Siller Holes, West Linton: a medieval lead mining site

Siller Holes, West Linton: a medieval lead mining site

Valerie E Dean

with contributions by
Carol Christiansen, the late Thea Gabra-Sanders, Anita Quye, Clare Thomas and Maureen Young

Address
Valerie E Dean, Honorary Research Associate, National Museum of Scotland, Chambers Street, Edinburgh, EH1 1JF

Author contact
V.Dean@nms.ac.uk

Funding
Hunter Trust

Hunter Archaeological & Historical Trust

e-ISSN: 2056-7421
https://doi.org/10.9750/issn.2056-7421.2019.81
Published by the Society of Antiquaries of Scotland with the Archaeology Data Service archaeologydataservice.ac.uk.

Society of Antiquaries of Scotland
National Museums Scotland
Chambers Street
Edinburgh EH1 1JF
United Kingdom

Managing editor: Catherine Aitken
Copy-editor: Helen Bleck
Production: Raspberry Creative Type, Edinburgh

www.socantscot.org
Registered Scottish charity no SC010440

TABLE OF CONTENTS

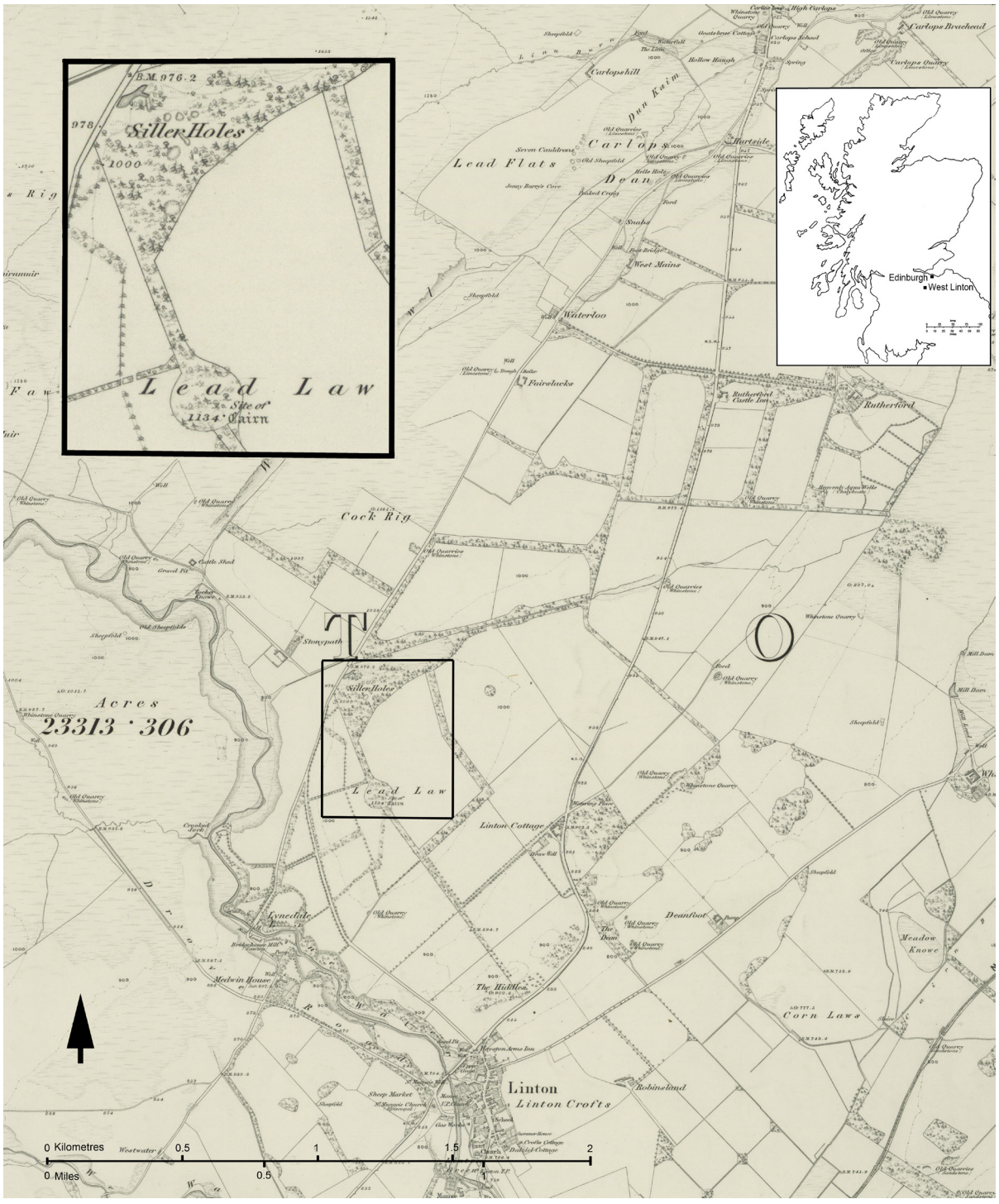
LIST OF ILLUSTRATIONS

ILLUSTRATIONS IN APPENDIX 2

LIST OF TABLES

1. ABSTRACT

Lead ore (galena) had been extracted from the site of Siller Holes, West Linton, from medieval times if not earlier; there, according to tradition, silver was refined from the lead (Pb). Creation of a pond at the foot of Lead Law produced large quantities of textiles, leather and pottery which could be dated to the 12th to 14th centuries; lead, slag and ore were also recovered. As there is no documented reference to the site until the late 16th century, it has not yet been established who was exploiting the minerals.



Illus 1 Location of Siller Holes, West Linton (Ordnance Survey 1858 'Peebles-shire', Sheet V, 1:10,560 (six-inch). Reproduced by permission of the National Library of Scotland)

2. INTRODUCTION

2.1 Background

At the request of Dr John Dent, Principal Officer (Archaeology & Countryside), Scottish Borders Council, a watching brief was mounted by Susan Oakes of West Linton on a development at Siller Holes (Canmore ID 344737), on the slopes of Lead Law (Canmore ID 50258), to the north-west of West Linton, Peeblesshire (Illus 1). This was in response to a desire by the farmer and owner of Cottage Farm, Professor J King, to plant trees and create a wildlife pond in the area between the road and the slope of Lead Law in an effort to improve an area of naturally poor drainage (Illus 2).

2.2 The site

The solid geology of Lead Law is rhyolitic tuff of Biggar Volcanic Formation (Old Red Sandstone). The drift, depending on location, could be till, fluvial sands and gravels or recent alluvium, but around NGR NT 145 533 it appears to be till (Nigel Ruckley, pers comm). There would be outcrop, probably the tuff, but there could be a little sandstone outcropping. The sandstone is from the Auchtitench Sandstone formation (Early Devonian).

The north-facing slope of the hill is covered with the remains of mine-working; there are pits, large and small, shallow and deep, and dumps of spoil (Illus 3), at the foot of which is an area of marshy ground. This had been in existence since at least as far back as 1849, being shown as a moss on a map of that date (Smith 1849). Running along the west edge of the site is a former Roman road (Canmore ID 108869) which later became the principal route between Moffat and Edinburgh (Illus 4). The first edition of the Ordnance Survey six-inch map (Illus 1) shows a pond close to the road and a number of the larger pits. It is not known whether the shallower pits had been backfilled with spoil from other pits or had not been further excavated.

A survey by the RCAHMS during October 1994 (RCAHMS 1995: 15) resulted in a detailed plan

Illus 2 The site. Trees cover the top of Lead Law, and pits and spoil heaps lie on its slope. The pond is visible behind the fence and the former Roman road is in the foreground (photograph: Valerie E Dean)

Illus 3 Siller Holes, looking north. In the centre, the extent of the mining remains is evident. The line of the Roman road runs diagonally across the area, to the west of the temporary camp (Google maps https://www.google.co.uk/maps/@55.7663242,-3.3621871,594m/data=!3m1!1e3 (accessed 24 April 2017). Imagery © 2016 Getmapping plc, Map data © 2016 Google)

Illus 4 In the centre is the pond, source of the finds. The area excavated by the University of Edinburgh lies to the far right (photograph: Valerie E Dean)

of the mining remains (Illus 5) which included many small, shallow pits, larger pits and spoil heaps (Illus 6) and a possible drift mine or adit. The pits run in two main east/west alignments across the slope of Lead Law, which suggests that they may be following a vein. Two parallel low banks mark a boundary between a former tree plantation and a neighbouring field to the south-west. These banks, in turn, overlie two sides of Stonypath Roman camp (Canmore ID 50251).

Illus 5 Field survey plan showing the rounded corner of a Roman camp amidst the mining remains. The finds were recovered from the disturbed areas around the pond (© Historic Environment Scotland)

Illus 6 Pits and spoil heaps litter the landscape (photograph: Valerie E Dean)

2.3 Archaeological background

During the period from the autumn of 1993 until the spring of 1998 the pond was dredged by machine and the silt dumped around the perimeter. Bone, cloth, leather, pottery, ore, slag and teeth were recovered by Susan Oakes from the resulting spoil dumps shown as disturbed areas on Illus 5 (Oakes 1994: 7). The distribution of the various finds was marked on sketch maps which have been deposited along with the finds currently held at the National Museums of Scotland Collection Centre. The bulk of more than 1,100 finds came from the most northerly dumps, where all categories were represented. Slag and ore were scarce in the more southerly recovery areas.

In June 1995 the Department of Archaeology of the University of Edinburgh (Coles 1995: 37–9) conducted its first annual field school in environmental archaeology at a site to the north-east of the pond, directed by Dr Geraint Coles and assisted by Dr Chris Burgess. The objective was to establish the origin of the medieval remains recovered from the site and to establish the relationship of these remains to the mines themselves.

Unfortunately, neither the 1995 excavation records nor the finds are available for examination; in particular the pottery was not studied. The

department's interim report (Coles 1995: 38–9) suggested three phases of activity, the first being associated by the finds to medieval mining, the second being the construction of water control structures and the possible cutting of new mine shafts during the late 18th and early 19th centuries, and the third phase linked to later agricultural improvements. There did not appear to be any stratigraphic or finds link of the site to the bell pits and spoil heaps, although some small pits cut into mine tailings.

As no study has been made of the pits and spoil heaps, these cannot be dated at present. The depths of the pits are unknown, as also are their functions – whether for extraction purposes or to provide ventilation for the lower workings. It may be that the spoil heaps' sizes give an indication of the depth of the pits. No structural remains have been found.

2.4 The finds

The finds, conserved and currently held by National Museums of Scotland, are therefore unstratified. They comprise a large collection of 12th- to 14th-century pottery, the largest collection of medieval textiles outside Perth, an abundance of worked leather (including several complete medieval shoes), butchered bone, wood, rope, slag and ore (see Table 10). As these had been recovered from a waterlogged environment, the degree of preservation was remarkable. The dating of this assemblage has led to the assumption that the mineworking was predominantly of the medieval period.

As the finds were recovered by fieldwalking, they are considered to be Treasure Trove and will be assessed and allocated to a suitable institution.

2.5 Historical background

The main lead vein appears to run south towards Lead Law from an area just below the village of Carlops, known as Lead Flats (Illus 1), where there are old workings. Jenny Barrie's Cave (Canmore ID 50178) is a rock-hewn tunnel and the Seven Cauldrons (Canmore ID 50177) are cone-shaped pits in a north/south alignment, possibly trial pits or ventilation shafts. According to local tradition, all these were worked from at least the mid-16th century.

An unpublished survey by Susan Oakes (nd) describes 46 mine and quarry sites in the West Lothian area where coal, lead, silver, ironstone, lime, sand, oil shale and clay were extracted and worked.

Lead is one of the first metals discovered and it has been mined and smelted for at least 8,000 years. Lead beads found in Anatolia have been dated to around 6500 BC and the Egyptians are reported to have used lead along with gold, silver and copper as early as 5000 BC (Britannica Online Encyclopedia 2017).

Beads made of lead were discovered in 1992 during the excavation of a Bronze Age burial site at West Water reservoir, just 3km south-west of Siller Holes. This, at almost 4,000 years ago, is the earliest evidence for the smelting of lead in Britain (Hunter et al 2000: 115–82). There are claims that stone and bronze implements were once found in old works at Leadhills and Wanlockhead (Hunter 1885: 376).

Galena, or lead ore, was probably mined in the Wanlockhead area as early as Roman times, although the fort nearest to it is at Crawford (Canmore ID 47396). However, as the Siller Holes site lies alongside a former Roman road, is adjacent to Stonypath temporary marching camp and is near to both North Slipperfield temporary camp (Canmore ID 144753) and Tocherknowe fortlet (Canmore ID 72048) at Lynedale House, extraction of lead and silver by the Romans cannot be discounted.

The Romans considered that ores no richer than two or three ounces (troy) of silver per ton of ore were worth cupelling for their silver (Bick 1990: 75). A lead pig was found at Strageath Roman fort (Frere et al 1989: 174–5) and its lead signature suggests that it was formed from ore mined in the Southern Uplands (Rohl & Needham 1998: 33–4, plot 16; Hunter 2006: 85). With the departure of the Romans, the need for both lead and mining skills went into decline. Metalwork found in Scotland after the second century AD was made from imported silver. Unfortunately, no Roman finds have been made at Siller Holes to date.

Norsemen are reputed to have mined lead on Islay (Pennant 1776: 207) and recent work on the island has established that lead mining was taking place there at least as early as the 1360s (Caldwell 2008: 231). There were also Norse settlements on Loch Sunart, adjacent to the Strontian lead vein; at both these locations the lead deposits were found close to the surface (Smout 1967: 108).

Silver was needed for coinage and David I (1124–53) is said to have obtained his silver from a mine in Cumberland (Macpherson 1805), which implies that none was readily available in Scotland at that time. It may have been the 16th century before Scottish silver was available for this purpose.

The first known name associated with Linton was the Norman name of Comyn, when a lesser family member, Richard Comyn, who had made a 'good' marriage to Hextilda, daughter of Uhtred of Tynedale and Bethoc, only daughter of Donald Ban, was granted lands by David I's son, Lord Henry; this may have been on the occasion of their marriage at around 1145 (Buchan & Paton 1927: 112). Sometime between 1152 and 1160 he granted to Kelso Abbey the church of West Linton, known then as Lyntun Ruderic or Rotheric, and half a ploughgate (26 hectares) of land in the 'villa' (Kelso Abbey 1846: 226, no. 274).

The powerful Comyn family became one of considerable importance, holding vast tracts of land across Scotland. However, as they had supported John Balliol's claim to the Scottish throne and had allied with Edwards I and II, they were dispossessed of their estates by Bruce sometime after 1308 (Young 1997: 205). Some lesser Comyns were more fortunate and were given lands; although Peeblesshire and Linton were not specifically mentioned, it is possible they may fall into this category.

There are several references to lead mining in Scotland in medieval documents, the earliest being to a mine on Crawford Muir granted to the monks of Newbattle in 1239 (Newbattle Abbey 1849: 110, no. 146). Nearly all refer either to coastal areas of the western Highlands or to the Lanarkshire–Dumfriesshire border, where the industry was later to have its greatest success (Cochran-Patrick 1878: passim). The monks of Newbattle Abbey may also have been responsible for the medieval exploitation of ore from Lead Law (Hall 2006: 204), although no direct connection has been established, or perhaps one of the Border abbeys may have had an interest there. These large buildings needed lead for roofing, window cames, water pipes and drainpipes and it was also used to make food vessels, utensils and trinkets. During the Wars of Independence the lead was stripped from the roof of Jedburgh Abbey in 1305 which would, in turn, have created a further demand for supplies for the repair works (Lewis & Ewart 1995: 140–43).

