commemorating the expansion of Granton Gasworks in 1926 records that mechanical stokers were installed at New Street in 1896 (Edinburgh Corporation 1926). The introduction of this equipment would have necessitated significant alteration to the retort house, including almost certainly the replacement of the retort mouths with ones designed for use with mechanical stokers. It is likely that the excavated retort was part of this final phase of the development and originally installed between 1896 and the Gasworks’ closure.



Illus 89 Flange of retort stamped ‘GLENBOIG’

9.4 The bricks and tiles

George R Haggarty

9.4.1 The bricks

A representative sample of bricks and tiles from the New Street Gasworks was collected for further study. Eighteen of the marked examples are impressed either 'GLENBOIG', 'HURLL' or 'HURLL GLASGOW'. The history of these intertwined brickworks is complex and not easy to untangle. James Dunnachie moved to Glenboig and soon became manager of an existing small fireclay company. In 1865 he formed the Glenboig Fire-clay Company with John Hurlll and John Young, themselves pioneer firebrick manufacturers, and when the partnership folded in 1872, Dunnachie built the Star-Works immediately adjacent and in competition with them. Glenboig specialised in the production of refractory ceramic goods, including furnace lining, bricks, etc, for the iron and steel industry. Subsequent expansion meant the company acquired and went on to operate several other works, including the Cumbernauld Fireclay Works & Mine (*c* 1882), Gartcosh Works (1890), Castlecary Fireclay Co Ltd (*c* 1919), Faskine & Palacerigg Bricks & Coal Ltd (*c* 1919), George Turnbull & Co Ltd, and the Bonnymuir and Dykehead Works (*c* 1919). The Glenboig Union Fireclay Co Ltd was purchased by General Refractories Ltd of Sheffield in 1936. The 'Old Works' in Glenboig closed in 1958 and were demolished by 1965.

The partnership of P & M Hurlll was established in 1887 working a mine and brickworks in Drumchapel, Glasgow during the late 19th century. They also produced firebricks and chimney pots in a pale creamy buff colour, using clay from the Glenboig seam in Lanarkshire. This was mined heavily and continuously until it was worked out, sometime in the 1970s. Over time there were around 50 other firms producing chimney cans, with the last survivor being P & M Hurlll. In 1908 Mark Hurlll also leased the Birkhill clay mine with its high-quality fireclay deposits from Hamilton Estates. Situated at Manual Junction near Bo'ness, this clay had been exploited since the 18th century. Hurlll is known to have used different types of clay, with the locally mined Glenboig material being used for his regular firebricks. The famous Klinit clay, which was high

in alumina and which came from his Birkhill mine, was sold for use in industries requiring extra-high temperatures. Hurlll's Dourie bricks were made using a mixture of poorer-quality Ayrshire clay and local fireclay to provide a cheaper, poorer-quality product for less demanding applications. They also made 'Feather' bricks, which were exceptionally light for their size. It is thought that sawdust was mixed with the clay and burned out during the firing process. P & M Hurlll's two Glenboig works, 'Garliston' and 'Garnqueen', sat either side of the Glasgow to Perth railway and, with the rest of the business, went into liquidation in July 1980.

A single brick marked 'ATLAS' and five marked 'ETNA' also derive from complicated interrelated brickworks. In 1797 an area of land called Harestanes, part of the Hopetoun Estate, was sold to a William Davidson who changed its name to Bathville, and coalmining began there. Later, a John Watson of Glasgow bought the Bathville site for about £10,500 and constructed brickworks using fireclay which was being mined along with the coal. Although Watson's company became one of Lanarkshire's largest coalmasters, financial problems in 1874 forced it to sell the Bathville brickworks to James Wood from Paisley. Watson's brickworks then reopened as Robertson & Love's Pipeworks. Robertson, Love and Co were in operation at Bathville as brick and tile makers from at least 1882 (Scottish Brick History website: Bathville). In 1893–4, James and William Wood formed James Wood Ltd, to take over the coal interests together with the Etna and Atlas Brickworks (Bathville Brickworks). In 1895 they also had financial problems, which caused their estates to be sequestered. However, with new capital, they joined with Daniel Robertson, a firebrick manufacturer at Bathgate, to incorporate a new Scottish joint stock company, Robertson, Love and Co Ltd. By 1898 Robertson & Love's Pipe Works had been joined by Bathville. In 1916 Robertson, Love and Co Ltd was liquidated, but its firebricks manufacture continued under the United Collieries Ltd banner.

Four firebricks were recovered stamped 'BANKPARK'. These were produced at John Grieve Bank Park Firebrick works, which lay just north of Tranent and which was in production from the 1860s until the 1890s. Towards the end of this period, the name seen on bricks changed from John Grieve to J & C Grieve.

There are a few single marked bricks, including one stepped corbel-shaped example marked 'PERCETON KILMARNOCK', produced by J & M Craig at their Hillhead and Perceton Fire Clay Works and Longpark Pottery, Kilmarnock. The Craigs were manufacturers of fire and enamelled bricks, sewerage pipes and all kinds of sanitary and plumbers' earthenware. Another brick is marked 'ARNISTON 1868', which was produced by the Arniston Coal, Lime & Brick Works in Gorebridge, Midlothian. First noted in 1867 as John Christie, Arniston and Vogrie Works, Gorebridge, two years later, in 1869, a Robert Clark was managing it. The Arniston Coal Co, Edinburgh was registered in 1874.

A single brick marked 'Scottish Terracotta Co' was produced by the short-lived (1895–1903) Lee Terracotta and Scottish Terracotta & Metallic Brick and Tile Works, Braidwood, Carluke, South Lanarkshire. Mark Hurll transported raw materials from Carluke and the Lee works were erected by John Ferguson and John Agnew, who also operated the Omoa Fireclay Co. A single brick marked 'MUIR' was produced by the Barbauchlaw Brickworks, Armadale, West Lothian, which was in operation from *c* 1893 to 1971 and was originally owned by Robert Muir and Company. A single brick impressed 'WHITEHILL' was produced at the Whitehill brickworks in Lasswade. It was founded in 1869 by Archibald Hood. It was taken over by The Lothian Coal Company, whose directors included Archibald Hood, Colliery Owner, Managing Director and President of the Mining Association of Great Britain.

9.4.2 The tile

One of two white glazed tiles is marked 'Robert Brown & Son Paisley', which was made at the Robert Brown & Son, Ferguslie Fireclay Works. Acquiring the property of Ferguslie in 1850, Robert Brown founded the Ferguslie Fireclay Works and this originally produced fireclay linings for furnaces, garden ornaments and statuary for gardens. By 1876 the business had expanded into the manufacture of white sanitary earthenware, wall tiles and bricks. Brown's Brickworks remained a significant manufacturer and employer until the mid-1970s.

9.5 The ceramics

George R Haggarty

9.5.1 Introduction

The ceramic assemblage from the New Street Gasworks represents very mixed examples of pottery types spanning the late 12th to the early 20th century. Small quantities of residual medieval and post-medieval fabric attest to the former affluence of the area, particularly during the 17th and 18th centuries, from which sherds of Chinese porcelain, German stoneware, Dutch tin-glazed tiles and Italian vessels are recognised. The bulk of the assemblage comprises locally produced 19th- and early-20th-century stoneware bottles, as well as examples of encaustic tiles, produced in factories across Britain, that provide a glimpse of the former appearance of the more public areas of the Gasworks.

9.5.2 Medieval and post-medieval ceramics

The excavation produced a few, mostly abraded, late 12th/13th-century medieval body sherds, the majority of which derive from contexts (P0004) and (P0005) (Illus 90). As well as Scottish White Gritty Ware, the fabric of some of these sherds is consistent with examples imported from Yorkshire. Work carried out on other Scottish burghs suggests that Yorkshire was the source of much high medieval pottery imported into the larger Scottish east coast burghs during the late 12th and 13th centuries. Apart from a few unstratified sherds of 15th- or 16th-century date (SF18), including a thick jug sherd (SF12, Test Pit 1/A (north)) and four probable 16th-century sherds (SF41) from Context (K0316) (Illus 91), there appears to be a late-medieval hiatus until the 17th century, when sherds of the typical Scottish Post-Medieval Oxidised Ware (SPMOW) and Scottish Post-Medieval Reduced Ware (SPMRW) industries become common (eg SF41, (K0316); SF10, Test Pit 7/C; SF11, Test Pit 6/A; SF15, Test Pit 6/B (north); Illus 92). These wares have a wide distribution and date range, and examples recovered in the Edinburgh area and their sources have been discussed and summarised at length (Haggarty et al 2011; Haggarty & Hughes 2013; Haggarty & Lawson 2013b). There are a few abraded 18th-century sherds, generally in 19th-century contexts, except possibly (C0289) and (J0121).



Illus 90 Late 12th/13th-century medieval body sherds, (P0004) and (P0005)



Illus 91 Probable 16th-century sherds, SF41, (K0316)

9.5.3 Imports

Identifiable imports are rare but include a Ch'ien Lung (c 1760–70) Chinese Export teapot cover from Area H, Layer 008, which retains part of a flower knob and traces of red and black painting (Illus 92 & 93). Sherds of Chinese porcelain occur frequently in Scottish 18th- and 19th-century archaeological contexts. By the second quarter of the 18th century, Chinese exported porcelain was pouring into Europe in increasing quantities and prices were falling, making it available to the middle classes with the continued expansion of tea drinking. Tea had been introduced into Britain in the second half of the 17th century and rapidly became extremely popular. By 1687 the East India Company could place an order for 20,000 pounds of tea and by 1750 it was shipping over 2.5 million pounds of the product, reaching 20 million pounds by 1800. A logical extension of this trade was the importation of ceramic vessels for tea drinking. By the 1720s, in excess of 2 million pieces of porcelain were being imported into England each year.

A hammer-head rim sherd from a north German Wesser dish or bowl (SF7, Test Pit 5/B (north)) was also among the assemblage (Illus 94). Its upper surface has been covered in a white slip under the usual decoration of trailed bands of brown slip below a lead glaze. Highly decorated examples of this type of dish/bowl generally date from 1580 to 1630 in places such as Amsterdam and almost certainly were imported into Edinburgh through the port of Leith.

Four German stoneware sherds (not illustrated) with a thick, dark salt-glazed tiger-skin glaze, three of which (SF3, SF5 and SF11 from Test Pits 4/A, 5/A and 6/A) may be from the same small 17th-century Frechen bottle, were discovered within the test pits in the northern Gasworks site. One of these sherds, (SF11), derives from a moulded Westerwald-type biconic jug decorated with light and dark cobalt-blue bands (Illus 95). Cobalt decoration was introduced at Raeren by the potter Jan Eames in 1582, and from about 1590 some of the Raeren potters moved to Westerwald, where they produced similar wares that are difficult to tell apart and are therefore referred to as Westerwald type.

A tin-glazed plate sherd decorated with a brown painted Chinese porcelain-inspired rim (SF3) came from Test Pit 5/A (Illus 92 & 96). It has been

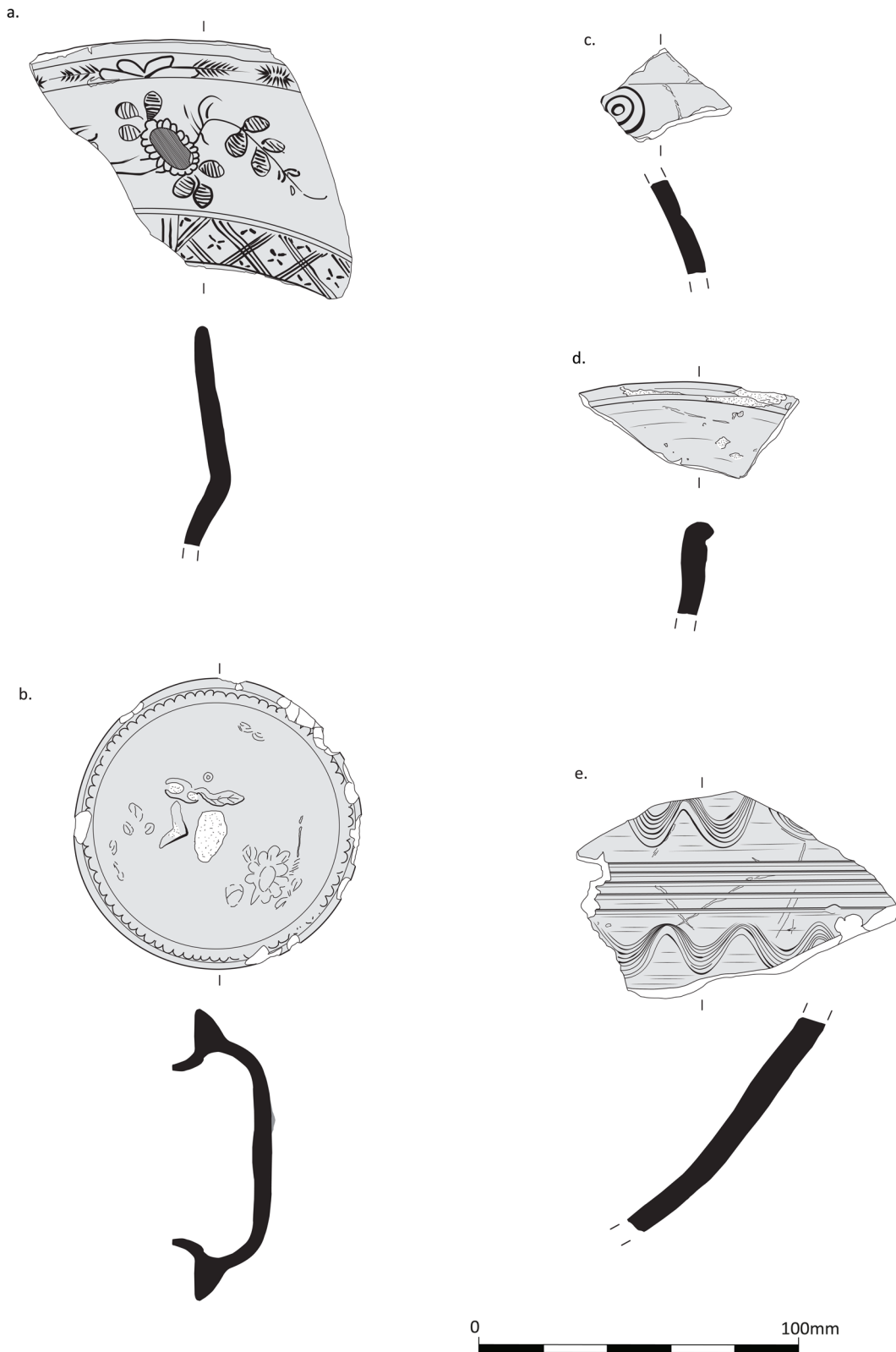
decorated with blue hatched flowers and leaves. The fabric is suggestive of production at a Glasgow Delftfield pottery. Similar tin-glazed fabrics were produced during experiments by James Watt in the third quarter of the 18th century (Haggarty & Grey 2013).

Italian wares are also represented from the northern area of excavation. These include a small redware flake from a 17th-century Italian marbled vessel (SF6 from Test Pit 2/A; not illustrated). This form of pottery has been noted among assemblages across Scotland and represents the fourth example from the Canongate (Haggarty & Hall forthcoming).

9.5.4 Later industrial-produced ceramics

The majority of the assemblage from the New Street Gasworks dates from the 19th century and is made up of common types of wares, including a few of the typical Prestonpans Rockingham glazed teapots (eg Bamboo and 'Duchess' styles), locally produced Portobello stonewares (Illus 97), and whitewares produced at a range of Victorian Scottish potteries. Very few of these late sherds are of significance, except for two transfer-printed plate sherds (SF93.2 and SF93.3) from Context (N0105); one has on its upper surface 'The British Public House Company Limited' (Illus 98) and verso a blue backstamp 'Genuine Ironstone China E. F. Bodley & Son Longport'. Edward F Bodley and Sons of the New Bridge pottery in Longton, Staffordshire were in production between 1883 and 1898. The second sherd of note has a transfer-printed vignette containing the letters [- - - DONIAN HOTEL / - - INBURGH]. This plate was almost certainly produced for the Caledonian Hotel which opened in 1903 and operates still at the west end of Princes Street, Edinburgh.

From Context (K1000), there is a moulded bisque porcelain figure of a (Russian?) boy (SF14), with a brown fur hat, green baggy trousers, yellow scarf and brown clogs (Illus 99). This figure almost certainly derives from one of many secondary 19th-century German ceramic factories and is likely to be associated with a moulded flower sherd (SF80.1) from Context (N0085). This sherd has on its verso printed '2264 GERM—', almost certainly a pattern number and part of GERMANY, which suggests a late Victorian date just prior to 1890. Due to the



Illus 92 Various medieval and post-medieval ceramics: (a) tin-glazed earthenware, TP5/A; (b) imported Ch'ien Lung teapot cover, Layer 008, Area H; (c) decorated SPMRW sherd, SF10, TP7/C; (d) SPMOW platter rim, SF11, TP6/A; (e) decorated SPMRW sherd, SF15, TP6/B



Illus 93 Imported Ch'ien Lung teapot cover, Layer 008, Area H



Illus 94 Hammer-head rim sherd from Wesser dish or bowl, SF7, TP5/B (north)



Illus 95 German stoneware sherd from a moulded Westerwald-type biconic jug, SF11, TP6/A



Illus 96 Tin-glazed earthenware sherd with a painted Chinese porcelain-inspired rim, SF3, TP5/A



Illus 97 Selection of intact stoneware bottles from New Street Gasworks



Illus 98 Transfer-printed plate base sherd, SF93.2 (N0105)



Illus 99 Bisque porcelain figure of a boy, SF14 (K1000); H: 103.5mm

introduction of the McKinley Tariff Act in that year, subsequently it would almost certainly have been printed MADE IN GERMANY. From the same production area and of similar date, but far better decorated, are three sherds from a small porcelain coffee can (Context P0003; TP2) with a green background and a band of painted polychrome flowers with traces of gilding (Illus 100); the verso surface has a simple pattern and [252] black backstamp.

A 17th-century German Frechen stoneware body sherd (SF102.1) from a small bottle covered in a thick iron wash under a salt glaze, along with traces of a typical moulded beard, came from unstratified soils. Also of 17th-century date are three small sooted redware body sherds from Context (P0003) which are likely to be Low Countries imports.

9.5.5 Encaustic tiles

Encaustic was the term adopted in the 19th century to describe medieval floor tiles, usually produced in red or brown clay, whose decoration was indented with lighter coloured clay, a term now used to describe all inlaid tiles. Herbert Minton is thought to have turned his attention to the production of



Illus 100 Small porcelain coffee can, (P0003); H: 65.4mm



Illus 101 Fragment of a Minton encaustic tile, SF6 (B0001)

encaustic tiles in 1828 but it was a Samuel Wright, a zaffer (raw cobalt ore) merchant of Shelton in Staffordshire, who took out a patent in 1830 (Beulah 1990). In 1836 Minton agreed to pay Wright a 10% royalty and at some stage he began

to use brass moulds instead of the plaster examples used by Wright. This gave Minton's tiles sharper edges and, after experimentation with various clays, by 1835–40 he had started to fulfil orders.

There are a few interesting tile sherds, including



Illus 102 Conjoining sherds of a Craven Dunnill & Co Ltd encaustic tile, SF6 (B0001)



Illus 103 Fragment of a moulded Craven Dunnill & Co Ltd fireplace tile, SF32 (unstratified)

one of note from Context (B0001), which consists of approximately half of an encaustic tile (SF6) pierced on the verso surface with round holes in three lines of five, along with 'PATENT / STOKE UPON TRENT' impressed in large letters (Illus 101). This

is a part of a stamp that would have read 'MINTON & Co / PATENT / STOKE UPON TRENT'.

Also from Context (B0001) are two conjoining sherds (SF6) from a Craven Dunnill & Co Ltd encaustic tan-red-tan coloured sandwich tile (Illus



Illus 104 Fragment of a late-19th-century Dutch tin-glazed earthenware tile, SF24 (K0000)

102). These were produced by pressing a thin layer of good-quality clay into the mould, adding a thicker layer of poorer-quality clay and finally another layer of good clay. This forms a laminated structure which helped prevent warping and added to the tile's strength. It is impressed verso '--- LL / TILE Co / PATENT /--- UPON TRENT'. The encaustic decoration, which is made up of black, white and tan, was produced at the Ironbridge, Jackfield works between 1880 and *c* 1910. Unstratified SF32 is a fragment from a thick moulded green-glazed fireplace tile with '- PATENT C D -' verso (Illus 103). This was also produced by Craven Dunnill & Co Ltd.

The earliest tile fragment from the site is SF24 (K0000), a corner fragment from a 7mm thick, late-19th-century Dutch tin-glazed earthenware wall tile, which copies a Low Countries 17th-century example (Illus 104). The tile has been printed in blue with secondary red and green painting and has a fleur-de-lis in its corner and part of an open pomegranate.

9.6 The clay tobacco pipes

Dennis Gallagher

9.6.1 Introduction

The pipes from New Waverley range from the early 17th century to the early 18th century, the first

century of the tobacco-smoking habit in Scotland. The habit of pipe smoking declined in Scotland in the early 18th century as snuff became the favoured means of consuming tobacco. Pipes became popular again in the early 19th century. There are no 19th-century pipes in the present assemblage despite the nearby presence of the major pipe factory of Thomas White in Jack's Close.

9.6.2 17th-century pipes

Early 17th-century bowls

William Banks (Illus 105)

The earliest pipe in the assemblage is a small bowl (C1) datable to *c* 1610–20. It has the castle basal stamp which identifies it as an Edinburgh product and is a product of William Banks, who is recorded as a pipemaker in Edinburgh in 1622 where he held a monopoly (Gallagher 1987a: 5–8). It is the earliest pipe that has been clearly identified as a Scottish product and as such is the earliest known Scottish tobacco pipe to be found in Scotland (two comparable Edinburgh products were recovered from excavations in Carrickfergus, Ireland: Davey & Norton 2013: 142). The pipe is made from a reduced grey fabric with dark gritty inclusions. There are also unmarked bowls from the period 1610–40 (A1–A7). Some may be early bowls of William Banks but



Illus 105 Clay tobacco pipes of William Banks, c 17th century (© Dennis Gallagher)

the lack of marks makes assignation to a particular maker difficult. The pipes are biconical forms similar to those excavated from a pre-1637 context at the Tron Kirk, Edinburgh (Gallagher 1987b; Haggarty & Lawson 2013a).

The assemblage contains a large number of later products of William Banks (A8–A30). The Banks pipes vary considerably in quality. Most pipes had mould-applied initials on the side of the base, as was usual on Scottish products in the 17th century. Many had a basal stamp based on the arms of the city, an indication of the maker's recognised position within the burgh. However, the highest-quality pipes were hand-burnished to give the clay a high polish (eg A8 and A9). Some of the pipes show evidence of the mould-imparted letters of the maker's marks on the side of the bowl having been recut, a sign of long use (A12, A30 and possibly A25).

Thomas Banks (Illus 106)

Thomas Banks was a son of William Banks. The small narrow-necked bowls marked TB (A31–A34)

are datable typologically to c 1660–80 and may be assigned to the period after his father's death, when he emerges as an independent maker.

William Young (Illus 106)

Young is first recorded as a pipemaker in 1653 in the Pleasance, Edinburgh, and he died in 1670. His pipes (A35–A40) are of a distinctly bulbous form. He used a basal stamp that is a detailed variant on the triple-towered arms of the burgh of Edinburgh. The examples in the present assemblage show signs of wear of the die, but A37 (US/56) still exhibits the fine detail of the masonry.

Patrick Crawford (Illus 107)

Pipes marked PC (A41–A55) are identified as the work of Patrick Crawford, recorded as a maker in Edinburgh 1671–96. He supplied pipes for the ill-fated expedition of the Scottish colony at Darien. Some of the bowls are generally dated typologically to c 1660–80 and are possibly early examples of his work. However, examples from Darien, found



Illus 106 Clay tobacco pipes of Thomas Banks and William Young, c 17th century (© Dennis Gallagher)

together with much larger bowls, demonstrate the possible longevity of such forms. Crawford pipes have a variety of basal stamp styles. These range from a castle with flanking letters, influenced by the marks of the Edinburgh hammermen (A48 and A53), to a simple three-letter form (A54).

Other Edinburgh pipes

While the above makers are well documented, others are less so and there is less certainty about identifying their products and assigning date ranges. The large bowls marked RS (A56) are much less frequent than those of Crawford, indicating a much



Illus 107 Clay tobacco pipes of Patrick Crawford, late 17th century (© Dennis Gallagher)

smaller scale of manufacture. There is a comparable large bowl with a fairly upright form, of late-17th/early 18th-century date, from Edinburgh Castle (Gallagher 1997: 179, no. A50) and more forward-leaning forms from Edinburgh Canongate backlands (Gallagher 2013: 25–6). The bowl (A57) marked A/M (or possibly AW) is an uncommon find. Davey (1997: 96–7) has suggested that a similar pipe from St Andrews was a product of William Arthur of Edinburgh. A further example was recovered from the Holyrood Parliament site (Gallagher 2010: 55 and 56, fig 1.33). The bowl marked A/A (A59) is an upright form similar to A56. The maker of the A/A bowl (A59), with crudely formed initials on the base, is tentatively identified as Alexander Aiken. Pipemakers named Aiken have been recorded both in Glasgow and Edinburgh but the present pipe may be a product of Alexander Aiken who was married in Edinburgh in 1680 (Paton 1902: 11).