It was in 1313 that the Morton branch of the Douglas family appeared in Linton (Buchan & Paton 1927: 114), when William Douglas held the lands of Whitfield. The Douglases gradually increased their holdings until they held almost the whole of Linton, either as landowners or superiors, as well as lands in Newlands parish.

By 1424 the Scots may have mastered the difficult art of refining silver from lead (Smout 1967: 104) when the Scottish Parliament granted to the Crown 'all mines of gold, and all of lead where three halfpennies of silver could be fined out of a pound of lead' (Cochran-Patrick 1878: lix).

There is a local tradition that in the 16th century Siller Holes lead ore was exported to Holland, where the silver was extracted (Nicol 1843: 180). The *Statistical Account of Scotland* (1796: 624) notes that silver said to have been obtained from lead mined from the Linton vein was used by Mary of Guise to pay troops during her regency (1554–60).

The earliest documented reference to Siller Holes is in June 1592, when the reduction of the tack or lease of Mr Eustachius Roche refers to:

> the semes of mettelis discouerit and wrocht of auld: To wit the gold in Crawfurd mwre, Hinderland and Tuedis mwre the copper seme in Crawfurd mwre at the place callit Vamlok heid [blank] The seme of leid at Lyntoun callit Siluerhoilis: And to haue enterit ane sufficient number of warkmen: To wit thriescoir men of all sortis of warkmen necessar for ilk seme at the leist and to haue biggit houses mylnes fornaces cassin sinkis and mynes and done dyuers and sindrie vtheris thingis necessar for the practise of the mater of mettelis acording to the vse of myneris in Germanie and vther partis quhair mettelis is exerceit … (Cochran-Patrick 1878: 55)

The fact that the name Siller Holes means silver holes or mines suggests that silver had previously been extracted there prior to that date – and presumably in sufficient quantity to justify the name.

In 1631 the Douglas connection was severed when William, the sixth Earl of Morton, sold all his Peeblesshire lands to Sir John Stewart, later

the first Earl of Traquair (Buchan & Paton 1927: 117). Thereafter Linton was owned by a number of other proprietors and Siller Holes became part of the former Medwyn estate, which was broken up in the late 1920s.

Other early references to mining at Linton can be found in Macfarlane's *Geographical Collections*, the 1908 edition of 17th- and early 18th-century manuscripts collected by Sibbald, for example, 'Near Lintoun in Tweddale is found Lead and Silver' and 'the Silver Mines of Lead Law, half a mile above Linton commonly called the Silver Holes' (Macfarlane 1908: 16, 143).

The mining of galena had become the main occupation of speculators by the late 17th century as a result of the increasing use of lead in the making of pottery and glass (Wanlockhead Museum Trust 1975: 3). It had been found quite widely across Scotland, in particular at Leadhills and Wanlockhead, but also in Islay, Tyndrum and Galloway. In 1606 a vein of silver was found at Hilderston, near Linlithgow, but proved to be less fruitful than first thought and was abandoned soon after 1614 (Canmore ID 47939). By the late 18th century probably more than 5,600 tons of lead ore per year were being produced in Scotland (Smout 1967: 105).

Regular working of the Linton mines stopped around 1753 when Ronald Crawford & Co., tacksmen of Leadhills, ceased operations. The Earl of Wemyss and March had considered resuming operations in 1828, but the expense was too great and the project was abandoned by 1835 (Buchan & Paton 1927: 98).

In the early 19th century, cheap Spanish lead drastically reduced prices, although a revival in the latter half of the century kept the industry alive in Scotland until 1928. In the second half of the 19th century, the Leadhills and Wanlockhead mines were producing 97% of the ore in Scotland (Smout 1967: 106–7).

3. THE POTTERY

Valerie E Dean

3.1 Introduction

The overall impression of the assemblage was that virtually all the pottery was in the Scottish White Gritty Ware (SWGW) tradition. Five sherds were of 19th-century industrial pottery and therefore not included in this report, which will deal with 538 sherds of medieval pottery, with a total weight of 4,835 grams.

Many vessels were crudely wheelmade, although some were quite finely potted and thin-walled; from the evidence available, they did not appear to be heavily finger-rilled. Establishing the diameters and angles of rims and bases proved difficult. In part, this was due to the small size of the sherd, but was also due to the somewhat irregular rims and to knife-trimming on the lower walls of the vessels.

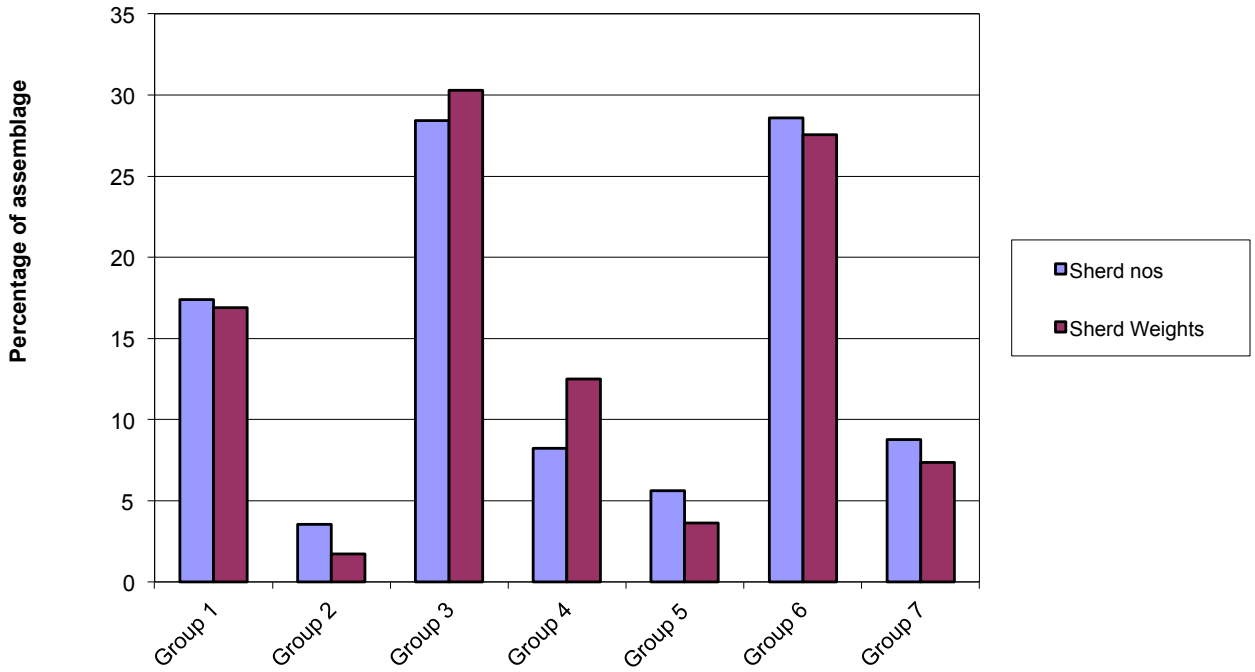
Few of the sherds had suffered abrasion since being broken, the original breaks remaining sharp; this did not include breaks during their recent discovery. The sherds were mostly quite small, the largest piece measuring 80mm × 70mm.

Very few joining sherds were found, due to the considerable disturbance caused immediately prior to their recovery. The degree of burning and sooting meant that only those sherds found close together or with fresh breaks were able to be joined.

The vast majority of the sherds appeared to be cooking pots, to judge by the amount of sooting: 85% of the material was heavily sooted. However, this is not a reliable method of identification, since many of the sherds had obviously been burned after they had been broken. Not only were interiors and breaks sooted, they had been so severely burned that in some cases identification of the fabric – as white gritty or anything else – was impossible. Uneven firing and later scorching resulted in some sherds becoming completely black. Even the colour ranges given below for each group may be somewhat inaccurate if the sherds had suffered later burning or scorching. A selection of heavily sooted sherds has been set aside for future radiocarbon dating.

More than 90% of the medieval pottery examined was of the SWGW tradition, with the remainder being a pale redware (Table 1). The white gritty sherds were split into two main groups, each of which was then further divided in three. However, there were considerable variations within the groups, the principal difference being that haematite in Groups 1 to 3 is absent or very sparse, whereas in Groups 4 to 6 it was much more apparent, suggesting different production sources.

Table 1 Sherd quantities



Traces of olive green glaze were noted on 72 sherds; on 34 sherds it was smooth, shiny and even, but on the remaining 38 sherds it was often barely discernible, being spotty and frequently very abraded. The heavy sooting may well have concealed further traces of glaze. It was impossible to ascertain the coverage as it varied from sparse spots anywhere between the rims and bases to the shiny, even coating on a very few body sherds. Many of the surfaces had been wiped, and creamy slip was present on a few redware sherds. A few sherds had been decorated by scoring with a sharp-pointed implement or with a comb.

3.2 Group 1: Scottish White Gritty Ware (Illus 7, Cat nos 1–10)

These 93 sherds, weighing 818 grams, are 2–10mm thick, have an irregular, hackly, laminated, voided and pockmarked texture and are fairly hard, with a harsh feel and rough fracture. The 30% inclusions comprise abundant, very poorly sorted, very fine to very coarse (grains up to 5mm), sub-angular, translucent quartz; sparse, poorly sorted, medium, sub-angular, black rock; very sparse, very poorly sorted, fine to coarse, angular ?slate; very sparse, poorly sorted, medium, rounded haematite; and very sparse mica. The outer surface varies from 10YR 7/4 very pale brown to 8/2 white. The interior varies from 7.5YR 7/2 pinkish-grey to 10YR 4/1 dark grey to 7/1 light grey to 8/4 very pale brown. The core goes from 7.5YR 4/1 dark grey to 10YR 8/2 white to 2.5Y 3/0 very dark grey. Several sherds are glazed, and the colour varies from 2.5Y 4/4 olive brown to 5Y 5/3 olive; it can be shiny, patchy or abraded.

3.3 Group 2: Scottish White Gritty Ware (Illus 7, Cat nos 11–13)

These 19 sherds, weighing 84 grams, are 2–6mm thick, have a fine texture and are fairly hard, with a slightly rough feel and fracture. The 20% inclusions comprise abundant, well sorted, fine, sub-angular, translucent quartz; sparse, well sorted, fine, rounded, black rock; and very sparse mica. The outer surface varies from 10YR 6/3 pale brown to 8/3 very pale brown. The interior is 10YR 7/3 very pale brown to 8/2 white, and the core is 10YR 5/1 grey to 8/2 white. One of the sherds has tiny flecks of olive glaze on the rim.

3.4 Group 3: Scottish White Gritty Ware (Illus 8, Cat nos 14–32)

The 152 sherds, weighing 1,465 grams, are 3–10mm thick, have a smooth texture which is occasionally slightly laminated or voided, is fairly hard, with a rough feel and fracture. The 10–15% inclusions comprise a moderate amount of very poorly sorted, very fine to coarse, sub-angular, translucent quartz; a moderate amount of very poorly sorted, fine to very coarse (5mm), well rounded and sub-angular, black and grey rock; very occasional, very well sorted, very fine, rounded haematite; and very occasional mica. The outer surface is 10YR 7/3 very pale brown, the interior ranges from 7.5YR 7/4 pink to 10YR 8/2 white to 8/3 very pale brown; the core is 7.5YR 6/4 pink to 10YR 8/2 white. Several of the sherds are glazed, ranging from 5Y 4/3 olive to 10YR 3/3 blackish brown to 4/6 dark yellowish brown to 5/4 yellowish brown; it tends to be even, but glossy or abraded.

3.5 Group 4: Scottish White Gritty Ware (Illus 8, Cat nos 33–36)

The 44 sherds, weighing 604 grams, are 3–10mm thick, have a hackly, irregular, laminated, voided or pock-marked texture and are fairly hard, with a harsh feel and rough to very rough texture. The 10–20% inclusions comprise abundant, very poorly sorted, very coarse, sub-angular, translucent quartz; moderate amounts of very poorly sorted, fine to very coarse, rounded haematite and red and grey rock; and very sparse mica. The outer surface is 7.5YR 7/4 pink to 10YR 7/3–8/3 very pale brown. The inner surface is 10YR 7/3 very pale brown to 8/2 white to 8/3 very pale brown. The core is 7.5YR 7/4 pink to 10YR 8/2 white to 2.5Y 4/0 dark grey. A few sherds have glaze, which varies from 10YR 4/4 dark yellowish brown to 5/4 yellowish brown to 2.5Y 5/4 light olive brown; it is even and shiny.

3.6 Group 5: Scottish White Gritty Ware (Illus 8, Cat no. 37)

The 30 sherds, weighing 176 grams, are 3–5mm thick, have a smooth, fairly hard texture, a slightly rough feel and a rough fracture. The 5–10% inclusions comprise fairly sparse, very poorly sorted, fine to very coarse (3mm), sub-angular, translucent

quartz; a moderate amount of very poorly sorted, fine to very coarse (3mm), rounded haematite; fairly sparse, very poorly sorted, fine to coarse, rounded, black, grey or red rock; and a moderate amount of mica. The outer surface is 10YR 8/3 very pale brown. The inner surface and core are 10YR 8/1 white to 8/3 very pale brown. One of the sherds has spots of glaze which is 10YR 4/4 dark yellowish brown.

3.7 Group 6: Scottish White Gritty Ware (Illus 9, Cat nos 38–52)

The 153 sherds, weighing 1332 grams, are 2–10mm thick and have a fairly smooth, occasionally laminated, fairly hard texture, with a slightly rough feel and rough fracture. The 10% inclusions comprise a moderate amount of very poorly sorted, fine to very coarse (3mm), sub-angular, translucent quartz; a moderate amount of very poorly sorted, fine to very coarse (3mm), rounded haematite; a moderate amount of very poorly sorted, fine to very coarse (5mm), rounded and occasionally sub-angular, black or red rock; and a moderate amount of mica. The outer surface is 7.5YR 7/4–8/4 pink to 10YR 7/3 very pale brown to 8/2 white; occasionally there is a surface skin 5YR 6/4 light reddish brown. The inner surface is 7.5YR 8/2 pinkish-white to 8/4 pink to 10YR 6/1 grey to 8/1 white to 8/2 very pale brown. The core is 7.5YR 4/0 dark grey to 10YR 5/1 grey to 8/3 very pale grey. Several sherds are glazed, and this varies from 10YR 4/6 dark yellowish brown to 2.5Y 5/4–5/6 light olive brown to 5Y 5/3 olive; it is generally even and shiny, but can be abraded.

3.8 Group 7: Redware (Illus 9, Cat nos 53–59)

These 47 sherds, weighing 356 grams, are 3–10mm thick, have a fairly smooth, occasionally slightly laminated, fairly hard texture, sometimes with grass voids. It has a slightly rough feel and rough fracture. The 20% inclusions comprise a moderate amount of very poorly sorted, fine to very coarse, sub-angular translucent and white quartz; abundant, very poorly sorted, fine to very coarse (3mm), rounded haematite; a moderate amount of very poorly sorted, fine to very coarse (4mm), rounded, black, red and occasionally white rock; and a moderate amount of mica. The outer surface is 7.5YR 7/4 pink. The inner surface is 7.5YR 6/4–8/4 light brown to pink. The core is 7.5YR 6/4–7/4 light brown to pink. Several sherds are glazed, and this varies from 7.5YR 5/4 brown to 2.5Y 5/6 light olive brown; it is generally even and shiny, but occasionally occurs as spots. A few sherds show traces of slip, 7.5YR 8/2 pinkish white or 5YR 8/3 pink.