Dutch-style pipes (Illus 108)

Dutch imports of pipes were common in Scotland during the first half of the 17th century; however, the interruption of trade during the wars with the Dutch Republic, particularly that of 1665–7, together with the imposition of an import duty on pipes in 1661, limited the number of Dutch pipes entering southern Scotland (*RPS* 1661/1/122). Most of the Dutch imports were of low quality, for example A76, a bowl with a moulded rose decoration, the moulded decoration not incurring an extra production cost. Variants of this design are found throughout Scotland. Davey (1992: 280–1),

in his survey of Dutch imports, identified over 50 examples of this design, and examples continue to be found in Scottish assemblages, for example Holyrood, Edinburgh (Gallagher 2010: 57 and fig 139, no. 107) and Stirling Castle (Gallagher 2015: 239, fig 14.24, nos 7–13). A more unusual pipe of Dutch origin is a stem fragment of a Jonah pipe (A79). The complete pipe would be in the form of Jonah being swallowed by the monster, the scales on the present fragment being part of the latter's body (Duco 1987: 92). There is a similar fragment from Scalloway Castle, Shetland (Davey 1992: 281). One stem fragment is decorated with two fleur-de-lis stamps (A77), a style of decoration commonly found among Dutch imports into Scotland, but in this case it is indicative of a higher quality of pipe, as extra work was required during production to apply the stamps.

English-style pipes (Illus 109)

The present assemblage included 11 spurred bowls of a mid-17th-century date (A82–A92), a form not associated with Edinburgh pipemakers. None are marked, so there is no direct indication of place of manufacture. The form is generally associated with English pipes, possibly Tyneside (cf Edwards 1988: 9, Type 5 dated to *c* 1645–60). They vary in the degree of finish, some with a high burnish being a better quality of pipe (A88). While it is possible that an Edinburgh maker produced an atypical form, pipes of high quality normally would carry a basal mark based on the city's arms, the sign of an accredited manufacturer. They occur in small



Illus 108 Dutch-style clay tobacco pipes (© Dennis Gallagher)



No A82



No A83



No A84



No A85



No A86



No A88



No A89



No A90



No A91



No A92



Illus 109 Spurred clay tobacco pipes (© Dennis Gallagher)



No C5



No C17



No C13



No C19



No C21



No C20



No C6

Illus 110 Clay tobacco pipes of 19th-century date (© Dennis Gallagher)

numbers in some Scottish assemblages and are likely to be imports rather than Scottish products. Some were found in Edinburgh on the site of the Scottish Parliament (Gallagher 2010: 55 and 58, fig 1.40).

The pipes date from the period 1640–60 and may be associated with the Cromwellian occupation of Edinburgh when Cromwell’s army was quartered in the Canongate from September 1650 until 1660. The port of Leith acted as a supply base for the English

army and provisions were shipped from Newcastle and King’s Lynn. An insight into the mechanisms of this supply chain was provided by the finding of Tyneside pipes from the excavation of an English warship known to be carrying supplies from Leith that was wrecked off Duart Castle, Mull, in 1653 (Martin 2017: 206). Another group of English-style pipes was found at Dunstaffnage Castle, also occupied by an English garrison during that period



Illus 111 Clay tobacco pipes of 19th-century date (© Dennis Gallagher)

(Gallagher 1996). These English-style pipes, whether made by Scottish makers or imported, may be taken as evidence of that occupation. The smoking habits of the English soldiers is well attested in the Scottish propaganda writings relating to the invasion, for example, at Castleton, Roxburgh, where it was said that they burned the church communion table and ‘lighted their tobacco pipes’ with the books of Session (Burn 1829: 177).

A stem fragment (B4) has the roller stamp of John Thompson of Gateshead, who is recorded as a pipemaker *c* 1663–90 (Edwards 1988: 56, fig 11, no. 6). Stems stamped with Tyneside marks are occasionally found in Edinburgh, eg Advocate’s Close (Gallagher 2017: 44–6).

9.6.3 19th-century pipes (Illus 110 & 111)

Pipes of 19th-century date were found only in the north of the excavated area and the most prominent maker in that assemblage was Thomas White, the principal pipe manufacturer in 19th-century Edinburgh. A pipe factory was established in Big Jack’s Close off the Canongate in 1810 by David Sinclair and it was purchased by White in 1815. This factory was situated to the south of the present site, outside the excavated area. White died in 1847 but the business continued under his name, as Thomas White & Co. It moved from the Big Jack’s Close premises *c* 1867 (Gallagher 1987c). White was renowned for the high quality of his products and he developed an extensive export trade, in particular to North America and Australasia. Many of his pipes carried his distinctive TW mark on the bowl as well as his name on the stem. Such was the reputation of this maker that his TW mark on a spurred bowl was later imitated by most Scottish pipemakers, although often in a thicker-walled fabric (Gallagher 1989). This creates problems for identification when only the bowl is present. Only six stem fragments were identifiable as Thomas White’s products (C25–C29) but 15 bowls had TW in an oval facing the smoker. It is probable that many, if not all, of the latter are also White’s products.

Other bowls are similar to the TW mark but with TD in an oval facing the smoker (C21–C23). These include a complete spurred pipe where the mark is badly impressed but the letters on the mould appear to have been changed from TW to TD (C21). The

TD pipe was a form popular in the North American market and is thought to have been the mark of Thomas Dormer of London (1748–70). Like the TW mark, it was subsequently widely copied by other makers (Walker 1983: 36–8). The production of TD pipes is indicative of the firm producing pipes aimed at the export market.

The other pipes whose makers can be identified are from much smaller workshops which sold only to the local market, some having learnt their trade from Thomas White. Four stem fragments are marked MACKENZIE/MCKENZIE (C30–C33), one of which has the partnership of Mackenzie & Begg. John Mackenzie had workshops at various locations in Edinburgh from 1862 to 1895. Various members of the Begg family had pipe workshops in Leith during the period 1867–89. This partnership with Begg has hitherto been unrecorded. Two of the pipes (C30–C31) are varieties of the cutty, a thick-walled short pipe popular in the second half of the 19th century. The Rifle Cutty (C31) reflects the popularity of the Rifle Volunteer movement, begun in 1859 as a government response after the Crimean War to the small number of trained soldiers in Britain compared to other European nations (Beckett 1982: 91).

Two stem fragments marked R.HALL (C35–C36) can be identified as products of Ralph Hall, a pipemaker at 1 West Norton Place, Edinburgh from 1868 to 1870. The stem fragment marked P.WILSON (C34) is a product of Peter Wilson; the workshop operating under that name was active in Leith from 1847 to 1902. Although Glasgow was the largest centre of pipemaking in Scotland in the second half of the 19th century, no Glasgow pipes were found, indicative that Edinburgh residents favoured local makers.

9.7 The copper alloy objects

Andrew Morrison

9.7.1 Overview

A small assemblage of copper alloy (283.0g) was recovered from the excavations and comprised 15 artefacts, which included: two coins, a finger ring, a servant’s bell pull crank fitting, a button, a nail, a lamp fitting, a buckle, a length of pipe, and segments of copper wire. The objects were mostly

corroded, necessitating the use of X-radiography to aid analysis. The coins were a 1913 penny of George V (SF38), and a likely Queen Victoria halfpenny dating between 1860 and 1875 (Area FA3, Layer B). The button, a simple four-holed copper alloy piece with concave centre and flat brim, is inscribed 'Marshall & Aitken Edinburgh' (N0105). Marshall & Aitken were woollen drapers, tailors, clothiers and military outfitters who operated out of the High Street and North Bridge area of Edinburgh and were in business between 1828 and the early decades of the 20th century (Scottish Post Office Directories – Towns, Edinburgh: 1828: 119; 1871–2: 140; 1901–02: 239).

An unstratified Victorian finger ring came from Area N, with a simple copper alloy shank, split on each end to form a forked shoulder, which supports a linear claw-set three-stone cluster, with one remaining moulded emerald green glass 'stone' (Illus 121). This ring, alongside the Marshall & Aitken button, provides insight into the dress accessories and clothing worn by male and female employees of the Gasworks.

A copper alloy or brass bell pull crank fitting (SF83) is part of a servant's bell, or door bell system: a wire leading from a bell pull is attached to a crank, which pivots on a central spindle that is anchored to

a wall or ceiling; as the crank turns, a wire attached to its other end actuates a bell. Servant's bell systems first came into use in British stately homes around the 1730s, and by the 1750s had become common in metropolitan areas. In the early decades of the 19th century, house bell technology was adopted by the middle classes, and by the 1870s was familiar to most homes (Madill 2013: 15–17). Electricity rendered the bell pull system obsolete by the 1890s (ibid: 27). It is possible that the bell pull relates to the office area of the post-1820s Gasworks.

A small oil lamp fitting was retrieved from Area FA2 (Illus 112 & 121). This fitting has a threaded base to screw into a globular oil reserve, a thumbwheel for controlling flame size, and a nozzle from which the flame was emitted. It is likely that a glass cover would have sat within the body's undulating, snake-like decorative edge, protecting and diffusing the light of the flame.

A buckle with attached canvas fabric was recovered from Area FA1. The form of the buckle, combined with the sprung pin and a secondary arching pin designed to lock a strap in place, suggests that the buckle was designed to cope with a fabric and strap that was under high tension.



Illus 112 Brass oil lamp fitting, Area FA2, Layer B

9.7.2 Catalogue of illustrated items

► **Finger ring.** Three-stone cluster, claw-set within a flat sexafoil mount. Plain copper alloy shank with centrally split shoulders. One of the edge settings contained a small, moulded emerald green glass 'stone', now dislodged; other two stones missing. Ring is complete but distorted. Ring: H: 21.6mm, W: 20mm, Th: 5.8mm; Stone: H: 3.9mm, Diam: 5.5mm, Area N, Unstratified. Illus 121.

► **Oil lamp fitting.** Flat, circular externally threaded base (Diam: 27.6mm, Thread pitch: 2mm, Thread depth: 6mm). Central, elongated slot in base for insertion of fabric wick, regulated by thumbwheel (Diam: 15.4mm) with a ridged edge, set on a thin circular-sectioned stalk. Stalk/thumbwheel projects from the light fitting's perforated body. Body/collar is covered with perforations, set in vertical rows of four holes each. Body fans out towards top, terminating in a decorative edge (H: 18.7mm). H: 47.8mm, W: 68.9mm, Th: 18.4mm. Area FA2, Layer B. Illus 112 & 121.

9.8 The iron objects

Andrew Morrison & Dawn McLaren

9.8.1 Introduction

The varied iron assemblage from the New Street Gasworks comprises 215 iron objects (57.6kg), dominated by fractured and heavily corroded structural fixtures and fittings, machine components, equipment and architectural elements relating to the industrial activity at the Gasworks complex. The most significant aspects of the assemblage are those that can be associated directly with the gas production processes and associated activities and include hand-forged tools used to feed and clear the retorts and furnaces, retort inspection boxes and decorative wrought ironwork which probably derives from the public areas of the Gasworks.

The condition of most of the iron objects is poor; many are damaged and incomplete, often displaying severe corrosion of the surfaces. After the closure of the Gasworks, the site was dismantled and levelled to make way for a new bus depot and all of the below-ground, brick-built rooms, furnaces and other features were filled in with demolition rubble, which inevitably contained various iron fittings, fixtures

and tools left behind after the abandonment of the complex. Many of these objects have seen further breakage and damage as the result of the levelling process.

Large quantities of the artefacts were retrieved from the later levelling deposits, meaning that it has not been possible, in most instances, to identify individual objects with particular buildings or phases of the Gasworks' use. The following report presents a summary of the assemblage, drawing attention to those components of the assemblage that can be directly related to the processes undertaken at the Gasworks, to the equipment and internal fittings of the buildings and to the people that worked at the site. The objects will be discussed by functional groups and individual catalogue entries will be presented for illustrated items only. More commonplace and generic components of the assemblage will not be discussed in detail. A full catalogue of all the ironwork is presented in the site archive alongside a detailed methodology.

9.8.2 Classifications

The iron assemblage has been separated into the following groupings: architectural ironwork; internal furnishings associated with gas production; gas production equipment; other equipment and tools; fittings; miscellaneous and unidentified.

9.8.3 Architectural ironwork

A very limited quantity of objects (Q=5) among the assemblage are recognised as architectural ironwork: a galvanised steel chimney stack (Illus 113); a cast iron roof finial (Illus 114); a galvanised steel capping brace for a pitched roof; a wrought iron decorative panel (Illus 115), perhaps from an exterior fence or stairwell balustrade (SF23); and a section of cast frame from a lattice window still retaining some of the glass panes (SF16). The paucity of exterior and interior architectural elements that survive strongly suggests that the buildings were stripped out and any potentially salvageable metalwork (eg fencing, roof vent covers and steel girders) were removed for reuse elsewhere.