3.9 Catalogue of illustrated pottery

▸ Fabric 1 (Illus 7)

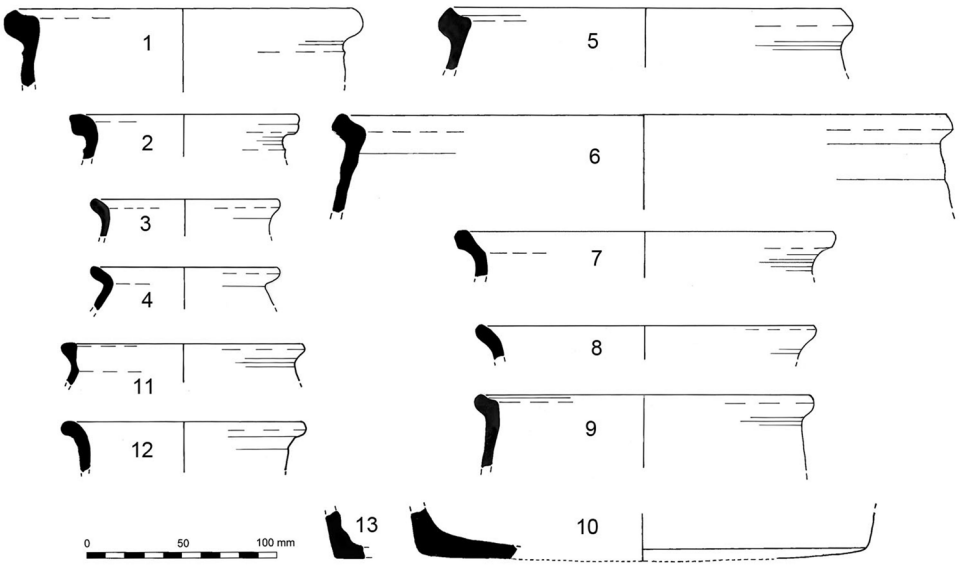
1 Jar or cooking pot.
2 Small cooking pot? Heavily sooted.
3 Small cooking pot? Tiny spot of glaze on rim.
4 Small cooking pot?
5 Jar or cooking pot. Tiny spots of glaze below rim.
6 Large jar.
7 Jar or cooking pot.
8 Jar or cooking pot? Traces of glaze on underside of rim.
9 Jar or cooking pot.
10 Jar or cooking pot. Large patch of glaze on base.

▸ Fabric 2 (Illus 7)

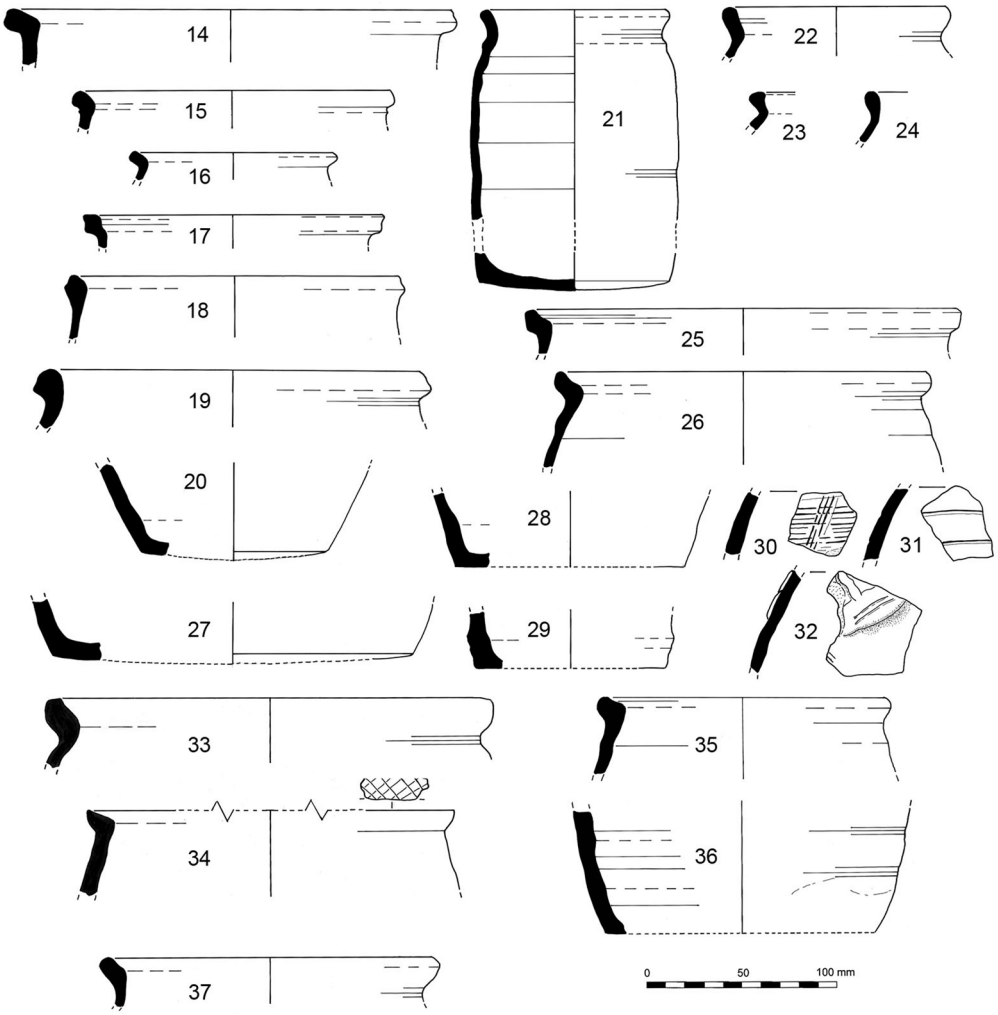
11 Small cooking pot?
12 Small cooking pot? Glaze spot on rim. Heavily sooted.
13 Base of small cooking pot? Trace of possible wire marks.

▸ Fabric 3 (Illus 8)

14 Jar or cooking pot.
15 Jar or cooking pot.
16 Small jar or cooking pot.
17 Jar or cooking pot.
18 Jar or cooking pot. Heavily sooted.
19 Jar or cooking pot.
20 Cooking pot?
21 Cylindrical jar.
22 Jar or cooking pot.
23 Jar or cooking pot. Glaze spot below rim.
24 Jar or cooking pot. (Grey ware.)
25 Jar or cooking pot. Splash of degraded glaze below rim.
26 Rounded jar or cooking pot.
27 Cooking pot? Glaze spots on base.
28 Cooking pot? Heavily sooted.
29 Jar or cooking pot.



Illus 7 Fabric groups 1 and 2



Illus 8 Fabric groups 3, 4 and 5

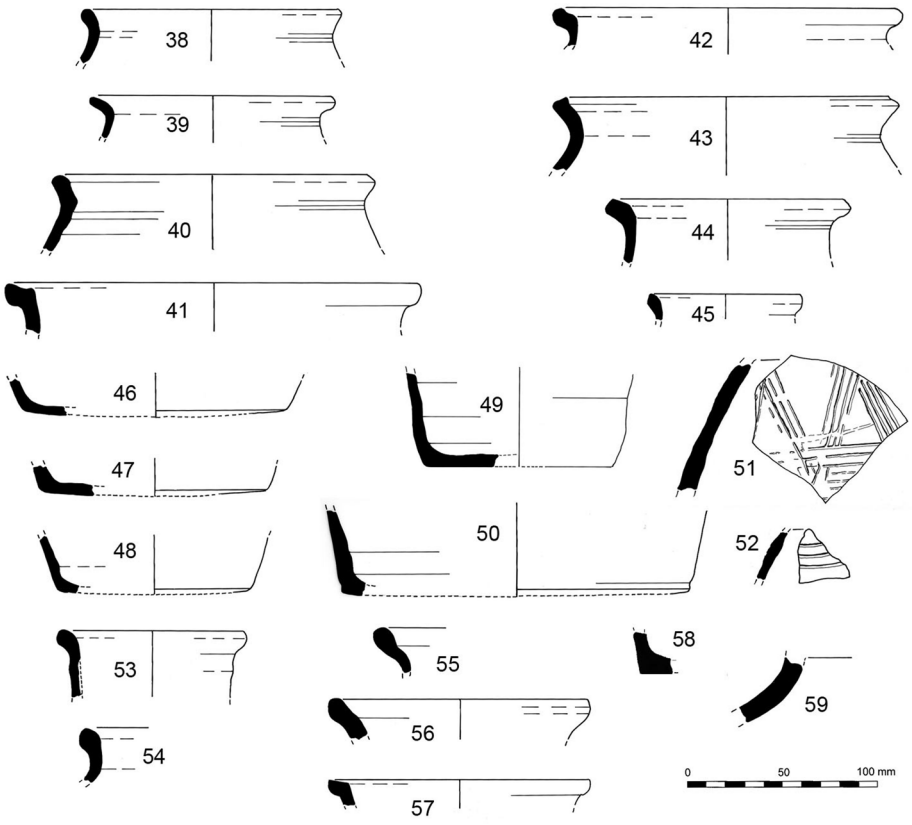
30 Jug? Body sherd with horizontal and diagonal combed decoration. Shiny, even glaze.
31 Jug? Body sherd with horizontal scored decoration. Traces of very pale yellow-green glaze in the scores.
32 Jug? Body sherd with trace of applied decoration. Shiny, even glaze.

▸ **Fabric 4 (Illus 8)**
33 Rounded jar or cooking pot.
34 Jar or cooking pot with criss-cross scored decoration on rim top. Heavily sooted.
35 Jar or cooking pot.
36 Rounded jug or jar. Thin, matt, even glaze on exterior.

▸ **Fabric 5 (Illus 8)**
37 Jar or cooking pot.

▸ **Fabric 6 (Illus 9)**
38 Jar or cooking pot.
39 Jar or cooking pot.
40 Rounded jar or cooking pot. Glaze spots on exterior.
41 Jar or cooking pot. Spot of glaze on exterior.
42 Jar or cooking pot.
43 Rounded jar or cooking pot.
44 Jar or cooking pot.
45 Small jar or cooking pot.
46 Jar or cooking pot.
47 Jar or cooking pot.
48 Jar or cooking pot.
49 Jar or cooking pot.
50 Jar or cooking pot.
51 Large jug? Body sherd with criss-cross combed decoration. Shiny, even glaze on exterior.
52 Jug or jar. Body sherd with horizontal grooved decoration.

▸ **Fabric 7 (Illus 9)**
53 Jug or jar. Tiny glaze speck on exterior.
54 Jar or cooking pot. Spots of glaze on exterior.
55 Jar or cooking pot. Slip on interior.
56 Small jar or cooking pot.



Illus 9 Fabric groups 6 and 7

57 Small jar or cooking pot. Very slight traces of external glaze.
58 Jar or cooking pot. Basal sherd with spots of shiny glaze on exterior.
59 Large jug? Shoulder sherd with abraded, shiny, external glaze.

3.10 Discussion

White gritty pottery was in widespread use across Scotland from the 12th to 15th centuries, suggesting that there were many production centres. However, the only one to be positively identified is at Colstoun, near Haddington in East Lothian (Brooks 1981; Hall 2007). More recently, signs of other sites have been noticed in Fife, but these have yet to be investigated, and others are suspected in the Lothians and Fife (Jones et al 2006).

From the limited vessel forms available and the amount of sooting it appears that most of these are cooking pots, typical of the 12th and 13th centuries, such as the straight-sided, flat-bottomed vessel (Illus 8, no. 21), which is similar to those from the 12th-century Pit BY at Kelso Abbey (Cox et al 1985: 381–98). There is a small portion of a flared spout (not illustrated), probably from a jug of similar date (Jones et al 2006: 55: type 12). A rim (Illus 8, no. 34), whose upper surface bears cross-hatched decoration, resembles a rim from Kelso phase 1 drain BT (Cox et al 1985: 389: illus 21, no. 51). Those cooking pots with more rounded bodies are likely to be of a slightly later date, perhaps into the 13th or 14th centuries (Jones et al 2006: 47).

It is possible that white gritty pottery cooking pots normally had a short life, since it would have been difficult to clean food residues from the interior; if left, these would have tainted future contents. By their very nature, these pots must have suffered when subjected to the wear and tear of heating over an open fire, which may account for the considerable number of sherds with sooting on the interior and on broken edges.

If the site was one that could be considered to be affluent, or within easy reach of a production centre or clay source, then such vessels might have been treated as being disposable. If, as Derek Hall suggests (Hall 2006: 204), the lead mines as Siller Holes were under the ownership of the Cistercian monks of Newbattle from the 12th century, then it is possible that they also established a pottery industry to supply the workforce.

On the other hand, the high degree of sooting on the Siller Holes vessels might suggest considerable reuse, implying that the local economy or the lack of availability demanded that care be taken to prolong their lives.

Redwares seem to have appeared a little later, in the mid-13th century, and are most commonly found along the east coast of Scotland (Hall 1998). This orange-brown fabric initially contained quantities of quartz but, as firing methods improved and metal was being increasingly used for cooking pots, the gritting became less important. An olive green glaze was often used. Kilns at Rattray, Aberdeenshire, produced redwares from the 13th to the early 15th centuries (Murray 1993: 148–69).

It is interesting that the dating of the leather footwear (see Section 8 below) corroborates these early dates, since the pottery was found in close association with the remains of shoes of the 12th to 13th centuries.

With the exception of a few sherds of 18th- or 19th-century industrial pottery, none of the assemblage could be dated to later than the 14th to 15th centuries.

4. THE TEXTILES

Carol Christiansen and the late Thea Gabra-Sanders

4.1 Introduction

The following report and catalogue was initiated following a request by the National Museums of Scotland (NMS) to complete work begun in the 1990s by the late Thea Gabra-Sanders on the textile assemblage from the Siller Holes archaeological site. NMS supplied Gabra-Sanders' preliminary unpublished report and incomplete catalogue, an unpublished report on the site and circumstances of the find, some photographs, unpublished dye analysis and leather finds reports. The author was given access to most of the textile finds for analysis, except those currently on display at NMS. After an initial review of the reports, catalogue and finds, it was decided that the textiles initially analysed by Gabra-Sanders should be re-examined, owing to the incomplete nature of her catalogue, a significant number of the collection which had not been examined by her, and changes in focus and methodology of textile analysis in the last 15 years.

The finds are numbered in the present report and catalogue based on find bag numbering and following the convention used in Gabra-Sanders' catalogue. Some textiles examined by Gabra-Sanders are not included in the present report because they are presently on display at NMS or because they could not be located. Conversely, textiles which had not been examined by Gabra-Sanders now have been analysed and are included in the present catalogue. Statistical analysis included in this report is based on woven textile finds examined by the present author only.

4.1.1 Methodology

The textiles were examined by eye, hand-lens and digital microscope. Each of the textiles was analysed using standard methodology for structure and appearance. These include spin direction (s, z), spin angle (ie degree of twist), thread diameter for each system, weave pattern (twill, tabby, etc.), thread count (ie fabric density), whether pigmentation is visible in any fibres, and surface appearance suggesting original surface treatments, wear and degradation (Walton and Eastwood 1988; Emery 1994). For spin angle and thread diameter, ten measurements were taken for each thread system; for thread count, three measurements were taken for each thread system, unless otherwise noted.

Each find was photographed using a DSLR camera and digital microscope image capture at 20× or 40× magnification. In each of the magnified images the woven textiles are situated with presumed warp threads in vertical position and the fabric is placed with the probable right (outer) side facing, unless otherwise noted.

The textiles were arranged and analysed according to visual groups based on methodology developed by Hammarlund (Hammarlund 1998; Hammarlund 2005; Hammarlund et al 2008). This convention balances the emphasis on quantitative results from standard analytical methods, and identifies qualities in the cloth that cannot be ascertained from standard analysis. Arranging the textiles by similarity of visible qualities can help to identify fragments which are similar and may have originated from the same textile.

4.1.2 The site

The Siller Holes textiles were discovered during an archaeological watching brief, in spoil heaps resulting from land development in an area of previous lead mining. The finds are reported to have been extracted from spoil over a five-year period. As such, no firm dating contexts exist. The majority of the textiles have been tentatively dated to the 13th and 14th centuries, but dye analysis suggests that at least two textiles may be modern. Some show evidence of soil, roots and sun-fading in patches due to exposure. These post-deposition conditions differ from textiles found in underground mines, where conditions were generally more stable (Stöllner 2005; Grömer et al 2013).

4.2 Woven textiles (Table 2)

The Siller Holes group of textiles discussed in this report numbers 101 woven textiles, seven examples of matted fibres, and four fragments of rope or separate thread. The majority of the woven textiles are typical medieval cloth types found throughout northern Europe. They comprise a range of extremely fine cloth to very coarse fabrics and exhibit a range of skill in terms of manufacture.

The three main weave types are represented: plain weave (tabby), 2:1 twill and 2:2 twill. There are no examples of lozenge, diamond or herringbone twills, or any other more specialised weave constructions such as tablet weaving. The Siller Holes group of textiles appears to be mainly plain fabrics with little embellishment and without requiring the skills of specialists to make. The medieval textile assemblage found at Perth is similar in this regard (Dransart et al 2012: 9–10).

In Scotland the assemblage can be compared with two other large collections from medieval contexts in Aberdeen and Perth (Gabra-Sanders 2001; Dransart et al 2012), in England from London (Crowfoot et al 1992) and from Tønsberg, Norway, Lödöse, Sweden, and Turku, Finland (Hammarlund et al 2008). Unlike these medieval urban locations however, the Siller Holes site was both industrial and rural and the textiles assemblage presents a similar but less diversified group than that seen in large urban contexts.

4.2.1 Wool preparation

The amount of processing required to prepare wool for spinning was time-consuming and could add to the cost and value of a textile. Teased or carded wool generally created a light, three-dimensional thread and more woollen cloth, with fibres going in many directions; combing was used where a smooth thread or more worsted fabric was required, since wool fibres were aligned parallel.

A number of the Siller Holes textiles show signs that fibres were combed before they were spun (Find nos 94.1, 94.3, 123.1, 136, 147, 163, 164, 265, 273, 285, 361, 452, 454.1, 631, 663). The wool fibres in both thread systems appear parallel, and the threads are shiny and smooth. These worsted fabrics could be stiff if woven tightly, or have drape if more loosely woven, but in either case they had reduced insulating properties than more woollen-prepared fabrics. Typically no finishing treatments were used on worsted fabrics and for that reason they were considered less costly to make (Crowfoot et al 1992: 39). One of these, Find no. 136, can be identified as a shirt front from the cut of the fabric, and may suggest that the other textiles with similar quality also were used for clothing. These cloths may not have been imports from England, where worsted fabrics were commonly produced. One fragment from Siller Holes (Find no. 164) is made of very hairy wool, and others include pigmented wool fibres. These worsted fabrics may reflect fleeces taken from local sheep flocks.

4.2.2 Spin

Most of the Siller Holes woven textiles (79%) were made with differences in spin direction between the two thread systems, which was a typical medieval practice. In medieval Perth, the situation is similar, with the majority of woven cloths using single spun threads using a z/s combination (Dransart et al 2012: 7). It is most likely that z-spun threads, which are usually narrower, are the warp and the s-spun, wider, threads are the weft.

In 2:1 twills, which are not the same on both sides, the weft is more prevalent on the reverse side. In the Siller Holes group, which is almost exclusively 2:1 twill, we see many fabrics where the s-spun threads are significantly wider than the z-spun thread (Find nos 124, 135, 328, 331.1, 358, 413, 521, 533, 557). On the non-twill (reverse) side of the fabric, the wider threads predominate, and create a soft, warm fabric next to the skin. This occurs in many of the coarser fabrics, whether plain or patterned (see below).

Generally it is more common for warp threads to have more twist than the weft, since twist imparts strength and warp threads are under tension while weft threads are not. However, in the Siller Holes assemblage the s-spun (weft) threads often have a higher level of twist than z-spun, and in some cases remarkably so (Find nos 113.2: 56%, no. 124.1: 60%, no. 313: 65%, no. 328: 61%, no. 351.1: 50%, no. 374: 80%, no. 521: 54%, no. 533: 57%, no. 610.2: 60%). This is an unusual occurrence in medieval fabrics. It meant extra work for the spinner, and was probably a conscious choice given its prevalence among the assemblage. The reasons for such high twist levels in the s-thread system may be due to the quality of wool available. Short fibres require considerably more twist to hold the thread together. Low-quality or waste wool is often short and could have been obtained from a variety of sources: heavily soiled wool removed

during wool grading, fibre waste from combing longer wools, and wool removed from stillborn lambs, slaughtered animals in autumn and winter livestock casualties. Such wool appears also to have been used in the felted and matted fibres.

There are 19 examples (19%) of z/z spinning but only three fabrics (3%) with s/s spinning in the Siller Holes group. In Perth 32% of fabrics were spun z/z, with fewer than 1% spun s/s. The apparent lack of s/s spun cloth in Scotland is typical for the period, as it appears to lose favour in the medieval period. It is under-represented in the cloth found in medieval London (Crowfoot et al 1992: 27).

4.2.3 Weaves

The most cohesive aspect of the Siller Holes collection is the overwhelming number of 2:1 twill, comprising 87%, against the other two most common binding types, plain weave (tabby, 1%) and 2:2 twill (1%). The 2:1 weave type was prevalent throughout the medieval period, gaining popularity and reaching a peak during the 13th century (Crowfoot et al 1992: 27). However, by the mid-14th century it had lost favour, possibly as a result of developments in horizontal looms in this period.

The Siller Holes group is highly unusual in the almost exclusive use of this weave type as compared to the Perth and Aberdeen finds, where 69.5% and 55% respectively are identified as 2:1 twill (Gabra-Sanders 2001: 222; Dransart et al 2012: 9), although note that weave type could not be determined in 45% of the Aberdeen textiles. The reasons for this are unknown, but may indicate a more homogeneous group of textiles owing to a localised, non-urban context. The viewpoint that 2:1 twills were not suited to the use of the vertical warp-weighted loom has been discounted in recent years, and this twill type can be made on either a vertical or a horizontal loom by a skilled weaver. Therefore, the prevalence of this weave type at Siller Holes cannot shed light on the introduction or diffusion of the horizontal loom in Scotland, and its prevalence at Siller Holes may have to do with localised regional preferences over a specific, limited period.

4.2.4 Finishing treatments

It was common in the medieval period to finish woollen cloth by fulling, sometimes in conjunction with napping, once the fabric had been removed from the loom. Fulling involves wetting and beating or stamping the cloth, thereafter stretching it to an even shape. It thickens and shrinks the cloth and can make it softer, more pliable and more hard-wearing, depending on the level of fulling imposed (Christiansen and Hammarlund 2014). By definition, fulling occurs to both sides of the fabric at the same time.

Napping was an additional process, which added significantly to manufacturing cost and therefore was not used on lower quality fabrics (McMillan 2012: 5). It required brushing the cloth with teazles to raise the surface fibres, then sometimes shearing the raised fibres close to the surface (Goldmann 2007). Napping could be applied to one or both sides of the fabric, but the more a fabric was napped the more expensive it became. A napped surface could wear off with use, making it difficult to recognise in the archaeological record.

Several examples (Find nos 77, 136.1, 313, 446, 454.2, 802) in the Siller Holes collection show evidence of napped surfaces. In two, Find nos 313 and 454.2, there is evidence of raised surfaces which have been sheared. Example 313 shows napped surfaces only on the underside of seams, and shirt front Find no. 136.1 has a napped surface on the inside facing of the central opening. These examples may indicate that the napped surface was used as the underside, to provide greater warmth.

In some archaeological textiles it is difficult to determine surfaces raised as part of a finishing treatment, especially where this surface has partially worn away, from woollen fibres raised during use. Certainly the thick weft threads used in the 2:1 twills, where they dominate the reverse of the fabric, achieved a disturbed surface during use. If a textile is very heavily used, any raised fibres are usually worn away until the cloth is literally threadbare. But textiles which have been discarded before they are heavily worn may show surface disturbance from use or from a finishing treatment. Such disturbed surfaces are noted in the Siller Holes catalogue.

4.2.5 Broadcloth

Three fragments (Find nos 77, 446, 802) are very hard fulled, with possible raised, napped surfaces. All are twills and one (Find no. 77) has been dyed. These qualities suggest they are broadcloth, a fabric developed in the medieval period and produced in large quantities throughout Europe by the 15th century (Coatsworth 2012: 97). Broadcloth was considered a high-quality fabric because of its intensive finishing treatments, which also made the fabric extremely hard-wearing. As such, clothing and other textiles made from broadcloth were passed down or traded for reuse (Munro 2009: 6). It is likely the Siller Holes examples are off-cuts of larger pieces of second-hand broadcloth, and because of their sturdy nature were ideal fabrics for paddings, insulation or other uses where a thick, hard-wearing cloth was required by mineworkers.

4.2.6 Colour and patterning

The use of colour in fabrics was important in the medieval period (Pritchard 1990; Dahl 2009; Vestergård Pedersen 2009). Even medium- to poor-quality fabrics at Siller Holes incorporate colour and pattern into cloth design in the form of dyed cloth, dyed yarns formed into coloured stripes, and the use of natural wool colours to create finely checked and mottled fabrics.

Dye analysis has been performed on some of the fragments where dyes appear to have been used. Dyes applied to the entire fabric, probably after weaving, have been used in some textiles (Find nos 77, 114, 454.2, 521, 555, 631). In other cases dyes are used sparingly, where dyed threads are inserted as stripes (Find nos 121.5, 139, 234, 256, 663.1) (Illus 10c; Illus 11c). The fragments are small and it is not possible to determine the extent of the use of stripes, or the original function of these cloths.

The Siller Holes collection includes a large group of fragments in which there is purposeful colour design by using one or two weft colours which differ from the colour of the warp. Like the majority of the cloth recovered at Siller Holes, these fabrics are 2:1 twill. The juxtaposition of different warp and weft colours creates a mottled effect on the twill side of the fabric, undoubtedly the right side, and a striped effect on the reverse (Find nos 94.2,115, 156, 261, 264, 331.1, 430, 453.1, 610.2.4, 801). A 2:1 twill fabric with thick wefts and colour differences between warp and weft has been found in an Irish burial dating to the 7th century (Wincott Heckett 2013: 167). It has been interpreted as a woman's tunic because of its attachment to a rib bone. There are six examples of mottled 2:1 twill from medieval Aberdeen, although the mottling is confined to a single-coloured weft (Gabra-Sanders 2001: 223)

In nearly all cases where natural wool colour mottling has occurred, the weft threads are significantly thicker than the warp. This may have been necessary to effectively show the different weft colours on the twill (right) side of the fabric, where the warp threads dominate. An added benefit to using thick wefts, especially in a twill where these threads dominate on the reverse, is that it creates a fabric which is thicker and more three-dimensional than in plain weave, or a twill with thin wefts. Plain-coloured textiles at Siller Holes also show this feature (see above). During wear the surfaces of the weft threads become disturbed and create a soft 'flannel' effect close to the body, which provides added warmth. This property can be seen in Siller Holes examples Find nos 94.2, 115, 156, 224.2, 261, 331.1, 430, 453.1, 610.3 and 801.

4.3 Matted fibres (Table 3)

Matted fibres are found in six examples. They are loose wool fibres with no underlying textile structure, which have become pressed together through the combination of movement and moisture. Most of the examples appear not to be true felt, which is fibre (usually processed by teasing or carding) that has been purposefully beaten with moisture into a mass to create a felt 'fabric'. The Siller Holes wool shows evidence of original wool staple formation, indicating the wool was not prepared before being pressed. It is in thin layers which can be loosened and were simply clumps of wool loosely pressed together, probably through use. All of the Siller Holes examples were originally white wool, with a few having some naturally coloured fibres mixed in. The matted wool fibres in the Siller Holes material are generally short, suggesting they were waste wool.

There is evidence that padding was used at Siller Holes, as in the two textile fragments found in shoes (Find nos 801, 802). Mine workers would have

benefited from various types of pads to protect the body or ease working conditions, especially when working in wet and damp conditions in open-pit mines. It is not clear whether any of the felted or matted fibres found at Siller Holes were used for this purpose, as at another mining site where felt pads have been found, one elongated example has been interpreted as padding for a shoulder strap (Nutz 2015). Numbers 584 and 617 have distinct holes, and may have been used as cushioning or insulation for building or industrial purposes.

4.4 Rope and thread (Table 4)

Among the textile remains are a number of rope fragments, all made of hair. Several of the rope fragments may have been made by twining. This is a very simple technique, in use since the Neolithic for making cords and ropes, and can be done by one person, without the use of tools (Reichert 2013: 79–81). Rope Find nos 110.6 and 545 appear to have starting knots, especially Find no. 545, where it is clear to see how this simple rope was constructed (Illus 10d). Rope Find no. 110.6 is a more complex mass of hair, with wool thread attached. Textile Find no. 695 is a knot of woollen thread and likely to be spinner's waste. This may indicate that the spinning of threads was taking place at the site.

4.5 Discussion: textiles at a mining site

The Siller Holes site revealed a number of small, shallow pits and several larger ones, perhaps indicating that some mining may have taken place on open ground and leaving the workers exposed to the environment. An adit on the slope of Lead Law suggests mining may also have taken place underground, although the entrance has not been fully investigated. In this case mine workers would have faced a different environment – potentially damp, but protected from the weather. Indeed, miners working deep underground often required little clothing, as the body was warmed by activity and ground heat. The differences between open pit and underground mining may have affected the types of clothing, and possibly the forms of industrial textiles, required to operate the mine and carry away lead at Siller Holes.

Miners across Europe appear to have worn padded or quilted clothing and some type of headwear (Turnau 1994: 96–9). None of the Siller Holes textiles show evidence of layered fabrics sewn or quilted together and no examples of headwear could be identified.

The majority of the Siller Holes textiles appear to be discards, scraps and offcuts of larger pieces of fabric, garments or other textiles. As such, their use at Siller Holes was probably secondary (or more) to their original use.

Some heavily fulled or felted textiles show evidence of cut edges, such as two small examples of probable broadcloth, Find nos 77 and 446, and fulled fragments Find nos 94.2, 374, 454.2, which may be discards from trimmed fabrics, and which had no further use. Larger pieces such as Find nos 67, 315.1 and 423 were also probably cut from pre-used fabrics but were valuable enough to be used again. These thick and heavily fulled fabrics may have served as pads for feet, knees or shoulders when working the mine or carrying away lead. Textiles such as these may have served more than people working at the mine. A late 16th-century document relating to lead mining in Lanarkshire shows that horses equipped with 'armour clothing' were used to transport lead from Crawford Muir to Edinburgh (Cochran-Patrick 1878: 102).