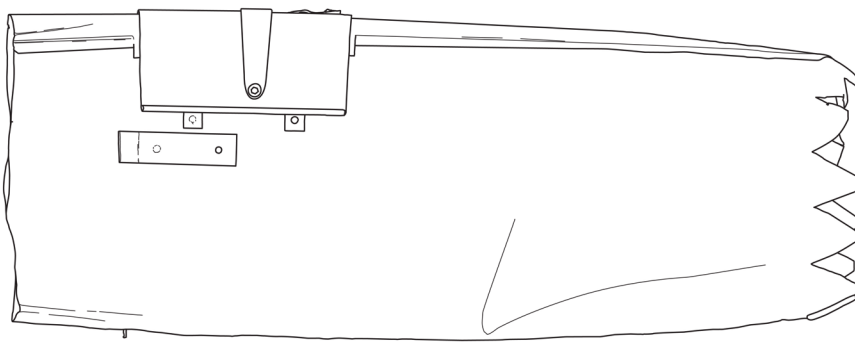
All these items came from demolition and levelling deposits and it is not possible to relate them to a particular building. The window frame (SF16)

and vinework panel (SF23) were both recovered from demolition deposit (K0000), while the roof finial was recovered from Layer B in Area 1A, and the roof-ridge capping brace and chimney pot were both from Layer B from Area FA2.

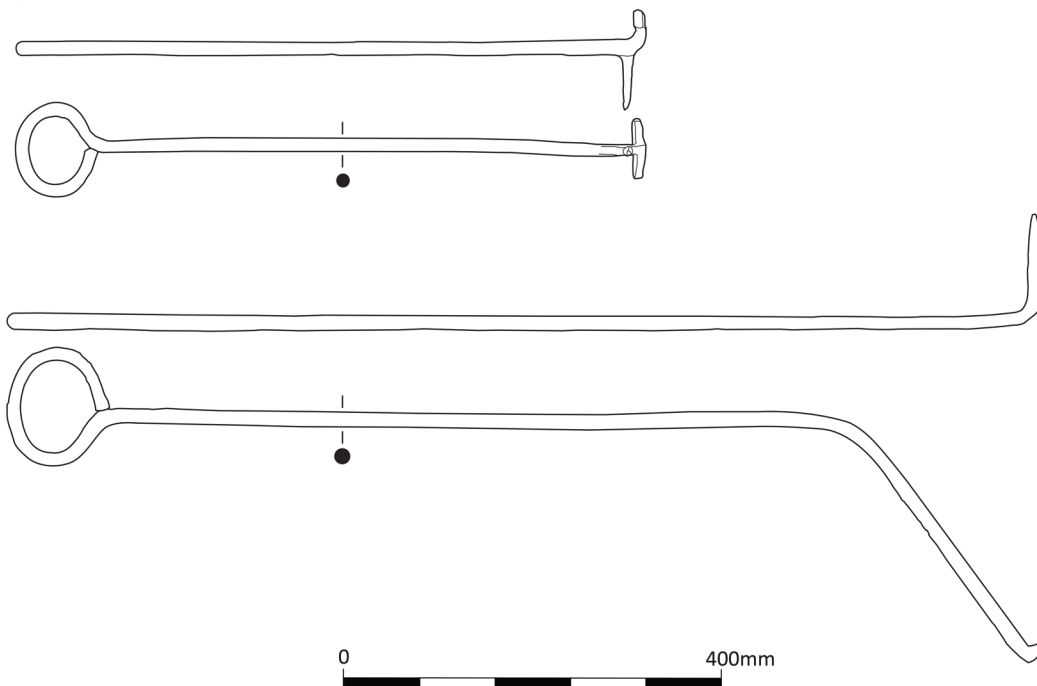
The galvanised steel chimney pot was originally cylindrical in shape with a crown top, though it is now distorted as the result of dismantling and subsequent burial (Illus 113). It would have been one of numerous chimney stacks used to vent fumes from the building interior and, as part of its

design, has a hinged access hatch and three L-shaped brackets at its base for fixing to the chimney structure. Made of the same form of galvanised steel sheet is a roof-ridge capping brace which came from Layer B, Area FA2. These braces are simple metal sheets which would have been hammered into position to act as a bracing cap along the ridge of a pitched roof and are a type of exterior fixture still used on roofs today. Galvanisation refers to the process of applying a zinc coating to the surfaces of iron or steel to prevent rusting of the metal. The

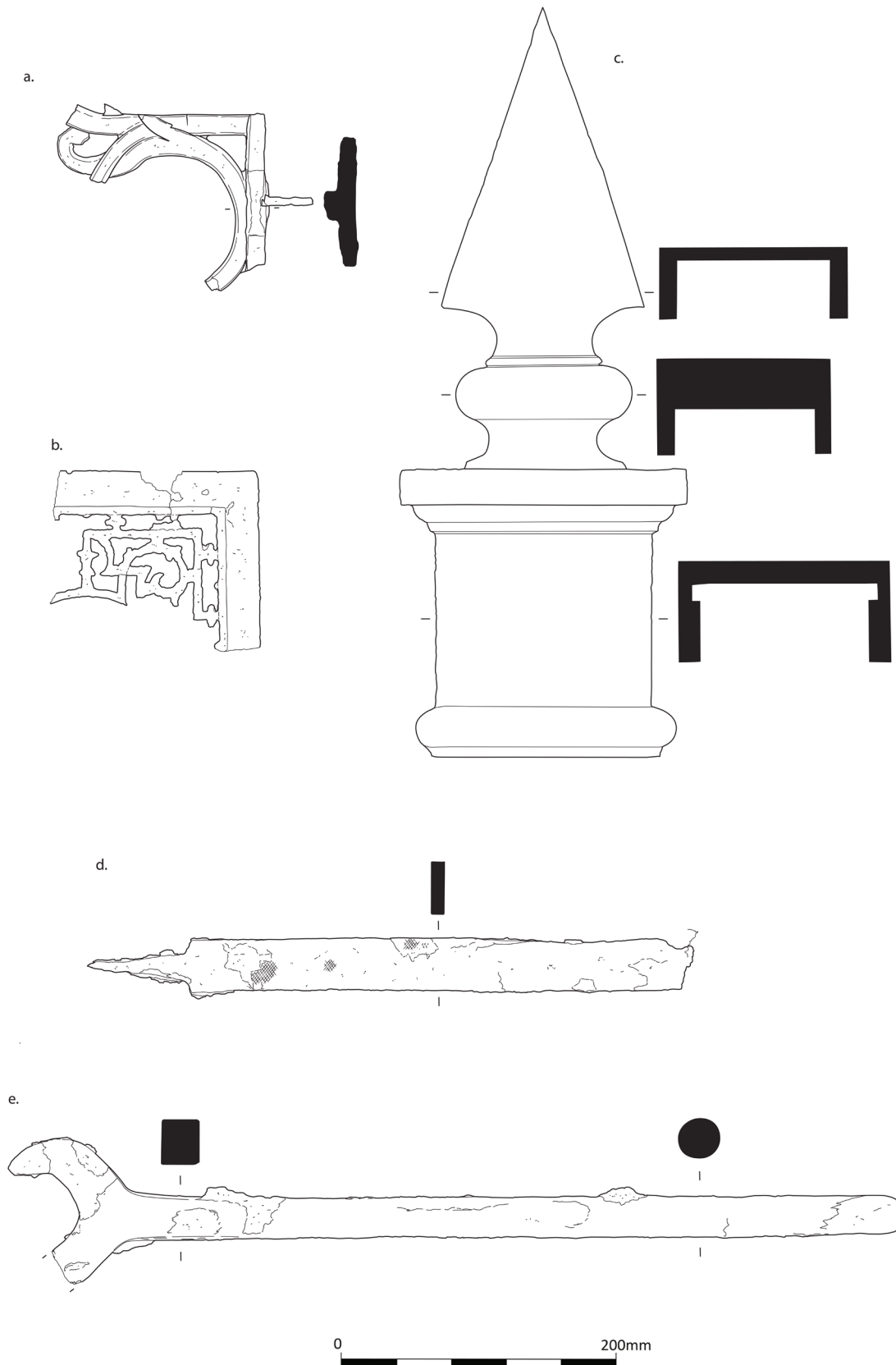
a.



b.



Illus 113 Iron artefacts: (a) galvanised chimney stack, FA2, Layer B; (b) long iron tools, Area 1A, Vault 9



Illus 114 Architectural ironwork and iron tools: (a) decorative wall-mounted bracket, SF22 (K0000); (b) fretted vent cover, (K0000); (c) roof finial, Area 1A, Layer B; (d) large hand file, Area FA2, Layer B; (e) open-ended spanner, SF76 (N0085)



Illus 115 Wrought iron decorative gate or fence panel, SF23 (K0000)

corrosion of iron and steel fittings at New Street Gasworks was a documented problem; the exposed surfaces of metal fell victim to the corrosive fumes released during the gas production process, which led to the rapid deterioration of the metal fittings and fixtures. The process of galvanising steel was first patented in 1836–7 but did not see widespread use in Britain until around the 1850s (The Galvanizers Association), suggesting that these architectural fixtures were introduced in the later phases of the Gasworks' operations.

A robust cast iron roof finial (Illus 114) was recovered, with a box plinth body, collared neck and elongated arrowhead-shaped terminal that would have projected skywards from the gable end of one of the buildings, perhaps an office block. The rear of the finial is hollow, and there is a slot in the flat base into which a thin plate would have been inserted to affix it to a structure.

A small section of cast iron window frame (SF16) in a lattice pattern was recovered from a demolition deposit in Area K. This would likely have been part of an exterior window. Also present is a section of elaborate decorative wrought ironwork (Illus 115) in the form of a curling vine with stylised leaves. Likely

a section of railing, gate or stairwell balustrade, the vine stalk curls in an S-shape, branching into multiple sections, and terminating in four leaves and two tendrils. It may have been designed to fill a triangular-shaped or corner void, or it may have formed the tip of an arching design.

► **Galvanised steel chimney pot.** Cylindrical, now flattened, with pointed crown. Constructed of a single sheet, rolled, with a folded seam. Three L-shaped brackets towards the base of the stack, evenly spaced; side-hinged access hatch (H: 225mm) with pivoting latch mechanism and simple looped handle for inspection and cleaning. H: 910mm, Diam: 350mm, Th: 2.1mm. Area FA2, Layer B. Illus 113.

► **One-piece cast iron roof finial.** Moulded face and sides, hollow back and base. Top is in the shape of a plain arrowhead with rounded shoulder and short, wide tang above a convex collar and hourglass-shaped neck. Sits atop a box plinth with crown and foot mouldings and a plain panel and flat base. Slot in back of plinth box for finial to slide onto fixing. H: 545mm; W: 200mm; Box plinth H: 210mm. Area 1A, Layer B. Illus 114.

► **Wrought iron section of a gate, fence or panel.** Curling vine with stylised leaves. Circular-sectioned vine stalk, curving in an S-shape, and branching into different segments. The branches of the vine terminate in four leaves and two tendrils. The overall form of the ironwork and the points of breakage suggest that it may have been designed to fill a triangular, or corner, void. Traces of black paint remain. L: 380mm; W: 355mm; Th: 66.1mm; Vine Diam: 11.0–25.5mm. SF23. Area K, (K0000). Illus 115.

9.8.4 Internal furnishings associated with gas production

A total of 14 artefacts identified as internal furnishings associated with gas production were recovered. These include: three retort bolts, one complete retort furnace inspection box, two inspection box sliding doors, two inspection box fragments, five sheet metal fins, and one fretted vent cover. The sheet metal fins (SF35) come from a sandstone flagged surface (K0040), though it is likely they were deposited during demolition works.

The three retort bolts are T-shaped bolts with robust rectangular heads and square-sectioned shanks, threaded and circular in section along the lower half (Illus 116). These bolts were designed to fit into T-shaped slots moulded into the outer lip at the mouth end of a fireclay retort (see 9.3.3 ‘The New Street retort’ above; Illus 88). With the flat surface sitting flush in the slot, the T-shaped heads would lock the bolts in place, while the threaded shank protruded slightly beyond the lip of the retort, onto which a large hinged iron door and gas extraction assembly could be secured. The three bolts vary slightly in size, which could be an indication of different manufacturing batches or variations of fireclay retorts. In 1894, the retort-maker P Hurlll described over 60 different clay retort designs, each one of which would have required a different retort bolt (Cotterill 1980: 26). The retort bolts likely date from the 1830s or later, when the Edinburgh Company switched from iron to refractory ceramic retorts (ibid: 26).