Three textiles were found associated with shoes (Find nos 110.5.1, 801, 802) (Illus 10a) and indicate that mine workers benefited from padding and insulation for their feet. The open nature of the pit mines, located in cool and damp central Scotland, may have driven mine workers to reuse thick cloth fragments underfoot, or possibly as protection and warmth for the upper part of the foot.

A number of seams survive, but often without much surrounding fabric remaining (Find nos 124.1, 163, 285, 313). The seams, being two to four layers of fabric stitched together, were the strongest part of a sewn textile. The surviving seam fragments are certainly scraps of clothing or other sewn textiles which were discarded once they had become threadbare and no longer usable.

An exception is the left yoke front of a shirt, Find no. 136.1 (Illus 10b), which was cut away from the rest of the garment. It had been repaired at least once, having a diamond-shaped patch of similar fabric carefully and artfully sewn onto the shirt front

at the midriff. This textile provides valuable evidence as to the quality of cloth used for shirts in central Scotland and may indicate the type of clothing worn by mine workers.

The largest shaped fragment, Find no. 124, may be a sleeve. It is hemmed on the long edge and on a short section of the lower edge (Illus 11a).

Another fragment which may be a remnant of a shirt is the dyed and gathered fabric Find no. 631 (Illus 11d). No dye analysis was undertaken on this textile, but the wool appears combed and the sewing threads are made with skill. Together these features indicate this was a quality fabric.

A number of the Siller Holes textiles are thick and coarse, but one textile, 67, stands out as similar to textiles identified as carrying cloths or bags in other mines. This textile is probably too coarse for clothing, but ideal as heavy sackcloth, either as sewn bags or as flat cloth bundled at corners into bags. It is similar in quality to 15th- to 17th-century hauling bags found at gold mines in Salzburg and Carinthia (Nutz 2015).

4.5.1 Bias strips

The Siller Holes textiles contain an unusual group of narrow fabric strips, cut on the bias (Find nos 99, 110.6, 224.1, 234, 315.2, 331.3, 377, 524, 612, 654, 803) (Illus 10c). There are no common features as to the quality of these textiles, other than that they are twills. Many of this group show one edge turned under, even those which are heavily fulled. These strips were purposely cut on the bias. In this way they resemble facings or bindings for textile edges, such as at the neck and wrist, or reinforcement for the tops of sacks. The bias cut would indicate they were meant to be placed on round openings, or their purpose required stretch.

Strips have been found at other mining sites, although they are not necessarily cut on the bias, as at Siller Holes. At Hallstatt and Carinthia these have been interpreted as fragments discarded or laid aside as part of a 'rag chest' to be used by mine workers for many purposes. In some cases they may have served miners directly as headbands, fingerstalls and other protective wraps for hands, and wound dressings (Stöllner 2005: 171; Grömer et al 2013: 130, 132; Nutz 2015). A brass relief from Clearwell Chapel in Newland Church, Forest of Dean, shows a 15th-century miner in work dress. He wears garters at his knees, and carries a container on his back, fitted over his shoulder with a strap (Nicholls 1858: [iii], 217).

In other cases cloth strips may have been used for operations in the mine. Indeed, a direct correlation between areas of discarded axe handle fragments and textiles at the Dürrnberg mining site strongly indicate that textile fragments were reused in the repair and hafting of tools (Stöllner 2005: 166). Evidence of looped and knotted strips, such as Find no. 118.2 (Illus 11b), have also been found at Dürrnberg and are thought to have served for hauling or hoisting (Stöllner 2005: 171).

4.5.2 Cloth qualities

Of the woven cloth, the most striking aspects of the Siller Holes assemblage are the nearly exclusive use of 2:1 twill, the preponderance of thick, tightly spun wefts and the application of surface treatments such as fulling. In addition, overall there is a lack of embellishment or decorative, complex weaves. Such fabrics can be made more quickly and cheaply than finer cloths.

These qualities indicate that the majority of fabrics at Siller Holes were designed to be soft, thick fabrics that could provide added insulation and warmth on the reverse side of the fabric. These fabrics would have been ideal for workers' clothing in open-pit mines, where they had to work outdoors in the damp, cool climate of central Scotland.

Some of the fabrics found at Siller Holes are likely to be second-hand off-cuts and scraps from larger pieces of fabric, to be used for purposes specific to work at the mine. These may have served as pads and insulation for the body or for industrial use. The preponderance of bias strips suggests that rags and cut lengths of fabrics were required for various purposes on site.

a

b

c

d

Illus 10 Textile finds. (a) Find no. 110.5.1: A leather shoe with its thick, felted lining (© National Museums of Scotland); (b) Find no. 136.1: A diamond-shaped patch has been carefully sewn into this shirt front (photograph: Carol Christiansen; © National Museums of Scotland); (c) Find no. 234: Dyed threads have been inserted as stripes in this bias-cut strip (© National Museums of Scotland); (d) Find no. 545: Starting knot in a piece of rope (photograph: Carol Christiansen; © National Museums of Scotland)

a

b

c

d

Illus 11 Textile finds. (a) Find no. 124: Possibly a sleeve, this fragment is hemmed on the long edge and on a short section of the lower edge (© National Museums of Scotland); (b) Find no. 118.2: This looped and knotted strip may have served for hauling or hoisting (© National Museums of Scotland); (c) Find no. 256: Dyed threads have been inserted as stripes (© National Museums of Scotland); (d) Find no. 631: This fragment's wool appears to have been combed and it has skilfully made sewing threads (photograph: Carol Christiansen; © National Museums of Scotland)

Table 2 Catalogue: wovens

Light blue cell highlight indicates textiles examined by TGS but not CC; * indicates missing

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
32	Thick, heavy and compact dark brown 2:1 twill; hairy fibres on both surfaces; edge around half of fragment turned under to wrong side in even width (5–7mm) and heavily felted in folded state	24.0 × 17.5	2:1 twill	z/s	42.8/52.4	0.87/1.1	9/6	medium-dark brown/medium-dark brown	x	probably fulled: very thick and felted; some surface areas heavily disturbed on both sides	
50.1	Very fragmented and worn stained fragment patched with 2 different fragments; weaving mistakes; two z-spun yarns paired at intervals; s-spun floats over 3 warps	28 × 23	2:1 twill	z/s			11/6	brown		felted on both sides	roots
50.2	Patch 1 of 50–1; stained fragment; has 3 hems which have a raw edge folded back and oversewn onto fragment 50/1. Sewing irregular.	10.5 × 6	2:1 twill	z/s			9/7	brown			sewing thread: 2 z-spun yarns
50.3	Patch 2 of 50–1; stained fragment with 3 pleats	0.5 × 3	2:1 twill	z/s			10/6	brown			sewing thread z-spun
52	2 pieces of fine, even 2:1 twill of same fabric, one piece with selvedge edge; selvedge edge turned under as if seam edge; very brittle; some roots	4 × 10; 3.5 × 8	2:1 twill	z/s	38.5/35.6	0.41/0.63	17/12–14	black-brown/ black-brown		smooth	analysis of larger piece only
57*	Circular fragment, heavy medium weight; cut.	1.8 diameter	twill	z/z			10/?	mid-brown		fulled, some wear	
58*	2 fragments of same material, light medium weight, soft to touch; 3 sides cut.	3.2 × 1.5; 2.5 × 1.1	twill	z/s			10/12	reddish brown		felted on one side	
59*	Triangular-shaped fragment, medium weight; 3 sides cut.	1.6 × 3.6	2:1 twill	z/s			10/8	reddish brown		felted on one side; some wear	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
60*	Triangular-shaped fragment; about 1/3 of the singed part is missing; heavy medium weight; harsh to touch; 3 sides cut.	5.5 × 1.0	2:1 twill	z/s		s-spun thicker	10/8	reddish brown		felted, worn on both sides	
61*	2 fragments, medium weight, soft to touch; both fragments worn and have 3 sides cut.	1.5 × 2.2; 1.5 × 1.8	2:1 twill	z/s			10/8	reddish brown		felted on one side	
62*	3 fragments same material, with different coloured yarn, medium weight; 2 fragments 2 sides cut.	3.1 × 1.0; 2.6 × 1.1; 2.2 × 2.1	2:1 twill	z/s			10/6	light brown/ dark brown		felted on one side	
63*	Rectangular fragment 3/4 missing, medium weight, heavily fulled; two sides cut.	3.5 × 5.5	twill	z/z			?/?	dark brown		heavily fulled	
64*	2 fragments, medium weight, soft to touch; both fragments have 2 sides cut	1.5 × 3.3; 1.2 × 3.5	twill	z/s			10/8	dark brown		fulled, worn on one side	
65*	4 strips cut into different shapes, medium weight	4.0; 3.5; 3.0; 2.5	twill					mid-brown		heavily fulled	
67	Thick 2:1 twill with thin warp and thick weft, and uneven spinning in weft	15 × 9 cm	2:1 twill	z/s	37.7/54.2	0.73/1.4	9/6	medium light brown/medium light brown	x	surface disturbance on both sides but more so on twill (right) side	
71	Hard, compact 2:1 twill with thin, dense warp and thick, unevenly spun weft; slightly crepey, but hard; some wool hairy	18 × 26	2:1 twill	z/s	39.3/55.3	0.69/1.05	13/8	medium dark brown/medium dark brown	x	more disturbance and felting of surface fibres on non-twill (wrong) side	
77	Triangular piece of heavily felted twill, dyed blue; very compact and dense; medium-fine fabric; 2 cut edges, the 3rd is narrowly folded, possibly original seam edge. Broadcloth type	5.5 × 11	twill	z/s	not possible	not possible	not possible	medium brown overdyed blue, dye now appearing uneven; dye analysis: indigotin	x	heavily fulled and felted on both sides	most elements obscured by surface disturbance, not possible to determine twill type

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
94.1	Fine and even 2:1 twill; crepe-like, hard; crease along length, with wear to crease edge and evidence of sewing holes, probably former hem edge; additional fold at narrow end	8.5 × 16	2:1 twill	z/z	41.7/32.4	0.44/0.43	19–21/15–17	medium dark brown/medium dark brown	x	smooth	sun-bleached in patches
94.2	Triangular fragment of 2:1 twill with alternating dark and light weft and cut edges; weft much thicker than warp and with large noil on reverse	8.5 × 11.5	2:1 twill	z/s	33.8/43.4	0.73/0.91	8/8	mottled light brown; warp is light, weft is one light, one black	x	surface disturbance on both sides, more so on pointed end of triangle shape but especially on reverse	
94.3	Large fragment of fine, smooth, even 2:1 twill; wool very shiny and smooth, probably combed; crepey; weaving errors	37 × 38	twill	z/z	35.1/31.5	0.41/0.56	24/15	light brown/ light brown		very smooth	small dark brown stain; numbered as 94 on paper storage envelope and not examined by TGS, so number given 94-3 in this catalogue to differentiate from 94-1 and 94-2 examined by TGS
97.1.1	Frayed, coarse fragment; weaving mistakes: in system 2, 2 light brown yarns paired, 2×; unreinforced selvedge	15 × 7	2:1 twill	z/z			8/6	brown			
97.1.2	Very frayed patterned fragment; z-spun dark brown yarn is used double in system 2. Weaving mistakes: system 1 has 2 yarns paired 2×. System 2, mistake in pattern: 2 dark brown yarns used instead of one. This fragment is sewn onto 97/1.1 with a running stitch.	16 × 7.5	2:1 twill	z/s			7/7	light brown/ dark brown			sewing thread, worsted light brown S-plied; 'run and felt' noted by TGS, probably referring to run and fell seam type

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
97.2	Compact 2:1 twill in smooth warp and weft and fragment of white woollen thread; wool shiny; defined hole in middle; rolled selvedge edge	10 × 26.5	2:1 twill	z/s	42.0/43.4	0.68/0.82	11/12	medium brown/ medium brown	x	smooth on both sides except on inside of former seam	short fragment of 2-ply white woollen thread: zz/s, each strand 0.5mm wide.
99	3 thin strips of very dark 2:1 twill; coarse fibres; even, smooth, tightly twisted yarns; even weaving; 2 smaller fragments appear to be seam remains; largest fragment has selvedge edge on one side; cut on bias; some ?sewing holes visible	a) 0.5 × 15.5; b) 0.5 × 5.0; c) 0.5 × 4.5	2:1 twill, warp?-faced	z/z	55.2/45.1	0.44/0.76	12/10–11	black/black; no dye detected	x	smooth	analysis of largest fragment only; seam fragment; only 1 measurement for warp? thread-count possible and measured over 0.5mm.
107.1	Very dense, compact, heavily felted twill in 2 colours; very coarse, hairy wool; 2-ply thread visible in places – sewing thread?	2.5 × 12.5	twill	z/s	not possible	not possible	not possible	original fabric with stripe: piece is medium light brown and medium dark brown with clear distinction between two colours	x	very dense, thick and heavily felted on both sides	most elements obscured by surface disturbance, not possible to determine twill type
107.2	Even, medium-fine 2:1 twill; wool shiny; weft is significantly thicker than warp and is a greater mix of fibre colour than warp.	10.5 × 16.5	2:1 twill	z/s	29.8/42.2	0.65/0.95	10/10	medium brown/ medium brown	x	some disturbance and felting of surface fibres on edges of both sides, otherwise smooth	
107.3	Fine, even black 2:1 twill; spin pattern anomaly: tiny circles are formed on surface by smooth yarn and high spin.	3 × 16	2:1 twill	z/z	31.4/46.9	0.55/0.6	9/12	black-brown/ black-brown; no dye detected	x	very smooth	
109	Large fragment of hard and coarse 2:1 twill with very coarse, overspun weft and fine, thin warp; wool shiny in some areas; many roots; warp missing in some areas	10 × 32.5	2:1 twill	z/s	45.7/58.8	0.6/1.3	11/6	medium brown/ medium brown	x	surface of wrong side felted and more compact than right side	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
110.4.1	Fine, wrinkled gauze fragment with fringe; selvedge, 8 ends closer set; weaving mistake: 2 weft threads paired; length of fringe 5mm.	15 × 13.5	tabby	z/z			20/16	darkish brown			
110.4.2	Fine, wrinkled gauze fragment; the selvedge of this material is sewn around a coarse woollen fragment 110.4/3	36 × 8	tabby	z/z	warp and weft tightly spun		20/16	darkish brown			raw edges overcast with brown sewing thread, S-plied, 5 stitches/30mm
110.4.3	Coarse fragment; cut on both sides	18 × 3.2	2:1 twill	z/s			8/6–7	brown		fulled	
110.5.1	Almost complete felt lining for boot, comprising sole, vamp and quarters, all in 1 piece, and top band. Impression of stitching along top edge of quarters/leg. Trace of stitching on topband. Crack down centre of vamp, identical to one on shoe vamp, suggesting a deliberate slit. No apparent join in felt	25 × 7						brown			on display with leather shoe, leather Cat no. 1
110.6.1	Length of very dense, thick, heavily felted twill, cut on bias; fibre is very coarse; many dark fibres mixed in both thread systems	2.3 × 32	twill	z/s	30.8/not possible	1.1/not possible	not possible	medium brown/ medium brown	x	extremely felted and compact	most elements obscured by surface disturbance, not possible to determine twill type
113	Thin strip of 2:1 twill; wool shiny; warp is lighter than weft	1.0 × 13.5	2:1 twill	z/s	34.9/36.2	0.8 /1.04	8/8	medium brown/ medium brown; warp lighter than weft		smooth on both sides	noted by TGS as SH 113
113.1	Square fragment of compact, heavily fulled, very stiff 2:1 twill; some very hairy fibres; some creases	9 × 12	2:1 twill	z/s	30.5/45.2	0.53/1.15	11/8	medium brown/ medium brown	x	worn, surface of weave disturbed; brittle	noted by TGS as 113, 1