The retort furnace inspection box is a cast iron hollow rectangular box equipped with a vertically sliding perforated door set within slots in the box’s flanged face; the door has a protruding tab with a chain attachment at one short end (Illus 117). The body of the box was designed to sit within the

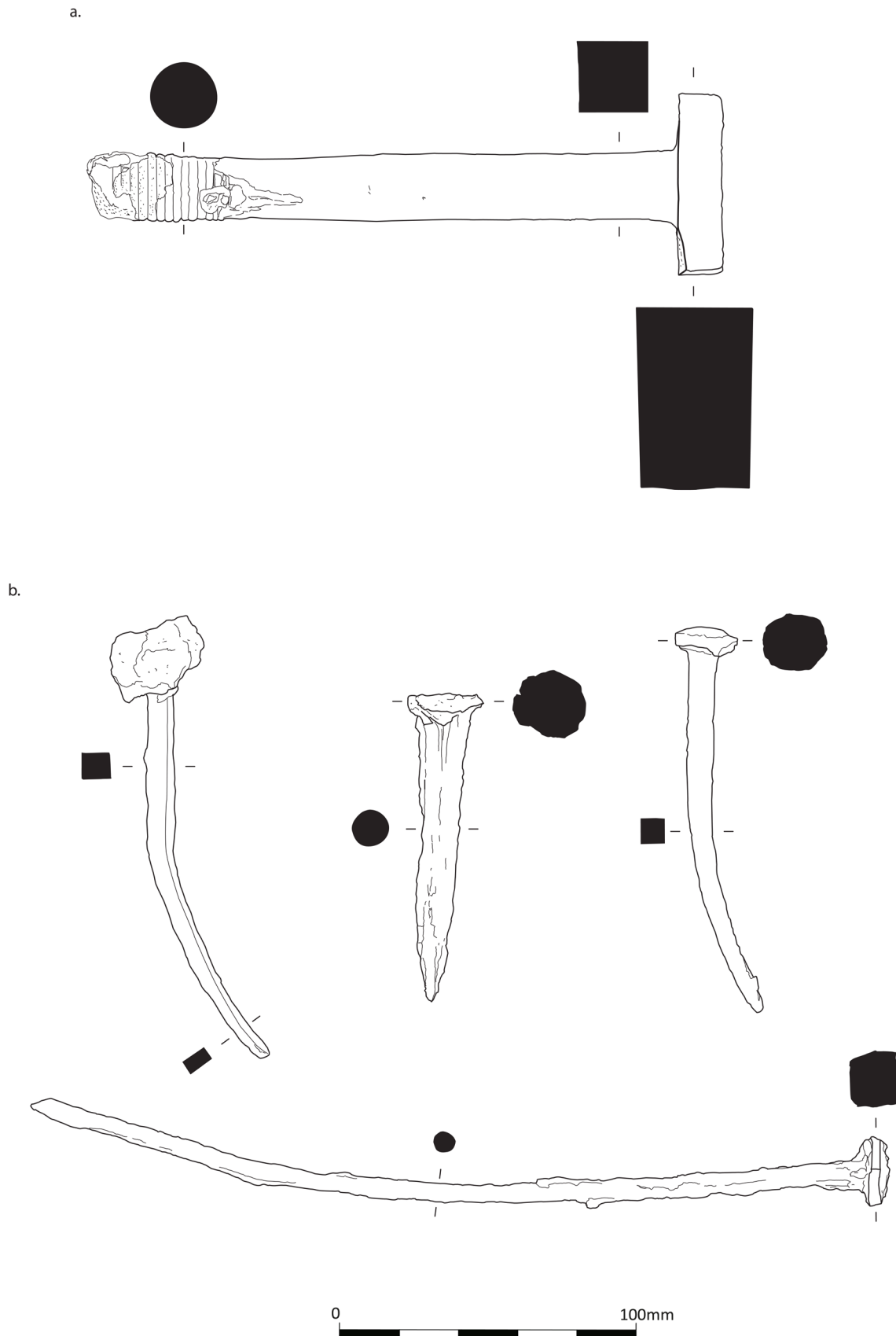
brickwork structure of the retort furnace, with the tab and chain of the door orientated to the top of the box, showing that it was designed to be pulled upwards to open, to allow inspection of the furnace interior to judge the temperature of the retort (Francis 2010: 12). It may also have been used as a vent to partially increase air intake if needed when left fully opened. The most complete example was found in situ within the brickwork of the Phase 4 furnace in Area 1A, indicating a date of 1875 or later.

Five semi-circular sheet metal fins (SF35) were recovered from the surface of a flagstone floor (K0040), a Phase 2 construction dating from between 1818 and *c* 1845. The fins are approximately the same size, around 520mm in length and 535mm or less in height. On each fin, the short, straight side is folded at a right angle to create an anchor plate, with a combination of both square and circular holes for the fixing bolts. These fins are thought to be part of a funnel system related to the delivery or removal of oil shale and ash from the retorts, or coal/coke to the furnaces.

A further object of note is the corner fragment of a square or rectangular fretted iron vent cover (SF21a; Illus 118). Broken into two fragments, the decorative vent cover was recovered from the demolition fill within Area K. A photograph on display at the Biggar Gasworks Museum shows a similar iron vent cover in situ within a brickwork wall behind a stoker working the retort bank.

► **Retort bolt.** Large, robust, ‘T’-shaped bolt with offset rectangular head and square-sectioned shank. Threaded, circular end. Long edge of rectangular head sits flush with one side of the square-sectioned shank. Associated with retort (SF5). For securing hinged iron door assembly on to fireclay retort. *c* 1850–90s. H: 210mm; Head L: 60.7mm, W: 38.7mm, Th: 14.9mm; Shank Diam: 23.0mm. Area FA3, Layer B. Illus 116.

► **Retort furnace inspection box.** Iron rectangular box with sliding door/panel. Open face and open rear. Slight inward taper of sides from front to rear. Flanged face with slot for thin sliding door/panel. Door is flat rectangular sheet with tab along one short end, bent upwards for handle/hook/attachment. Hole in tab contains bent S-shaped wire which would have fastened to a chain. Nine circular



Illus 116 Iron fittings: (a) T-shaped bolt, Area FA3, Layer B; (b) iron nails, (J0121)



Illus 117 Iron retort inspection box in situ within furnace wall

perforations in a row down the centre of the door along the long axis. Box: L: 230mm; W: 140mm; H: 122.5mm. Area 1A, Layer B. Illus 117.

► **Fretted iron vent cover.** Incomplete and surviving in two joining fragments. Corner fragment with flat undecorated edge and raised internal lip, framing a central section showing an open-work square and vine motif. H: 129mm; W: 149mm; Th: 7.8mm. Area K, (K0000). Illus 114 & 118.

9.8.5 Equipment: tools associated with gas production

The artefacts discussed in this section have been identified as tools which can be directly related to

processes in the production of gas that required an element of human input or interaction – mainly in the delivery and removal of coal or coke, and the charging and unloading of the retorts.

In total, ten tools could be directly related to the gas production process. These comprise: five iron rod tools, a nail rake, a shovel blade and a spade blade, as well as a barrow wheel and axle-support bracket. Overall, the condition of the artefacts is very poor, with several objects surviving in a fragmented, highly corroded and extremely friable state.

The most significant of the tools associated with gas production recovered are five iron rod tools. These tools are made from a length of robust circular-sectioned iron rod, bent at one end into



Illus 118 Fretted vent cover, SF21a (K0000)

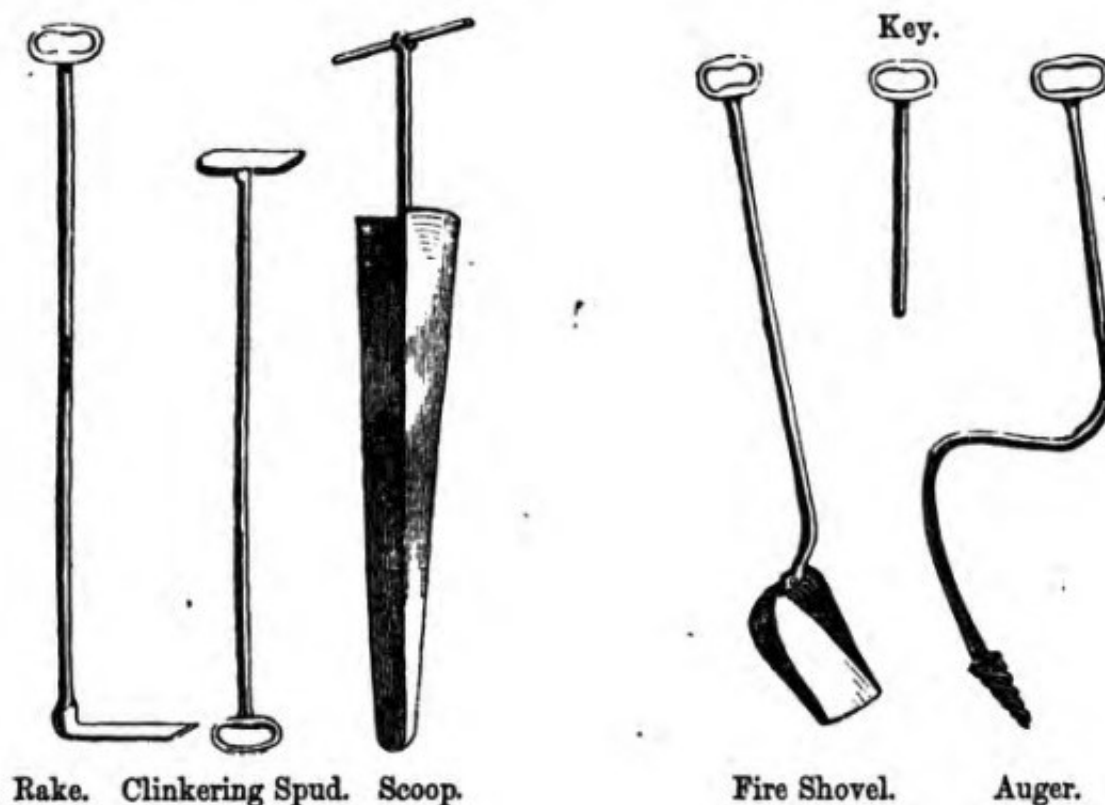
a simple looped handle with the other end either bent and shaped to form the tool head, or with a specialised head welded on (Illus 113). The five iron rod tools vary in terms of preservation, but two are complete and were discovered leaning against a brick side wall within Vault 9 in Area 1A. The shorter of these tools, measuring 0.6m in length, has an ovoid handle and straight shaft which is bent at 90° at the tip, from which a slightly curving bar-shaped rake head protrudes. A pointed spike extends from the head, forming a double-sided tool head. The longer of the tools measures 1.2m in length and has a head that is bent 90° and is cut to form a spike, perhaps used to stir the fuel during firing. The shaft of the tool is also bent, though this likely is caused by damage from use.

These simple elongated tools were ideal for manipulating materials that were worked at high temperatures, allowing the worker to keep at a safe distance from the heat source. Long iron rod rakes of up to 3.7m in length were used during the gas production process to draw the red-hot coke to the mouth of the retort where it was then either dropped into the coke vault below or wheeled away

in barrows (Anon 1866: 79–80). The length of the tools relates both to the depth of the retort and the heat of the material being worked. The short length of these tools, combined with their location within the vaults below the retort benches, suggests that they were most likely used for breaking up the coke once it had already been removed from the furnace, and would have been known as ‘clinking bats’ or ‘clinking spuds’ (ibid: 80; Illus 119).

A broken and corroded section of the head of a nail rake (FA2, Layer B) was recovered from a demolition deposit within Area FA2. Made up of a section of rectangular iron bar, it has three substantial protruding iron spikes, regularly spaced, and a hole at the broken end of the bar indicating the location of a fourth spike. It is likely that this nail rake would have been used to scrape out the bottom of the retorts, possibly after the coke had been removed.

The shovel blade (SF8) had an intact socket containing remnants of the wooden handle and a fixing peg still in place (Illus 120). A photograph (Illus 21) taken in the coal shed of the New Street Gasworks around the time of demolition shows the



Illus 119 Contemporary images of similar elongated tools to those found at New Street (Anon 1866)

coal being shovelled from slat-built wooden carts onto a massive coal pile. A spade blade (SF36; not illustrated) has a flat, rectangular non-tapering blade that curves slightly towards the shoulder and, unlike the shovel blade, which is used principally to scoop material, the spade is designed to cut through material and probably saw use in another part of the Gasworks, such as the coal tar tanks or lime shed.

The barrow wheel and wheel assembly (SF36) recovered from floor surface (K0040) consists of a cast iron spoked wheel with projecting axle that spins within a pair of axle-support brackets, only one of which survives. Another D-shaped axle-support bracket (FA3, Layer B), identical in shape and size, was recovered from a demolition deposit in Area FA3. The wheeled barrows from which these components derive were used in the Gasworks to ferry fuel to the furnaces and to transport exhausted clinker and ash from them.

► **Rod tool.** Iron rod tool with bar and spike head and looped handle. Tool head is double sided, with

rod bent downwards 90° into a wide, flattened and slightly curving bar-shaped rake (H: 40.4mm; W: 63mm, Th: 10.5mm), with a pointed spike (H: 50mm; W: 10.5mm) projecting upwards from the top. Straight circular-sectioned shaft (Diam: 16mm), transitioning to an ovoid looped handle (W: 104.3mm). Tool is intact and undistorted. L: 665mm. Recovered from within Vault 9. Illus 113.