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
113.2	Fine, even and open 2:1 twill with overlapping seam	13 × 7	2:1 twill	z/s	29.6/46.3	0.58/0.71	15/9	light brown/ light brown		stiff and brittle	noted by TGS as 113, 2; fabrics sewn together appear to be same; sewing thread very hidden but appears to be z-spun singles, doubled, with no pigmentation.
114	2:1 twill with z-system thicker than s; blue staining in areas, esp. on edges; compact; slightly curved through wear	14.8 × 5.0	2:1 twill	z/s	37.3/50.3	0.59/0.6	13/12	medium brown/ medium brown, with blue stain		wrong side much disturbance, fuzzy	
115	2:1 twill fragment with alternating dark and light weft; warp may have been combed; weft significantly thicker and softer than warp; compact – beaten hard on loom, possibly fulled, creating thick, 3-dimensional fabric	8 × 10	2:1 twill	z/s	36.6/47.9	0.64/0.86	12/9	mottled light brown; warp is light, weft is one light, one black	x		areas of sun-bleaching
118.1	Frayed fragment patterned with narrow bands and stripes; weaving mistake in system 2: 2 yarns paired; pattern: weft 6 blue/black, 2 red, 6 blue, 2 red	12.5 × 4.5	2:1 twill	z /s			12/12–14	dark green brown/dark green brown; dyes: indigotin, luteolin and indigotin + carminic acid			
118.2	Very felted strip of material has been knotted into a loop with a 'granny' knot; length of loop 70mm, width 40mm	1.5?	?	z/s			?	felted			
120	2:1 twill; weft uneven with many weft threads considerably thicker than warp; wool very shiny in warp and weft	27.5 × 12.5	2:1 twill	z/s	41.1/51.9	0.77/0.97	11/8	medium brown/ medium brown	x	more surface disturbance on wrong side	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
121.5	Soft 2:1 twill with 2 red stripes in weft; wool very shiny; some weft threads missing; red stripes are 4 wefts wide	5.0 × 6.5	2:1 twill	z/s	33.4/38.0	0.83/1.05	9/10	ashen pale brown/golden pale brown, red; no dye detected		smooth on both sides; one edge very felted	
122*	Fine, 2:1 twill, very fragmented and worn, folded L-shaped strip; unreinforced selvedge; weaving mistakes	38.5 × 36.5	2 : 1 twill	z/s			12/13	light brown			
123.1	Fine, even 2:1 twill with folded edge, possibly seam edge; fibre very shiny; open weave in some areas due to wear and stretch; numerous weaving faults	24 × 6.5	2:1 twill	z/s	49.5/43.6	0.45/0.56	12/14	light brown/ light brown		some areas of surface disturbance, especially at probable seam edge	
124	Shaped fragment, worn, with holes, 2 tears, hem on 2 sides, matted on one side, probably inside	58 × 32–5.5cm	2:1 twill, mottled effect	s/s			10/9	light brown/ dark brown			? sleeve, cut on 2 sides
124.1	Coarse 2:1 twill with hem; at centre of fragment fabric is bound together and tied in knot; warp threads very thin and spaced wide apart in some areas; hem edge along selvedge; hem folded over 1cm max and stitched with doubled sewing thread	5 × 27	2:1 twill	z/s	27.5/44.0	0.48/0.89	5–11/8	medium dark brown/medium dark brown; slight green tinge to fabric	x	very worn and gaps where warp threads have broken or disappeared	sewing thread: z-spun; 0.66 wide; 29.7 degree twist.
124.2	Coarse 2:1 twill, densely woven	1.7 × 13.5	2:1 twill	z/s	39.4/42.3	0.81/1.3	10/7	medium brown/ medium brown		worn, brittle	only 5 measurements of weft possible
133	10 small fragments of extremely fine and even 2:1 twill; 1 weaving fault: missed shed, on largest fragment	5.2 × 7.8cm (largest frag.)	2:1 twill	z/z	36.0/40.5	0.35/0.42	18/19	pale light brown; pale light brown		very smooth, no surface fibres	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
134.1	Fragmented and worn fragment patterned with 2 maroon stripes 5mm wide and a yellow stripe 10mm wide. Red brown 5 s-spun yarns, yellow 10 s-spun yarns; weaving mistake system 2: 2 weft yarns paired, 2×. 2 stripes each 5mm, 5 picks yellow stripe 10mm wide 10 picks mottled	16.5 × 5.5	2:1 twill	z/s			8/10	brown		felted on one side	
134.2	Small very fragmented and frayed fragment	1.5 × 6.5	2:1 twill	z/s	44.8/37.25	1.07/1.16	7/6–8	medium-brown/ medium-brown; very shiny yarns	x	smooth; some s-system yarns disturbed	only 6 measurements possible for width and angle of s-system; thread-count measured over 5mm
135	Medium coarse open twill with thin, light warp and thick, dark weft; worn, open and stretched due to use	5 × 14	2:1 twill	z/s	43.1/41.5	0.9/1.62	7/5–6	light brown/ medium brown	x	smooth, with some felted areas	
136.1	Large fragment of 2:1 twill in with unevenly spun weft, with square patch; cut indicates it is left side of shirt front, with shoulder edge (where there is a seam), neck and opening to mid-chest. Edge of neck and front opening on wrong side is heavily felted. Patch is same fabric, laid diagonally and sewn with blind running-stitch, fabric underneath is worn through at one end; includes thread fragment	15 × 42	2:1 twill	z/s	44.8/41.3	.88/1.32	9/7	medium-brown/ medium-brown	x	smooth on right side, very disturbed on wrong side; many noils in unevenly spun weft	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
139	2:1 twill with uneven weft and 2 blue weft stripes; worn and stretched in some areas; blue stripes are more visible on 'wrong' side; stripes made of 3 weft threads each, which are narrower than main colour wefts; 5 wefts of main colour between stripes	7 × 13.5	2:1 twill	z/s	45.27/53.7	0.63/1.33		medium brown/ medium brown, blue; dyes: indigotin, possible flavonoid		smooth on right side, more surface disturbance on wrong side	
147	Fine and even 2:1 twill; threads from 1 system missing in areas	6.5 × 21.5	2:1 twill	z/z	36.9/30.5	0.46/0.51	18–20/13–15	medium brown/ medium brown		very smooth; fabric brittle.	
156	2 coarse 2:1 twills with alternating dark and light wefts, sewn together in overcast stitch; dark weft 25% thicker than light weft; many weaving faults; noils on reverse in light wool; weft in secondary piece very worn and non-existent in many areas. Like 413	22.5 × 15.5	2:1 twill	z/s	41.4/44.0	0.65/0.92	9–11/8–10	light brown, dark and light brown; weft is generally 1:1 alternating dark and light yarns	x	quite smooth but very worn and stretched; felting around seam	2-ply sewing thread very smooth zz/s.
163	2 pieces of the same fabric sewn together; fine and even 2:1 twill, hard, crepe-like; flat-fell seam, neatly executed; sewing thread same colour as fabric; neat stitching on either side of seam edge	7.5 × 13.5	2:1 twill	z/z	41.2/48.6	0.45/0.49	12/14–15	medium dark brown/medium dark brown	x	smooth; fabric very wrinkled	
164	Medium 2:1 twill, wool very shiny; fabric crepe-like	12 × 16	2:1 twill	z/s	26.5/38.6	0.66/0.97	10/8	medium brown/ medium brown	x	smooth on both sides	
176.3	Same fabric as 282, 412, 464.1, 464.2, see 282 entry for construction measurements; dye analysis on 412 suggests synthetic dye = modern	includes very large fragment, 30 × 33, and many smaller fragments in 33 bags									

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
224.1	Very compact and fulled or felted 2:1 twill; 2 light wefts alternating with 2 dark wefts; cut on the bias like 261	6.5 × 1.0	2:1 twill	z/s	36.5/51.6	.72/.96	count not possible; approx 8	medium light brown/medium light brown and medium dark brown	x	very felted on one side so that fabric structure is obscured completely	only 5 measurements taken for width and angle for both systems
224.2	Small single-colour 2:1 twill fragment	2.5 × 5.5	2:1 twill	z/s	53.2/64.8	.62/1.5	9–10/6	medium light brown/medium brown	x	very disturbed on one side	only 7 measurements possible for system 2 on width, 6 for angle, and 1 for count
234	Thick and dense twill with colour striping, including 2 bands of white; 1 system face-dominant; possibly float-weave?; cut on the bias	2.8 × 13	twill	z/s	not possible	not possible	not possible	?/black and russet-brown with 2 bands of white; dyes: 1) red-brown = carminic acid; 2) black = indigotin, carminic acid-like anthraquinone	x	felted and compact; surface disturbance on wrong side	not stained by burial – white stripes are white; measurements not possible due to size and only partially visible on white area
256	Square fragment patterned with narrow bands; stained on both sides; 2 sides cut	5.5 × 5.5	2:1 twill	z/s			10/14–16	off white/off white, brown and red		felted on both sides	TGS notes below 'white' – 12, below 'brown' – 14, white 4, 2 red; ?check pattern
260	Fine and even 2:1 twill; compact; brittle, s-system overtwisted in many areas	5.5 × 8.0	2:1 twill	z/s	39.8/55.3	0.39/0.54	17–20/10–13	medium dark brown/medium dark brown	x	smooth, some surface dirt, more worn on reverse	
261	Small fragment of multi-coloured twill; like 224-1	8.5 × 1.5	twill	z/s	30.8/not possible	0.82/not possible	not possible	z-system mainly light; s-system light and dark fibres?	x	heavily disturbed on wrong side	thread diameter and twist angle on z-system averaged over only 8 measurements

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
264	Soft and thick 2:1 twill with dark and light warp and weft threads	23 × 6	2:1 twill	z/s	48.3/59.8	.96/1.08	11/7–8	warp and weft both alternating light and dark threads	x	smooth in some areas, but some felting of surface fibres, especially dark wool	
265	Large fragment of 2:1 twill, with reinforced selvedge edge; wool smooth and shiny, possibly combed	20 × 27	2:1 twill	z/z	35.9/43.5	0.63/0.88	13/11	medium brown/ medium brown	x	smooth	
273	Large piece of fine, even, dark 2:1 twill; regular weaving faults; some noils; very wrinkled; colour slightly mottled on surface as though had been dyed and surface dye has worn off in areas.	18 × 34	2:1 twill	z/s	33.0/35.7	0.43/0.57	18/14	medium dark brown/medium dark brown	x	smooth, little wear	
279	Fine, even 2:1 twill, compact, possibly fulled; weft-dominant	9 × 22.5	2:1 twill	z/s	39.8/41.1	0.66/0.55	12/13	light brown/ light brown	x	smooth, but more surface wear on twill side; roots	light sun-bleaching, especially on twill side
282	4 fragments (1 large, 3 small) of dark twill, evenly spun and woven; soft and thick, but not strong; many roots; large fragment has evenly folded edge and distinct hole; same as 412 – dye analysis of 412 suggests synthetic dye = modern	16 × 13	2:1 twill	s/s	11.6/36.1	0.44/0.99	7/8	black/black; dye: probably synthetic		measurements taken from largest fragment	
285	2 pieces of fine, even 2:1 twill sewn together with double-strand sewing thread	8.5 × 4.7	2:1 twill	z/z	42.3/50.2	.45/.59	19/16	medium brown/ medium brown		smooth	sewing thread is smooth, z-spun, .5mm wide, 34.1 degree twist
307	Medium-brown 2:1 twill with weft thicker than warp, dense	8.5 × 5.5	2:1 twill	z/s	44.1/44.1	0.51/.68	14/12	medium brown/ medium brown		more surface disturbance on wrong side, including one large noil	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
313	Length of seam edges, comprising same fine, even cloth type sewn together; 1 of the fabrics has been folded at the seam edge, the other abuts it and is sewn with running stitch; probably fulled with raised nap on one side	17.5 × 2	2:1 twill	z/s	30.6/50.6	0.48/0.54	14/14	light brown/ light brown		smooth; underside of seam edges are fulled and raised	thread-count for s-system taken from 2 measurements over 5mm; noted as 313/1-2 by TGS
315.1	Fine and even 2:1 twill, compact, hard, tight weave; crepe-like, wrinkled	8.5 × 9	2:1 twill	z/z	29.8/44.7	0.53/0.48	16/16–19	black-brown/ black-brown	x	smooth	
315.2.1	Medium-sized fragment: fine and even 2:1 twill; open weave, soft and pliable, cut on the bias	3 × 8	2:1 twill	z/s	44.2/30.2	0.61/0.81	9–11/9–11	medium brown/ medium brown	x	some wear to surface of threads	
315.2.2	Smaller fragment: 2:1 twill, slightly felted	0.5 × 3	not possible	z/s	32.3/35.7	0.58/0.76	not possible	medium brown/ medium brown; slight red tinge?		very worn; surface disturbed	
328	Very coarse 2:1 twill with brown warp and black weft; threads very shiny; weft thread is slightly felted (as yarn) and is significantly larger than thin warp; includes 2-ply white sewing thread	4.5 × 10	2:1 twill	z/s	36.2/58.5	0.71/2.33	8/5	medium brown/ black	x	mainly smooth but slightly disturbed on wrong side	sewing thread is 2-ply, zz/s; about 1mm wide each ply, 1.5mm wide as 2-ply. Only 5 measurements taken for width and twist angle for s-system; only 1 count taken for each system's thread-count
331.1, 331.2	2 fragments of 2:1 twill with thick weft and open weave	14 × 12; 17.5 × 8	2:1 twill	z/s	45.1/52.9	0.55/1.5	9–10/7–8	light brown/ dark and light brown; weft alternating dark and light yarns	x	more surface disturbance on wrong side; much stretched with wear; surface dirt	
331.3	Dark brown, even 2:1 twill, cut on the bias	7.5 × 2.5	2:1 twill	z/z	35.6/32.5	0.6/0.9	11/10	medium dark brown/medium dark brown	x	smooth, no apparent wear	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
352	2:1 twill with light-coloured thin warp and darker thick weft; very dense, compact and felted; some surface fibres very shiny	18 × 16	2:1 twill	z/s	43.2/62.1	0.66/1.02	9/8	light brown/ medium dark brown	x	much wear on surface, especially reverse has much felting of surface fibres	
358	Triangular fragment of multicoloured twill with cut edges and 1 side turned under	13 × 10.5	2:1 twill	z/s	35.0/47.0	0.92/1.0	9/9	mottled light brown; warp is light, weft is 1 light, 1 black	x	twill side disturbed but less raised than reverse; on front some matting and mixing of surface fibres which obscure weave, this is much more prominent on reverse where areas are felted; some large noils on reverse	
361	Medium coarse open weave 2:1 twill with thin warp and thick weft; weaving faults; great variation in s-thread thickness; very worn and thin in places, especially s-thread	9.5 × 21.5	2:1 twill	z/s	39.6/31.4	0.91/1.29	8/5–6	medium brown/ medium brown	x	felting in areas, especially on reverse	
374	Triangle of thick, fulled fabric with alternating dark and light weft threads; light weft thinner than dark; wool very hairy in places; cut edges, gusset-shape, no evidence of sewing	9 × 16	2:1 twill	z/s	29.7/53.6	0.73/1.2	8/8	mottled light brown; warp is light, weft is one light, one black	x	heavily disturbed on both sides, especially reverse; disturbance on right side more at wide end than narrow end, with clear demarcation line at crease	some roots
377	Open 2:1 twill, weft significantly thicker than warp; weft very variable in width and more worn than warp; folded edge on most of one side, cut on the bias	9 × 44	2:1 twill	z/s	35.9/32.9	0.78/1.24	10/8	medium-brown/ medium brown	x	worn, some disturbance but loose fibres on surface mainly worn away	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
378	Dark twill fragment, smooth, even, crepey; yarns in both systems even and shiny, possibly combed	9 × 18	2:1 twill	z/s	34.1/50.1	0.69/0.77	12/8	dark brown/ dark brown	x	few signs of surface treatment or wear; some soil and many roots	
389	Patterned strip with a fringe on one side; pattern: one dark brown s-spun yarn, one light brown s-spun yarn etc. Very felted fringe – difficult to see how it was made, but seems to be made up of 4 groups of 4 ends which are tied together with a z-spun yarn in places	24 × 7.5	2:1 twill	z/s			12/12	light brown/ dark brown		felted	389 also in fibre catalogue, which is a different fragment
397	Narrow strip of multicoloured twill on bias; cut edge	14.5 × 0.8	2:1 twill	z/s	26.5/not possible	0.84/not possible	not possible/ not possible	?light warp/light and dark weft?	x	heavily disturbed on reverse side	
405	Soft 2:1 twill with dark weft thicker than warp; compact but with drape, soft; wool shiny	5 × 9.5	2:1 twill	z/s	36.1/35.1	0.89/1.04	9/8	medium-brown/ medium brown; slight green tinge to some weft yarns; dye: indigotin		more worn, surface disturbance on right side	
412	Same fabric as 176.3, 282, 464.1, 464.2, see 282 entry for construction measurements; dye analysis on 412 suggests synthetic dye = modern										
413	Medium twill with thin warp and thick weft in slightly darker colour; many weaving faults; much stretched with wear; includes small fragment in bag. Like 156	20 × 15	2:1 twill	z/s	47.3/53.0	0.71/1.16	9–12/8–10	light brown/ medium brown; weft is darker than warp	x	more surface disturbance on wrong side; plant material adhering to edges	
423	Coarse, thick and dense 2:1 twill; very compact and dense, many slubs and noils	15.5 × 21	2:1 twill	z/s	52.5/55.7	0.81/1.05	10/8	medium brown/ medium brown	x	worn and disturbed the same on both sides	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
430	Large multi-coloured twill fragment with large cut hole in centre; mottled appearance on right side due to colour mixing; weft high twist and overtwisted in area; includes small strip fragment of same cloth, 13 × 0.5cm and small bag of 'vegetable matter', likely roots	20.5 × 14.5	2:1 twill	z/z	40.4/54.7	0.68/1.2	9/7	mottled medium brown; warp is light, weft is 1 light, 1 black	x	twill side disturbed but less raised than reverse; on front some matting and mixing of surface fibres to obscure weave, this is much more prominent on reverse where areas are felted; some large noils on reverse	roots
446	Thick, compact heavily felted fabric; fibre coarse; long edge is original fabric selvedge, other edges cut; broadcloth?; very similar to No. 801, shoe lining	18.0 × 6.4	probably twill	z/s	not possible	not possible	not possible	medium dark brown/medium dark brown	x	extremely felted and compact, dense and thick	
448	Large fragment of medium brown 2:1 twill; drapey; large difference between warp and weft yarn thickness; fibres still very shiny, esp. in warp yarns; warp even, prepared; fabric fulled.	34 × 22.5	2:1 twill	z/s	35.6/38.8	0.92/1.3	10/6	medium dark brown/medium dark brown	x	creased; wrong side has numerous patches of surface fibre and noils.	
452	Black 2:1 twill, very even spinning and weaving; dye analysis suggests synthetic dye – late 19th-century date?	2.0 × 12.5	2:1 twill	z/s	35.4/41.7	0.5/0.7	16/11	black-brown/ black-brown; dye: probably synthetic	x	smooth, no apparent wear	not possible to get 10 discrete measurements on z-system because of narrowness
453.1.1	2:1 twill with light warp and dark and light weft; soft, pliable	8.0 × 8.5	2:1 twill	z/s	42.7/46.5	.95/1.0	8/8	pale brown/pale brown and dark brown	x	smooth, little disturbance	
453.1.2	2:1 twill with light warp and dark and light weft; soft, pliable	14 × 6	2:1 twill	z/s			8/8	pale brown/pale brown and dark brown	x		

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
453.2	Fine and even 2:1 twill	2.5 × 4.8	2:1 twill	z/z	38.6/47.4	0.5/.45	17/14	black-brown/ black-brown	x	smooth; some dirt patches	
454.1	Length of twill with uneven spinning; seam and hem corner; worn and misshapen	11 × 30.5	2:1 twill	z/s	35.1/44.4	0.86/1.15	10/7	medium brown/ medium brown	x	more disturbed on wrong side	
454.2	Triangular fragment of thick, compact, heavily fulled fine and even twill with blue tinge; heavily fulled; edges appear cut; dyed with indigotin?; probably broadcloth	6 × 8	2:1 twill	z/s	33.8/42.8	0.45/0.73	14/10	medium brown/ medium brown with overall blue tinge	x	both sides have napped surface but more so on wrong side, indicating raised and napped surface, which has worn away during use.	thread-count measurement an average of only 2 measurements for each system
464.1, 464.2	Same fabric as 176.3, 282, 412, see 282 entry for construction measurements; dye analysis on 412 suggests synthetic dye = modern										
482.1	2 fragments knotted together with an overhand knot; a) Folded fragment; z-spun thread fine and appears combed; reinforced selvedge, 45mm, 1 edge cord of 5 ends; paired warps. b) Fragment; z-spun fine and appears combed; fragmented reinforced selvedge, 60mm, 1 edge cord of 5 ends; paired warps	13 × 3 total length; a) 4.5 × 2; b) 7 × 3	a) ? ; b) ?	a) z/s; b) z/s			a)12/5; b)12/5	a) brown; b) brown		a) very felted on both sides; b) felted	
482.2	Loose fragment, z-spun is fine and appears combed; this is a different material	6 × 2.5	2:1 twill	z/s			10/6	brown			
519	2:1 twill with system 1 lighter than system 2; soft, drapes; slightly compact due to use; much surface dirt	12 × 15	2:2 twill	s/s	42.7/59.4	1.03/1.08	7–8/6	light brown/ medium light brown		disturbed surface on both sides	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
520	Medium fine 2:1 twill, warp-dominant, very even warp	20.5 × 17.5	2:1 twill	z/s	38/35	0.62/0.86	14/7	light brown/ light brown		Some felting in very small patches on right side; much more felting on wrong side	only 5 measurements of weft spin angle, and these in worn areas on wrong side
521	Coarse and uneven 2:1 twill with noils and felted surface; blue staining, as though leached dye or in contact with dyed material; very worn; 1 edge turned under as seam edge	13.5 × 23.5	2:1 twill	z/s	40.8/62.9	0.55/1.0	15/8	medium brown/ medium brown; blue staining throughout		very felted surface on right side	
524	Coarse, thick and compact 2:1 twill; fulled, or felted through use; fold on 1 side, where it is more felted, cut on the bias	3 × 12	2:1 twill	z/s	43.4/38.8	0.89/1.19	8–9/6–7	medium brown/ medium brown		wear and disturbance, especially on reverse	
533	Small fragment of 2:1 twill with thin warp and thick weft; compact; hairy fibres in both systems	3.0 × 6.5	2:1 twill	z/s	30.72/48.3	.64/1.38	11/6–7	medium brown/ medium brown	x	slightly felted on both sides	only 1 thread-count measurement possible for z-systems
552	Small fragment of very frayed coarse, loosely woven twill of thick, dark brown and black threads; hairy and coarse fibres	1.0 × 3.0	twill	z/z	not possible	not possible	not possible	dark brown-black/dark brown-black	x	smooth	
555	2:1 twill with decorative raised thread, probably warp-wise; blue dye staining	9.2 × 2.0	2:1 twill	z/z	37.8/36.4	.45 /.58	17/13	medium brown/ medium brown, with blue stain		smooth	decorative raised thread is z, 0.92 wide, 36.5 spin angle, dyed
557	Small dark 2:1 twill fragment with fine warp and thick weft; slightly crepey; yarns very smooth, possibly combed; overtwisting in some areas	6 × 8	2:1 twill	z/s	43.5/41.6	0.61/0.96	9/9	dark brown/ dark brown	x	smooth	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
559.2	Coarse, open tabby, with 1 system thicker than the other; soft, with drape; some patches of darker staining; weft more disturbed than warp	13 × 15	tabby	z/s	46.2/66.8	1.07/1.72	7/4–5	light brown/ light brown		worn and disturbed in areas on both sides; stretched and pliable, not compact	
578	Fine, even 2:1 twill with open weave; occasional warp or weft thread is thicker than rest, forming what appears as self-check in fabric but fragment too small to determine if intentional weave pattern or spin anomaly	6.5 × 8.5	2:1 twill	z/z	35.3/39.1	0.43/0.45	14/20	pale brown/pale brown		smooth	
595	Large triangle of coarse 2:1 twill with wefts thicker than warp and some noils	27.5 × 19.5	2:1 twill	z/s	34.1/44.2	0.83/1.1	9/8	medium brown/ medium brown	x	noils on wrong side	
610.1	Hard and compact 2:1 twill with seam on 1 long edge and hem? On other long edge, with gathering at short end; tight gathers sewn with 4 rows of 2-strand sewing thread in running stitch; 8.5 cm between seam edges	11 × 25	2:1 twill	z/z	38.4/40.5	0.51/0.52	13/12	medium dark brown/medium dark brown	x	smooth on both sides	roots
610.2	Triangular twill fragment with multicoloured thick weft and very thin warp	4.5 × 12.5	2:1 twill	z/s	31.4/50.4	0.61/1.21	8/8	very light beige to medium brown/medium brown to black	x	very worn and stretched	
610.3	Narrow strip of multicoloured twill on bias, folded in half; very worn and frayed; possibly same fabric as 610.2	4 × 22	2:1 twill	z/s	28.2/42.0	0.54/1.33	12/6	very light beige to medium brown/medium brown to black	x	smooth on right side, disturbed on wrong side	
610.4	Narrow strip on the bias and folded in half	1.4 × 23.5	2:1 twill	z/s	31.1/43.2	0.7/0.67	9/10	medium light brown/medium light brown	x	disturbed on right side, fabric becoming soft and velvety; heavier disturbance on wrong side	s-system thread-count taken from only one measurement

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
612	Narrow strip cut on the bias with folded edge, very even	3 × 28	2:1 twill	z/z	36.6/38.8	0.57/0.57	19/14	dark brown/ dark brown	x	smooth, little wear	
623	Even, open 2:1 twill; loosely spun thread system has opened out in the weave and is more worn	5.3 × 2.5	2:1 twill	z/z	29.9/42.3	.66/.65	11/12	medium brown/ medium brown		smooth	
631	Red medium-fine hard-spun 2:1 twill, with dark brown and white stitching; red tint is more apparent in folds, is absent from frayed edges; possible folds or pin-tucks at 1 end; crepey, possibly due to overtwisting and fairly open weave	10 × 34.5	2:1 twill	z/z	39.9/49.5	.39/.50	17/11–12	medium brown with red tint/ medium brown with red tint; no dye analysis	x	very smooth	seam edge stitched with white thread: zz/s, single 0.5-0.9, 1.75-1.85 ply, 35 degrees each single ; dark brown sewing thread (as top-stitching?): zz/s, single: 0.5, ply: 1.1; single 30 degrees, very smooth
639	Small fragment of 2:1 twill, showing little wear; warp smooth and shiny, possibly combed; fibres still lustrous	5 × 6	2:1 twill	z/s	41.1/37.1	0.69/0.76	11/9	medium light brown/medium light brown	x	smooth with little wear or disturbance but some raised fibre surface on reverse; surface soil on reverse	
654	2 narrow strips of heavily felted 2:1 twill, cut on bias; probably same fabric; compact; very hairy fibres; twisted with use	1) 9.5 × 1.5; 2) 9.5 × 1.0	2:1 twill	z/s	40.0/48.2	0.76/0.69	not possible/10	medium dark brown/medium dark brown; some dark staining – dye?	x	heavily felted, especially on one side	all measurements taken from sample 1; only 4 counts for angle and width for system 1; dirt obscuring some elements
655	Small square fragment of fine and even 2:1 twill; weft-dominant	4.8 × 3.5	2:1 twill	z/s	39.9/38.4	0.5/0.53	14/15	medium brown/ medium brown		more worn on twill side	

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
661.1	2:1 twill with 1 thread system narrower and more even than the other; spinning even in thickness and twist on system 1; soft, pliable	8.5 × 11.5	2:1 twill	s/s	41.1/56.6	.91/1.44	6–7/4–6	light brown/ light brown		slightly disturbed on both sides; protruding section is more disturbed and felted	
661.2*	Patterned folded strip, ? part of a hem; cut on the bias; fawn colour was originally white	23 × 1.0	twill	z/s			10/7	fawn/dark brown		felted on both sides	
663.1	Open weave 2:1 twill with red weft thread every third shed; extremely worn and threadbare, fabric stretched and misshapen; some weft threads very highly twisted but others have lost twist due to wear and stretch, opening weave; red thread slightly thicker than other weft threads	4.5 × 8	2:1 twill	z/s	34.8/38.6	.65/.71	9–11/6–8	medium brown/ medium brown and pale coral red; dye: anthraquinone, purpurin = wild madder?		threads very worn on surface and worn through in places	only 2 measurements possible on thread-count for both systems.
663.2	Evenly spun and woven 2:1 twill; z-system slightly smoother and more even than s-system; s-system yarns have higher differentiation in width than z-system; worn with some stretching, and open areas of weave from use	7.5 × 7.5	2:1 twill	z/s	42.1/40.9	.61/.67	12/10–12	medium brown/ medium brown		smooth; some areas of caked dirt	.
665	Rectangular fragment of 2:1 twill with brittle appearance; threads made of variable coloured fibres	12 × 15	2:1 twill	z/s	29.8/43.2	0.85/0.61	12/11	medium brown/ medium brown	x	apparent surface wear and fibre breakage in places; some fulled areas with raised surface, which appear darker	roots

Table 2 *cont*

Find no.	Description	Maximum dimensions (cm)	Weave	Spin direction	Spin angle	Thread diameter (mm)	Thread-count (cm)	Colour (each system)	Pigmentation	Surface	Remarks
670	Large fragment in 3 pieces of fine, open weave; gauze-like, even spinning; largest fragment has several seams where same textile is sewn on; medium-sized fragment has seam edge with stitch holes visible but no sewing thread; brittle, very misshapen and stretched with use	35 × 14 (largest fragment)	2:1 twill	z/s	42.5/33.6	0.57/0.54	12/16	light brown/ light brown; some red staining in areas but appears to be rust		surface more disturbed on wrong side; caked with dirt in some areas	sewing thread is 2 strands, z-spun, 0.5mm wide each strand.
697	Medium-fine and worn 2:1 twill with felted surfaces; stretched and misshapen	12 × 6.5	2:1 twill	z/s	38.0/43.3	0.63/0.81	12/9	light brown/ light brown		twill side slightly fulled from wear and surface of threads worn and disturbed; reverse side heavily felted surface due to wear; evidence of ?mildew and area caked with soil	
801	Very coarse 2:1 twill with light warp and thick wefts in alternating 2 dark/2 light threads; 1 side is selvedge edge; drapey feel but compact in areas due to use; numerous weaving faults	12 × 24.5	2:1 twill	z/s	44.0/39.8	1.12/1.55	7/5	light brown/ light brown and dark brown-black	x	more disturbed on wrong side; felted through use	from leather shoe
802	extremely compact and felted twill; stiff and very thick; long edge appears to be selvedge	11.5 × 27.5	twill	z/s	not possible	not possible	not possible	medium dark brown/medium dark brown	x	heavily felted on both sides	felted lining, shoe, not possible to determine twill type
803	Heavily felted narrow strip of twill fabric, cut on bias; twisted with use	23.5 × 1.1	twill	z/s	not possible	not possible	not possible	medium brown/ medium brown		heavily felted or fulled on both sides	most elements obscured by surface disturbance, not possible to determine twill type