► **Rod tool.** Iron rod tool with spike head and looped handle. Head bent 90° and cut to form a spike (H: 117mm). Circular-sectioned shaft (Diam: 15.5mm) bent at approximately 45°; unclear if the bend is design or distortion. Shaft is long and straight, transitioning to an ovoid looped handle (W: 130mm). Tool is intact. L: 1,207mm. Recovered from within Vault 9. Illus 113.

9.8.6 Equipment: other

A wide range of other tools and equipment (Q=22) was recognised among the assemblage, including:



Illus 120 Shovel blade, SF8 (B0001)

barrel hoops, buckets, cans, canisters, chisels, files, clamps, keys, nippers, oil cans, punches, scrapers, shackles, spanners, straps and wrenches. These are general equipment typical of industrial works and are not unique to gasworks. Many are associated with the maintenance of the Gasworks apparatus and day-to-day building upkeep.

This group includes a hand punch, used to punch circular holes in sheet metal and usually used in conjunction with cast iron rivets. Tools like this could have been used to produce the rivet holes seen on the sheet metal fins noted above. An extremely large intact spanner (SF76) came from Context (N0085) and is likely associated with Phase 2 activity (*c* 1818–45). It was probably used to maintain the miles of piping that delivered gas from the retorts to the condensers, among other uses. More general tools include various different files from Area FA2, chisels, nippers for cutting steel wire, punches and a wrench that may have seen use in the smithy in the west of the site.

More portable tools, potentially carried for routine maintenance tasks around the Gasworks,

include a small double-ended alligator wrench, hand-forged with a short, rounded rectangular-sectioned handle (SF19), a possible scraper (SF33a) and a triangular head from a small hoe-like tool which came from Area FA1, Layer B. The function of this tool is unclear. Like the alligator wrench, it is a hand-forged object, probably made in the smithy on site and likely to be unique.

► **Large open-ended spanner.** Single head (W: 105.5mm) with fixed U-shaped jaws (Jaw profile: 56.1mm), one of which is broken. Long, circular-sectioned shaft (Diam: 29mm) transitioning to square section at head. L: 645mm. SF76, Area N, (N0085), likely associated with Phase 2 (*c* 1818–45). Illus 114.

► **Large hand file.** Rectangular section and straight sides. Damaged tip, with concretions and loss to corrosion. Appears to be a single-cut file. Tang is intact (L: 75.7mm). File: L: 365mm; W: 38mm; Th: 9.5mm. Area FA2, Layer B. Illus 114.

9.8.7 Fittings

The majority of the iron assemblage from the site (146 items; 68% of the assemblage) falls under the category of structural and internal fixtures of types which are commonplace at any 19th- and early-20th-century industrial building and are not considered to be unique to a gasworks setting. These include various nails (Illus 116), bolts, brackets, spacers, pipes and handles.

Among the more generic fixtures and fittings are components of hydraulic equipment and mechanisms. These include a large, robust possible cotter pin (Context FA3, Layer B) used to fasten two parts of a moving mechanism together, and a composite spacer made of eight separate movable parts (SF37) which was recovered from Context (K0040), undoubtedly a component of a hydraulic system. Various pipe fragments, pipe junctions and flanged pipe brackets were recognised among this group but it has not been possible to connect these with certainty to a particular stage of the Gasworks' processes; they could have been used to distribute the unfiltered gas from the hydraulic main to the condenser but equally could have facilitated the transport of water around the factory. At least two spoked hand wheels came from Layer B in Areas FA1 and H. Photographs of the compressor suite prior to demolition capture the configuration of the hydraulic equipment, including hand wheels, which would have been used to adjust the pressure and flow within the pipes by opening or closing valves within the pipes.

Also present is a substantially complete latch plate from Layer B, Area FA1 – a flat rectangular plate with a circular peg protruding from one end. This robust fixture is not consistent with the type of latched fitting used to secure the cast iron retort doors but could have served a similar function, perhaps on the furnace doors.

Alongside the more practical fixtures and fittings is a robust decorative wall-mounted bracket (SF22), which was recovered from unstratified material in Area K. It is a right-angled bracket with a lobed anchor plate and decorated bifurcated arm and may have functioned as a decorative shelf support.

► **Wall-mounted bracket.** Robust, decorative right-angled bracket with a dual-lobed anchor plate (W: 95.8mm), one ear projecting from each side of the vertical back bar. One hole in each of the lobes, set within a rectangular groove cast into the rear of the anchor plate. A square-shanked nail survives in situ within one of the anchor holes. A horizontal arm with a flat top (W: 21.8mm) projects from the vertical back bar (W: 30mm), bifurcating towards the tip, splitting downwards. Decorative curled ironwork loops from below the horizontal arm, snaking below in an S-shape to the vertical back bar. The lower extent of the horizontal arm and curved base of the vertical section appear broken, and would possibly have joined in a circular loop. H: 127mm; L: 150mm. SF22. Area K, (K0000). Illus 114.

9.8.8 Miscellaneous

Within any large assemblage of industrial ironwork there is a small number of individual components that cannot be closely identified due to their fragmentary condition or their unremarkable form. Within this assemblage various bars, box fragments, rings, loops, rods and sheet metal fragments could not be assigned to a particular function or date.

9.8.9 Discussion

It is clear that the majority of the Gasworks' iron fixtures and fittings, machine parts and tools had been stripped out for reuse or recycling prior to the demolition of the structures and what was left behind comprised broken, damaged or hard-to-reach items of limited further use. Only a few recognisable implements and fixtures survive to enable a snapshot of the workings of the factory.

The architectural elements, including the roof finial and vinework panel, are the only artefactual survivors to provide an indication of the overall external appearance of the Gasworks structures. An analysis of photographs of the New Street Gasworks did not show these components in situ, though most photographs were either taken from a distance or captured the Gasworks during its dismantling. Most likely dating to around the mid-19th century, the elaborate vinework panel and decorative roof finial were designed to be visible to the public, and may

have been part of the main office building, or of the street facade (Pearson 2016: 59), and they survive as reminders of the importance of image and style for the urban Victorian industrial complex.

The damaged condition of the recovered tools is perhaps not surprising, as they would have been subjected to high heat and high stress, and would have seen heavy, continual use, with frequent damage. The long rod-shaped retort tools were most likely manufactured on site at the Gasworks smithy and would have been quick and easy to produce, with the same simple loop handle and iron rod shaft fixed with a multitude of heads (Anon 1866: 80). Due to the probable high rate of turnover of these tools, it is likely that the two intact tools recovered from Vault 9 were among the last of the tools used prior to the Gasworks' decommissioning in the early 20th century. Surviving examples of the looped handle, iron rod tool type on display at the Biggar Gasworks Museum indicate that these tools were also used in the operation of the boilers, as well as in the cleaning out of the retort gas extraction tubes that led to the hydraulic main.

In general, the surface condition of the iron artefacts was poor, likely to be the result of corrosive gases that were documented in contemporary sources as a problem, and does not indicate the use of low-quality or inferior iron or steel. Steps to circumvent this corrosion were taken during the later years of the Gasworks, indicated by the installation of innovative galvanised steel fittings, such as the chimney stack, which would withstand the polluted air more effectively.

9.9 The lead objects

Andrew Morrison

9.9.1 Overview

The small assemblage of lead (Q=21, mass: >1,880g) is dominated by roofing nails and also includes pipes fragments, lead sheet, a rectangular open-topped box, molten spill and a possible wheel rim counterweight. The finds were in relatively good condition, with little corrosion present, apart from the open-topped rectangular box (SF2), which showed considerable loss to corrosion.

Roofing nails were the most numerous lead artefacts recovered (Q=13), representing almost

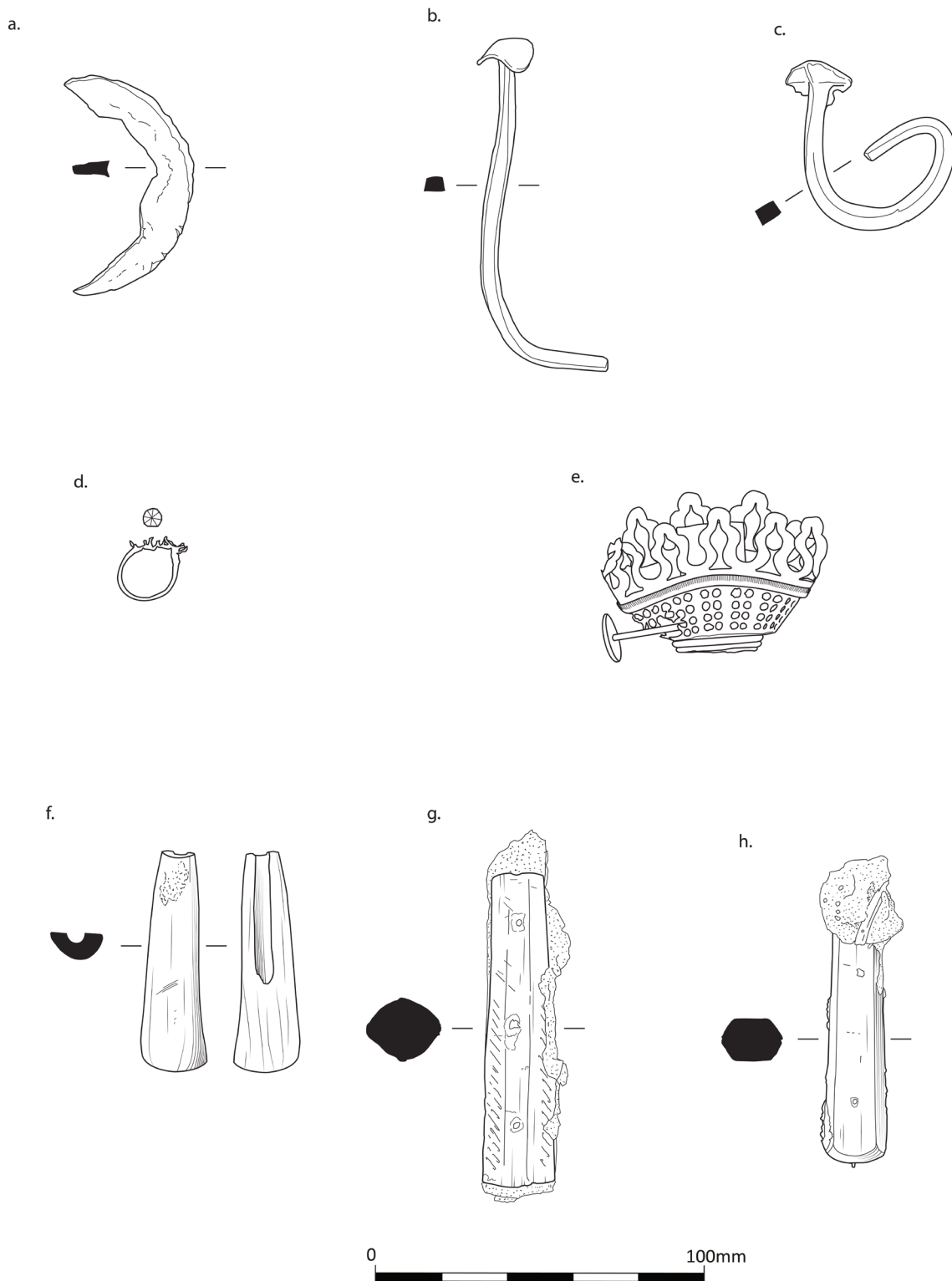
62% of the assemblage (Illus 121). The nails were retrieved from different areas but are likely all associated with the demolition of the buildings, making it impossible in most instances to assign individual objects to specific buildings of the Gasworks. The nails all have flat, circular heads with casting lines underneath, slightly tapering, trapezoidal-sectioned shanks and flat tips. They are all roughly the same size, with a head diameter around 19mm, an average length of 116mm, and shank dimensions between 4mm and 7mm in width. Most of the nails are curled in a C- or G-shape, or with a bend towards the tip, with damage to the head, suggesting distortion during removal. One of the roofing nails (FA2, Layer B) is preserved in situ within a fragment of roofing slate, inserted through the nail hole, and held in place by its circular head and curled shank. The lead roofing nails would have acted as 'bent pegs' (Hathaway 2012: 20), with the heads acting as stoppers to the slate nail holes rather than striking platforms, and the flexible shanks used to hook around the roof purlins.

Another find of note was a small possible wheel rim counterweight (Illus 121). An unstratified find from Area N, this possible counterweight is crescent-shaped, triangular in section, with a slightly concave edge tapering to a point at each end. The concave edge is thought to reflect the shape of the inside surface of a small wheel rim. This object would have served to balance a small wheel during rotation, possibly set against the movement of a piston.

Other finds include: a rectangular, open-topped sheet lead box (SF2), a triangular fragment of lead sheet (FA2, Layer B), a length of small-diameter lead pipe (SF20.2), a fragment of large-diameter lead pipe or vessel rim (SF72), and three fragments of molten lead spill (SF70). The rectangular, open-topped sheet lead box is made from a single lead sheet bent around to form the face, base and rear of box, with separate rectangular sheets forming the two sides.

9.9.2 Catalogue of illustrated objects

► **Possible rim counterweight.** Crescent-shaped, lightly distorted, with slightly concave edge tapering to points on each end. Roughly triangular in section. Edge shows indentation from contact with another circular surface, likely the inner rim of a small wheel.



Illus 121 A selection of lead, copper alloy and worked bone artefacts: (a) possible rim counterweight, SF81.5 (Unstratified between (N0501) and (N0502)); (b) lead nail, Vault 9; (c) lead nail, Vault 9; (d) copper finger ring, Area N; (e) brass oil lamp component, Area FA2, Layer B; (f) bone handle, SF5, TP4/A (north); (g) bone knife handle, (P0004); (h) bone knife handle, SF79 (N0085)

Likely to balance a wheel by acting as a counterweight, possibly a wheel with a piston attached. Diam: 66.5mm, covering roughly 50% of a circle; Th: 4.5mm. Mass: 25.22g. SF81.5. Area N, unstratified between (N0501) and (N0502). Illus 121.

► **Nails.** Three roofing nails. One straightened, two curled in C- or G-shapes. Tips all flat, not distorted. Total Mass: 91.96g. Area 1A, Layer B, Vault 9.

1. Straight nail, with distorted round head. Slightly trapezoidal shank tapering to a flat tip. Head Diam: 15mm; Head Th: 1.7mm; Shank W: 4.5 × 6.9mm; L: 117mm (not illustrated).

2. Nail bent in G-shape. Head Diam: 20.1mm; Shank W: 6.1 × 6.8mm; L: 118mm. Illus 121.

3. Nail bent in C-shape. Head Diam: 17.6mm; Shank W: 6mm; L: 109mm. Illus 121.

9.10 The glass

Andrew Morrison

9.10.1 Introduction

An assemblage of glass (12kg) comprising approximately 130 artefacts, included: 19 intact

glass bottles, four of which had their closures in place, 70 sherds of bottle glass, 41 window glass sherds, 11 tableware sherds, various fragments associated with glass working, a patented wedge-shaped object and a glass marble.

9.10.2 Bottles

The glass assemblage is dominated by mid-19th- to early-20th-century bottles (Illus 122) and bottle glass, including wine, beer and spirit bottles, aerated water bottles, medicine bottles, and food storage bottles and containers, with some tableware and window glass also present. These finds are contemporary with the period between the mid-19th-century expansion of the Gasworks up to its eventual demolition in the early decades of the 20th century.

Typical of 19th- and early-20th-century urban glass assemblages, a similar range of bottle glass has been uncovered on nearby sites such as Advocate's Close (Wilmott 2017: 35) and Parliament House (Murdoch 2008). The glass is largely mass-produced, mould-formed glass, many examples of which bear the moulded markings from local businesses in the



Illus 122 Selection of intact 19th- and early-20th-century glass bottles

Canongate and Leith, as well as ones further afield. Green bottle glass such as this is common on most Scottish sites from around the early 18th century onwards (Murdoch 2008). While some of the bottle glass recovered may date to the earlier 18th century, its date of deposition could be much later, as bottles were refilled and reused over extended periods before breakage and discard (*ibid*). A few examples of unstratified late-18th- and early-19th-century bottle glass are recognised. The bottle glass from the north area of excavation ranged in colour from a forest green, to a light to dark olive green, with the window glass mostly showing a light greenish-yellow tinge. No intact bottles were recovered, though sherds representing all parts of the bottle were recovered.

Some of the more diagnostic bottle sherds include: an olive green base sherd with bulging heel and dome-shaped push-up, dating to the late 18th to early 19th century (SF5), and an 18th-century, light olive green neck and finish sherd with added rounded string rim (SF8).

A total of 19 intact bottles were retrieved, four of which have their closures in place, and some with remnants of liquid contents and residue still within. Of particular note are an intact 'William Younger and Company Ltd, Edinburgh' beer bottle (post-1921) with closure in place and liquid contents within (Unstratified); an intact spirit bottle from 'William Laird, Wine and Spirit Merchant, 88 Constitution St Leith', dated 1895–9 (Area 1+2, Layer B); a partial spirit bottle from 'Robert Liddle, Spirit Merchant, 186 Canongate, Edinburgh', dating from 1895–1904 (SF29); an intact soda bottle from 'G & C Moore aerated water manufacturers and bottlers, Glasgow', dating from the 1880s–1920s, with closure in place (Unstratified); an intact amber glass prescription bottle from 'Parke, Davis & Company Pharmaceuticals', from the 1870s to early 1900s (SF13); an intact late-19th- to early-20th-century bottle of 'Angier's Emulsion', with oily residue (Unstratified); a large, intact fruit jar from 'Cannington, Shaw & Company Ltd St Helens, Lancashire', dating from 1892–1913 (SF13); and an intact preserve jar from 'Samuel Hannah & Company, Rutherglen', dating from 1890–c 1912 (SF13).

Few glass finds were recovered from secure contexts, although those that were provide valuable

dating information. Among these are a diagnostic green bottle glass base and body sherds dating to the late 19th to early 20th century from (J0269), including a base fragment with 'A' and '1879' moulded on the base (SF30.2). An intact, clear blue aqua glass bottle with cork closure, as well as a possible ink well with burst lip finish, were both recovered from (N0085), associated with a stone wall, and both date from the mid-19th to early 20th century (SF80.2).

9.10.3 Table wares

Tableware fragments among the assemblage included joining sherds of light emerald green faceted glass, possibly representing a Victorian candle holder (SF29), and a fragment of a clear, press-moulded sunburst-patterned dish, dating from the late 19th to early 20th century (SF80.2).

9.10.4 Window glass

A small quantity of window glass (41 sherds) was recovered, comprising mostly clear, colourless sheet window glass, likely dating from around the mid-1800s to the early 1900s; sheet glass was introduced into Britain around 1830 and quickly overtook crown glass as the preferred method of manufacture (Murdoch 2008: 287). Some window glass shows a slight green tinge and may date to the 18th century or slightly earlier, including four sherds displaying possible edges (SF88) from (N0105). One sherd of clear green aqua coloured glass (SF6) from TP2/A also displays a potentially hand-finished edge and is also likely to be 18th century in date.

9.10.5 Other

Other glass finds include: a robust glass wedge, a cylindrical tube, a marble, as well as objects that suggest a possibility of a small amount of glass working taking place on site. The robust glass wedge (SF12) is a fragment of a larger, patented object of unknown function. Found unstratified in Area J, the clear, colourless moulded glass rises at an approximate 35° angle, with flat, frosted edges. The object may possess optical properties, though it is unknown if these would be intentional. The cylindrical tube (SF102.2) came from Area N and

may have been involved in the transport of gas during production.

A few of the glass objects recovered suggest the possibility of glass working in the vicinity of the site and are likely unrelated to the Gasworks. These include a large lump of clear molten glass, a lump of molten dark inky-blue glass, and a fragment of industrial ceramic with a greenish-clear molten glass coating. Finally, a fragment of industrial firebrick-type ceramic with a clear to greenish tinge molten glass coating was recovered from Layer B within Area FA3. The glass appears to have formed and flowed in layers over the surface of the ceramic,

which is roughly circular in section, sloping to a wedge shape at one end.

9.11 The industrial residues

Dawn McLaren

Various industrial residues were encountered during the excavations, particularly in and around Areas C and K, focused on the flues, furnaces and retorts. Small quantities of these residues, totalling 1,025g in weight, were collected as representative samples and have been retained as part of the site archive. Macroscopic examination has allowed these residues to be identified as unintended by-products



Illus 123 Corrosive vitrified residue build-up in the interior of working retort at Biggar Gasworks Museum

of the high-temperature processes involved in gas production. None of the waste is diagnostic of metalworking, despite the documented presence of a blacksmith's workshop within the Gasworks complex. A further 4,504g of waste, dominated by mixed fuel residues, were extracted from soil samples.

The majority of the residues consist of fractured, broken-up pieces of thin films of vitrified materials which had formed as sheet-like coatings on the interior surfaces of the flues and retorts. In the main, these appear to have formed as the result of high-temperature reactions between the fuel (coal and coke), the various corrosive gases released from the coal, ash, and the surfaces of the ceramic material of the structures (eg brick and refractory ceramic), which would have acted as a flux, as seen in metalworking furnaces.

A low-density, highly vesicular, non-magnetic film of vitrified material was noted on the interior surface of brick-built flue (C0032) and on the surrounding floor. This brittle and friable material is a light grey/mid-grey in colour, adhering in places to a red-brown ceramic (brick?) and yellow-brown stone. Amorphous chunky fragments of a low-density, sintered, ceramic and ash-rich residue came from the inner surface of flue (C0034). This has vertical lathe-like structures which appear to be slow-formed accumulations of granular heat-affected siliceous material, probably extruded from the bricks, and formed against a flat surface. Similar small fractured sherds of this heat-affected material were also recovered from contexts (F0032), (J0312) and (K0537). Fragments of a thin, flowed film of a dense vitrified material with vertical lathe-like impressions in relief were recovered from the interior of round-headed brick flue (C0035). Each fragment of this material was coated on one surface with an off-white powdery material, possibly lime or sulphur deposits.

Large, flat, fractured sheet fragments of a ferrous-rich material came from around the retorts in the area of (K0009). These residues could easily be mistaken for ironworking debris, particularly due to their silvery-grey colour, metallic-looking sheen and magnetic response. However, a similar film of waste was noted on the interior surfaces of a ceramic retort excavated at Salamander Place, Leith (McLaren forthcoming),

which derived from the Edinburgh and Leith Gas Company, and was observed inside the working retorts at Biggar Gasworks Museum (Illus 123). This material is likely to have accumulated over time, building up in layers on the interior of the retorts as the result of chemical reactions between impurities in the coal being heated, particularly naturally occurring iron-bearing clasts, the steel retort collars, the corrosive gases released from the coal, and siliceous material from the ceramic retort which would have acted as a flux, resulting in the viscous material becoming partially or fully molten.

9.12 The leather

Clare Thomas

9.12.1 Introduction

The leather assemblage comprises 37 items, all footwear of riveted construction apart from two squashed fragments of a ball.

9.12.2 Footwear

The footwear consists of 15 shoes or significant parts of shoes, 11 sole fragments and 10 small pieces of uppers (Illus 124). The soles and uppers were all joined by rivets. A few soles had been repaired and upper fragments were machine sewn to each other. Many upper fragments also displayed evidence for linings, lace-hole facings and heel stiffeners. A few soles were reinforced with iron plates. Ten uppers had lace holes for a central fastening. Sizes varied between a child's size 1 (continental 16½) and an adult 6 or 7 (continental 39–41). One upper has part of a manufacturer's stamp.

9.12.3 Construction

All the sole fragments and the uppers with lasting margins bear evidence for riveted construction, in the form of both rivets and rivet holes. The rivets used on boot 18 have a screw threading. Five sole fragments have hobnails (Catalogue nos 1, 17, 20, 26 and 27). Two heels have iron heel reinforcers; another sole fragment has an iron plate, and a further iron plate survives separately (Catalogue nos 16, 17, 20 and 27).



Illus 124 Leather shoe fragments: (a) quarters and lining of ankle boots with central fastening, SF17, Cat 5; (b) upper of boot with central lacing and manufacturer's stamp, SF17, Cat 12; (c) latchet of shoe or boot, SF17, Cat 10; (d) vamp, Cat 15; (e) quarters, Cat 15; (f) infant's left shoe, SF77, Cat 4; (g) vamp and quarters fragment, Cat 18; (h) sole and quarters fragment, Cat 18; (i) boot with central fastening, SF17, Cat 13; (j) right boot with central fastening, Cat 17

9.12.4 Styles

Six shoes have rounded toes (Catalogue nos 1, 4, 16, 17, 19 and 21). Two have oval toes, while two have broad, almost square toes (Catalogue nos 14, 18, 20 and 22). There is only one example of a pointed toe (Catalogue no. 13). Nine uppers are complete enough to be identified as boots, not shoes. All of these have lace holes for central fastening (Catalogue nos 1, 5, 12, 13, 14, 15, 16, 17 and 18). One upper was probably not a boot, perhaps a high shoe, with a latchet with only three lace holes (Catalogue no. 10).

9.12.5 Soles

The most complete soles within the assemblage usually have an outer sole, often covering only the forepart, a midsole and an insole. The midsole often consists of two or more thicknesses, sometimes incorporating strap-like pieces (Catalogue nos 6, 17, 18, 20 and 21). Two insoles have raised ribs with tunnel stitching for attachment to the midsole (Catalogue nos 1 and 7). The insoles have the grain side uppermost.

9.12.6 Heels

The assemblage included nine heels. The simplest, on an infant's sole, was made of a single lift of leather (Catalogue no. 4). Four had four or five leather lifts and are 15mm high (Catalogue nos 1, 2, 16 and 21). Two had seven or eight lifts; one has a height of 17mm, the other of 30mm (Catalogue nos 17 and 3). Two had 10 or 11 lifts, with one of these also having a black composite top piece, possibly of rubber; these had heights of 33 and 45mm (Catalogue nos 13 and 14). Two other soles bear impressions of heels (Catalogue nos 18 and 23).

9.12.7 Uppers

Uppers consisted of vamps and quarters. Eight uppers also had toe caps (Catalogue nos 2, 9, 13, 16, 17, 19, 21 and 31). Two quarters were made of one piece (Catalogue nos 12 and 15). Eight were composed of two pieces, with a central closed seam at the rear (Catalogue nos 1, 2, 5, 13, 14, 16, 17 and 18). Toe caps, vamps and quarters were joined together with lapped grain-flesh stitching channels.

These stitching channels were often in pairs, forming a band enclosing decorative round perforations. Sometimes, these perforations were separated by pairs of dots or, in one case, by four dots forming a diamond shape (Catalogue nos 16, 21 and 17). Usually, the seams joining vamp and quarters had double grain-flesh stitching channels, but four examples had triple rows of stitching, and one had four, made up of two double rows (Catalogue nos 5, 16, 17, 18 and 20). The rear of quarters were sometimes reinforced with backstraps, running from lasting margin to close to top edge. These could be either external (Catalogue nos 2 and 12) or internal (16 and 17). On other examples, internal stiffeners were used; these were usually semi-circular in shape and did not extend as far as the top edge (Catalogue nos 1, 13, 14 and 37). Evidence for tongues is very slight. Boot no. 2 had a two-part tongue, consisting of two approximately rectangular fragments; two other items may have had tongues (Catalogue nos 16 and 36).

Ten shoes had lace holes for a central fastening. One only had three lace holes; these were on a strap-like latchet (Catalogue no. 10). The others had between six and 19 lace holes and were part of ankle boots (Catalogue no. 2 – eight pairs; no. 5 – eight pairs; no. 12 – six pairs; no. 13 – 14 pairs; no. 14 – 19 pairs; no. 15 – seven pairs; no. 16 – eight pairs; no. 17 – eight pairs; no. 18 – ten pairs). All the boots had metal eyelets, although no. 18 only had them for the top two pairs of lace holes. Boots 17 and 18 also had metal hooks at the top of the columns of lace holes. Boot no. 15 had no evidence for lace-hole facings, in contrast to the rest, where the facings and stitching for them survived. On Boot no. 18, the stitching for the lace-hole facing extends backwards for approximately 15mm near the fifth (from top) lace hole, at the point where the leg of the boot bends. This was presumably to prevent the leather splitting on the fold. Boot no. 14 had a woven black fabric lace still in place. It also had a black fabric material lining forming a 45mm wide band inside the top of the leg. Four other uppers had linings; one lining had a reddish covering, of neither leather nor woven fabric (Catalogue nos 2, 5, 17 and 18).

Boot no. 12 has a maker's name stamped on one side of the quarters. It is incomplete; what

survives reads: 'RRY HARRIS WARRANTED' On the other side of the quarters is stamped the number '7'.

9.12.8 Wear

The footwear showed signs of wear; the parts most affected include foreparts of soles, heels, toes of vamps and rear of quarters. There is only very slight evidence for repairs. Three soles had been patched with clump soles, which had been nailed on. Two of these were on the forepart, the third on part of the waist. This last item was made of reused leather, which has stitching channels on it (Catalogue nos 2, 14 and 17).

9.12.9 Sizes

Thirteen soles or uppers were complete enough for an estimate to be made of modern shoe size. Shoe sizes are based on internal measurements, but these are not always possible, when uppers are very stiff. Where external measurements have been used, these have been adjusted. A fourteenth shoe has '7' stamped on it.

The smallest shoe was a child's 1 (continental 16½). Otherwise, sizes ranged between a child's 10 (continental 28) and an adult 7 (continental 41), with two examples of an adult 2 (continental 34). The shoe with a pointed toe was an adult 2–3 (continental 34–35) and was almost certainly a woman's shoe. Some of the smaller boots could have belonged to either women or youths.

9.12.10 Conclusions

This is a small but significant assemblage. Riveted shoes date from after 1853, and were at their most common from the 1880s until the end of the First World War. They were produced in large numbers in factories and were typical cheap working wear (Thomas 1996: 167). Riveted construction indicates that this was cheap, mass-produced footwear. However, the backstraps, stiffeners, linings and facings show that attention to detail was not sacrificed, and that these boots were designed to be reasonably sturdy. The size range suggests the wearers were both children and adults; the children included a small infant. The adults included at least one woman.

9.12.11 Catalogue of illustrated items

► **Cat 4. Infant's left shoe.** Sole, heel and upper of infant's left shoe. Outer sole L: 117mm; Forepart W: 51mm; Heel L: 38mm, W: 36mm, H: 4mm; Inner L: approx 112mm. Modern shoe size approx child's 1, continental 16½. SF77.

► **Cat 5. Quarters and lining of ankle boot with central fastening.** Quarters has a double grain-flesh stitching channel, stitch length 1.5mm, for central closed back seam, machine sewn. Stitching also indicates position of backstrap, now missing. Lining matches quarters with identical stitching and lace holes. Surviving height *c* 110mm. SF17, bag 1 of 7.

► **Cat 10. Latchet.** Latchet of shoe or boot, with three lace holes with metal eyelets, with a diameter of 7.5mm and set 22mm apart. Also, lace-hole facing or lining, matching latchet. SF17, bag 5 of 7.

► **Cat 12. Upper of boot with central lacing and with manufacturer's stamp.** Upper of boot with central lacing, comprising one-piece quarters, backstrap and lace-hole facing or lining. Surviving L: approx 170mm, H: 135mm. An adult 7 would have an inner length of 271mm. SF17, bag 6 of 7.

► **Cat 13. Boot with central fastening.** Sole, heel and upper of boot with central fastening. External L: *c* 240mm; Forepart W: 70mm; Waist W: 39mm; Heel L: 44mm, W: 40mm, H: 33mm, but possibly originally less, as lifts are separating. Modern shoe size adult 2–3, continental 34–35 (allowing for adjustment for external measurements). SF17, bag 7 of 7.

► **Cat 15. Right boot with central fastening.** Right boot, comprising small sole fragments, vamp with lining and quarters with lace holes for central fastening. Vamp L: *c* 180mm, W: (throat) *c* 120mm, Th: 1–1.5mm; Quarters H: approx 95mm, Th: 2–2.5mm; overall L: approx 230mm. Modern shoe size adult 2, continental 34. Context FA1, Layer B.

► **Cat 17. Right boot with central fastening.** Right boot with central fastening comprises sole and upper. L: 250mm; W: (forepart) 85–90mm, W: (vamp) 90mm, W: (waist) 60mm; Heel W: 65mm,

H: 17mm; Quarters H: (excluding sole and heel) *c* 140mm. Modern shoe size adult 3–4, continental 35½–37, allowing for adjustment from external measurement. Context FA1, Layer B.

► **Cat. 18. Right boot with central fastening.** Parts of right boot with central fastening, comprising waist and seat of sole, vamp, two pieces of quarters, two fragments of lining and one piece of lace-hole facing. Upper L: approx 270mm; Quarters H: 145mm. Modern shoe size adult 6–7, continental 39–41, allowing for adjustment from measurements from upper. Context FA1, Layer B.

9.13 The worked bone

Dawn McLaren

9.13.1 Overview

Three hand-carved handles for iron knives were recovered from the Gasworks (Illus 121). A tapering cylindrical bone handle with a rounded butt and a drilled cylindrical socket along its length designed to hold the iron tang of the implement, and two matching sub-rectangular scale plates with incised geometric decoration, came from the northern area of excavation (Test Pit 4/A, SF5 and Test Pit 1/ (P0004)). Another pair of rectangular scale plates remain attached to the iron (steel?) tang of a razor or knife, secured in position by two widely spaced rivets (SF79; Context (N0085)). The first two examples are probably personal implements, carried on the person and put to general use including food preparation and consumption, while the latter may be from a razor or knife.

9.13.2 Catalogue

► **Handle fragment.** Fragment of a tapering, sub-cylindrical bone handle, split across the narrow elongated drilled socket for the iron tang of the implement, resulting in one half of the handle being lost. The drilled tang socket is 38mm in length and 5mm in diameter, terminating sharply in a narrow point. The handle is squared at the narrow, open end, expanding gently in width along the length to terminate in a rounded butt. The surfaces have been smoothed but lack any polish. A deep oblique gouge and a patch of pitted erosion on the external surface are likely to be post-depositional damage.

L: 67mm; W: 10–20mm. SF5. Context: TP4/A (north). Illus 121.

► **Handle.** Two sub-rectangular bone handle plates, plano-convex in cross-section, with incised geometric decoration, remain attached to the scale tang of an iron implement, probably a knife. The plates are squared at the narrowest end and gently expand in width along the length to a wide, squared butt, currently coated in corrosion from the terminal of the knife tang. The plates have been secured to the tang by three equally spaced iron pegs (Diam: 3.5mm). The rounded surfaces are decorated by two fine, parallel, transverse, incised lines which flank the iron pegs. To either side of these lines, running up the edges of the handle on both faces, are a series of closely and evenly spaced, short oblique incised lines. Towards the blade-end of the handle, these decorative markings gradually soften as the result of rubbing from use. There is a high sheen across the surfaces from handling. L: 95mm; W: 17–22mm; Th: 18mm. Context: TP1/P0004 (north). Illus 121.

► **Handle.** Two sub-rectangular bone handle plates, rectangular in cross-section, with steeply bevelled tapering edges, which remain attached to the scale tang of an iron implement, possibly a razor or knife. The plates are squared at the narrowest end, the bevelled edges expanding gently in width along the length to terminate in a rounded butt. Both faces of the handle are flat and plain and have been secured in position by two widely spaced, narrow, circular pegs (Diam: 2mm). L: 75mm; W: 15.5–18.5mm; Th: 13mm. SF79. Context: near Area N, N0085. Illus 121.

9.14 The worked stone

Dawn McLaren

9.14.1 Overview

A single bar-shaped slate whetstone (not illustrated) came from Context FA2, Layer B and is undoubtedly related to the maintenance of iron blades and other tools. It is likely that this tool would have been used in the smithy located in the west of the site during the later phases of the complex's operations.

► **Whetstone.** Rectangular bar of slate with squared, vertical edges. One saw-cut squared narrow end remains; opposite end is broken and original length

of stone is unknown. One long vertical edge has a regular series of linear, oblique, tool marks running along length; opposite edge has overlapping, diametrically opposed oblique tool marks forming a cross-hatched texture. Surface spalls have detached from one face, the other is scratched and damaged but lacks evidence of extensive use. L: 220mm; W: 39–40mm; Th: 18mm. Context FA2, Layer B.

9.15 The wood

Andrew Morrison & Dawn McLaren

9.15.1 Overview

Degraded wooden planks and broken timber fragments were noted among the levelling and demolition deposits but few preserved sufficient surfaces to enable close identification. It is probable that any good-quality timber was stripped out of the Gasworks building at the time of demolition to be sold on and reused elsewhere.

A few timber items are worthy of further note. These include 14 staves from a wooden barrel which came from Area 1A, Vault 9, Layer B. It is likely that this was a whisky barrel, measuring approximately 692mm in original height, which had been repurposed as an open-top barrel for temporary storage and transportation of coal tar, indicated by the thick internal coating and external spills of once-viscous black tar. Robust iron brackets have been added to opposing sides of the barrel, which would

have held rectangular beams to facilitate transport, and a lead or tin plaque has been fastened with numerous small iron nails to three of the staves; the plaque is now corroded and illegible. An original circular bung survives, which appears to have been sealed with wax.

Four planks with spacers (SF25a–d; Area K) form part of a composite object, also associated with extraction and processing of coal tar. The planks have been sandwiched together horizontally, one atop the other, separated by long, narrow wooden spacers or runners which have been nailed to the top and bottom of the planks, running the width of the plank at each end. The edges of the short sides of the planks are cut at a 45° angle, and are successively shorter in length, forming an overall V-shape when stacked together. Thick coal tar is present on all faces, concentrating on the lower faces of the planks. The accumulation and morphology of the coal tar suggests that it flowed through the gaps between the planks when viscous and there may have been some form of mesh fixed with nails along the top edge of the planks, now lost.

Further lengths of degraded timber, likely to be components of dismantled internal structural fixtures and fittings, were noted across the excavated area, including a section of a plank-built block (SF4a–b) which had been used to block a gap between two brick walls in Area D (Context D0014).