Table 3 Catalogue: fibres

Light blue cell highlight indicates textiles examined by TGS but not CC; * indicates missing

Find no.	Description	Maximum dimensions (cm)	Colour	Pigmentation	Remarks
71.2*	Tuft of hair	5 (length)	dark brown		
110.5.2*	Loose cattle hair, fine and coarse				
114	Tuft of horse hair, shallow wave	9 (length)	black		
132	A mixture of light/dark brown hair, at one end a pluck of very fine fibres	9 (length)	light and dark brown		
193	Tuft of hair, mixed with fine fibres	10 (length) × 1.5	black		
207	Large, very thick fragment of felted fibres in several layers; distinct edges in places; some dark brown fibre masses felted in; some wool still in partial staple formation	15 × 30	mainly light brown	x	pigmented fibres generally distinct and not well blended
210	Irregular-shaped fragment of felted fibres, some still partially in original staple formation	8.5 × 10	light brown		
235	Tuft of hair, with plant remains	7 (length)	brown		
389	Very small fragment of felted fibre	2.5 × 3	light brown		see also woven textile 389 entry (on display) catalogued by TGS
464.1	Length of matted and felted fibre, one side is distinct scalloped edge, where wool forms waves and curls	5 × 19	light brown	x	pigmented fibres very few and coarser than non-pigmented
485	Hair, probably horse	17 (length)	dark and light brown		
559.1*	Two matts of similar fibre, not hard felted	5 × 10	light brown		

Table 3 *cont*

Find no.	Description	Maximum dimensions (cm)	Colour	Pigmentation	Remarks
560	Dark and light brown hair, mixed with wavy white wool; hair in soil	9 (length of hair); 4 (length of wool)	dark and light brown/ white		
584	Large, irregular-shaped piece of felted fibres; two holes of similar size and shape; similar in quality to 210	15 × 24	light brown		
617	Irregular-shaped fragment of thick felted fibres, some still in partial staple formation, with crimp visible; one hole	12 × 16	light brown	x	pigmented fibres not well blended

Table 4 Rope and thread (see also sewing thread under Remarks in Table 2)

Light blue cell highlight indicates textiles examined by TGS but not CC; * indicates missing

Find no.	Description	Maximum dimensions (cm)	Spin direction	Spin angle	Thread diameter (mm)	Colour	Pigmentation	Remarks
70	Cabled rope fragment; unravelled at one end into 3 z-plied ends. The other end has an overhand knot through which a 180mm-long rope with an overhand knot at either side is added, s2/z3/s; horse hair	107 × 0.9	s2/z3/s			black		on display
110.6	Hair and wool rope of several strands, tied in large knot; main strand is 3-ply twined hair, with 1 strand protruding from ply 5cm from knot, leaving remaining rope strand only 2-ply; additional strand of dark brown hair, untwisted, protruding from knot; 3rd strand of medium brown hair, unspun, protruding from top of knot; short length of light brown wool protruding from knot	33 cm long	zz/s	ply: 35 degrees	main strand: 4.75–5.5cm wide	dark brown	x	white papery substance on some hairs

Table 4 *cont*

Find no.	Description	Maximum dimensions (cm)	Spin direction	Spin angle	Thread diameter (mm)	Colour	Pigmentation	Remarks
117	Cord with an overhand knot on one end and frayed at the other end; combed wool	16 × 2.5	ss/z			dark brown		on display
185	Short length of 2-ply hair rope	10.5cm long	ss/z	34.6/49.9	4.7/6.6	dark brown	x	fibres now very broken
545	Length of 2-ply twined hair rope with starting knot, wound in a circle	approx. 40cm long	zz/s	22.8/ply angle not possible	2.3/ply diameter not possible	medium dark brown, with slight variation in fibres	x	thread diameter over 8 measurements; spin direction over 5 measurements
632	Group of loose hair fibres, unspun	11 cm long	n/a	n/a	n/a	dark brown	x	not formed into thread
695	Short length of overspun woollen thread, and has twisted back on itself and become knotted; spinner's waste	approx. 12 cm long	s	59.8	0.75	black	x	thread diameter over 4 measurements; spin angle over 2 measurements

5. THE DYE ANALYSIS: PART 1

Anita Quye

The dye analysis was done as two separate reports, which is how the text is laid out. The tables have been combined for easier reference.

5.1 Summary

Eleven fragments of striped woollen textiles recovered from Siller Holes were analysed by high-performance liquid chromatography with photodiode array detection to identify any dye which may still have been present. Nine samples were found to contain traces of one, or a combination, of the indigoid, flavonoid and anthraquinoid compounds associated with natural dyestuffs. In some cases, these could be more specifically identified as indigotin (blue), luteolin (yellow) and carminic acid (red).

While it is not possible to identify the exact sources of the dyestuffs because of the widespread occurrence of these natural dye components, the study has nevertheless shown that the analysed textiles had been dyed. Further analysis of the two fragments found to contain carminic acid may reveal minor components which could show which variety of cochineal (European or Mexican) had been used. This information might assist with dating the finds.

5.2 Introduction

Fieldwalking at the lead mining site at Siller Holes, near West Linton in Peeblesshire, recovered a number of leather and fabric fragments. Some of the textiles were coloured (red, green, brown and black), striped and made from coarse wool. It has been proposed that these striped woollen fragments date from the late medieval period, perhaps imported into Scotland. The textiles may also have been made from recycled quality garments.

Samples were submitted for dye analysis by photodiode array high-performance liquid chromatography to determine whether the textiles had been dyed and if this revealed more about their provenance.

5.3 Experimental

5.3.1 Sample descriptions

Fibres were viewed under a light microscope at ×80 magnification to describe the colours given in Table 5.

5.3.2 High-performance liquid chromatography with photodiode array detection

Samples were prepared and analysed as described in Appendix 1. Full results can be consulted; they will be held with the original data, currently at the National Museums of Scotland Collections Centre prior to their being deposited in Canmore.

5.4 Results

Component retention times and spectra were compared with those for reference dyes. Table 6 summarises the data. Although several peaks appeared in the reagent blank chromatogram arising from sample preparation, these did not interfere with the dye components.

5.5 Discussion

A number of chemicals associated with natural dyes were detected and identified in the textile fragments from Siller Holes. More detailed assessments of the results follow.

5.5.1 Anthraquinones

Anthraquinones are present in many plants and insects which produce red dyes. A compound in both Samples 5 and 9 gave a good chromatographic and spectral match with carminic acid, a major anthraquinone component of several historically important insect red dyes. As a trace level compound in Sample 10 showed spectral, but not chromatographic, similarity to carminic acid, it can only be concluded that an unspecified anthraquinone compound is present.

Until the importation of Mexican cochineal (*Dactylopius coccus*), both Polish cochineal (*Porphyrophora polonica*) and Armenian cochineal (*Porphyrophora hameli*), along with kermes (*Kermes kerria*), were the main sources of insect red dyes in western Europe (Wouters & Verhecken 1989).

Although more expensive, Mexican cochineal quickly established itself as a much better alternative to kermes and the European cochineals because of its superior dye content. This is reflected in historical accounts and testified to by dye analysis results for red-coloured quality 14th- to 17th-century European textiles, which show a distinct transition in the preferred insect red from European to American cochineal over this period (Hofenk de Graaff 1983; Wouters & Verhecken 1989; Cardon 1990: 345–78).

An analytical study of the anthraquinone content of historical insect red dyes has shown that different sources for these dyes may be identified from the relative ratios and presence of certain anthraquinone compounds (Wouters & Verhecken 1989). If the carminic acid detected in the Siller Holes samples was found to derive from Mexican cochineal, then the textiles, if European in origin, are almost certain to date from the late 14th century at the earliest. However, a European insect source for this red dye could indicate that the textiles are older. Unfortunately, none of the characteristic secondary dye components could be detected in either Sample 5 or Sample 9 of the Siller Holes textiles, and so it is not possible to classify the source(s).

The anthraquinoid compound detected in Sample 11 was chromatographically more similar to those present in plant, rather than insect, dyes, although it could not be identified conclusively.

5.5.2 Indigotin

Indigotin was identified in Samples 1, 2, 3, 5, 8 and 10. This compound is the main colouring compound of woad (*Isatis tinctoria*), a plant indigenous to Europe, as well as Indian indigo (*Indigofera tinctoria L.*) and synthetic indigo. It is not analytically possible to distinguish between the two natural sources, or even between synthetic and natural sources, at present.

5.5.2 Flavonoids, including luteolin

Analysis revealed that Sample 4 contained the flavonoid luteolin, one of the most widespread flavonoids found in yellow-producing dye plants. The two most popular western European yellow dyestuffs were weld (*Reseda luteola L.*) and dyer's greenweed (*Genista tinctoria L.*). Weld maintained its reputation as one of the best fast yellow colours for many centuries in western Europe until the advent of more light-fast and cheaper yellows, like quercitron bark, in the late 18th century.

Unfortunately, secondary flavonoids, such as apigenin and genistein, which could have enabled the plant source to be determined, were not detectable in Sample 4 from Siller Holes. An unidentified compound with a flavonoid-like UV-visible spectrum was detected in Sample 8.

Yellow and blue dyes were often combined to produce a reasonably fast green colour. Although Samples 1, 2 and 3 appeared green, no additional dye compounds besides indigotin could be detected. This may be for two reasons: (i) burial has given the fibres a yellow tinge through wool discolouration or absorption of tannins so that they appear green; or (ii) the yellow dye(s) have degraded and are no longer identifiable.

5.6 Conclusions

This preliminary study of textile fragments from Siller Holes has revealed that 9 of the 11 samples analysed contain traces of major chemicals relating to natural yellow, red and/or blue dyes.

The dyestuff sources can only be speculated upon because additional characteristic compounds could not be detected, but the most likely plants and insects to have been used were popular for many centuries.

Further analysis of larger quantities of red fibres from SH 118 (3) and SH 139 might reveal more chemical information which could help characterise the insect dye source.

6. THE DYE ANALYSIS: PART 2

Anita Quye

6.1 Summary

A further seven woollen textiles recovered from Siller Holes were analysed to identify dyes. High-performance liquid chromatography with photodiode array detection revealed detectable dyes in four of the seven samples. In two cases, components related to natural dyestuffs (indigotin, purpurin and an unidentified anthraquinone) were identified, while two other cases were most probably synthetic dyes. No dyes were detected in the remaining three samples.

6.2 Introduction

Striped coarse wool fragments were recovered from the lead mining site at Siller Holes, West Linton. Eleven of these wool textiles had already been analysed for dyes by photodiode array high-performance liquid chromatography (see Part 1). A further set of seven fragment samples, mostly black, were subsequently submitted for dye analysis and their results are reported here.

6.3 Experimental

6.3.1 Sample descriptions

Fibres were viewed under a light microscope at × 80 magnification to describe the colours given in Table 5.

6.3.2 High-performance liquid chromatography with photodiode array detection

Samples were prepared and analysed as described in Appendix 1. Full results can be consulted. They will be held with the original data, currently at the National Museums of Scotland Collections Centre.

The acidified methanol extraction solution for Sample 15 turned from clear to bright red then muddy red-brown almost instantly upon heating (the fibre remained black). This rapid and distinctive extract colour change has not been observed with

Table 5 Sample descriptions

Sample no.	Find no.	Description	Colour × 80 magn	Sample weight
1	SH 77	s-spun yarn	blue-green	3.1mg
2	SH 118	warp	dark green-brown	2.1mg
3	SH 118 (1)	weft	dark green-brown	4.9mg
4	SH 118 (2)	weft	brown	1.9mg
5	SH 118 (3)	weft	dark green-brown	3.0mg
6	SH 121.5	weft?	red-brown	1.7mg
7	SH 134	weft	mid-brown	1.7mg
8	SH 139	weft?	dark green-brown	2.3mg
9	SH 234 (1)	weft?	red-brown	1.8mg
10	SH 234 (2)	weft?	black	3.3mg
11	SH 256	weft?	mid-brown	0.5mg
12	SH 99.1	z-spun yarn	black	2.6mg
13	SH 107.3	z-spun yarn	black	2.6mg
14	SH 405	s-spun yarn (probably weft)	green-brown	1.4mg
15	SH 412	s-spun yarn	black	3.0mg
16	SH 452.2	s-spun yarn	brown	4.3mg
17	SH 452.1	z-spun yarn	black	4.0mg
18	SH 663.1	s-spun yarn	light brown	1.3mg

any natural dyestuff samples or references so far analysed in the NMS laboratories.

When water was added to the extracts from Samples 16 and 17 after first reconstituting them with methanol, the solutions turned from golden yellow to black with small black particles. The black solution was not produced with methanol alone, indicating that something in these extracts was water-insoluble. This again had not been observed with other natural dye extracts.

6.4 Results

Component retention times and spectra were compared to those for reference dyes. Table 6 summarises the data.

6.5 Discussion

6.5.1 Samples 12 and 13

The areas of textiles analysed as Samples 12 and 13 did not appear to be dyed or, if they had been originally, dye components were no longer detectable. It is possible that the dark colour is natural pigment in the wool.

6.5.2 Sample 14

Indigo (natural or synthetic) and woad are the expected sources for indigotin in Sample 14. Synthetic indigo was commercially available in the 1890s, but it is not possible to analytically differentiate between synthetic and natural indigo.

6.5.3 Sample 18

Cultivated madder and similar dye plants contain two major anthraquinone compounds, purpurin and alizarin. Wild madder, however, contains almost exclusively purpurin with only a trace amount of alizarin, a distinguishing feature between it and related dyestuffs (Schweppe 1989; Cardon 1990: 37–41). Only purpurin was detected in Sample 18, suggesting that wild madder (*Rubia peregrina*) rather than cultivated madder (*Rubia tinctoria L.*) or related *Galium* plants was possibly used. Whether alizarin would degrade in preference to purpurin on archaeological textiles is doubtful as the compounds are so chemically similar, but no extensive research on buried textiles has been done to test this supposition.

6.5.4 Samples 15, 16 and 17

The analytical results for Samples 15, 16 and 17, coupled with their unusual behaviour during sample preparation, suggested synthetic dyes. Conclusive proof through their identification with known references is needed, but little analytical information or published data on synthetic dyes applicable to historical textiles exist at present to enable this. Until further information comes to light, it is proposed that synthetic dyestuffs are present in the sampled areas of these textile fragments.

6.6 Conclusions

The continued study of textile fragments from Siller Holes has revealed that two further samples analysed contain traces of natural dyes, and another two are likely to have been dyed with synthetic dyestuffs.

The natural dyestuff sources can only be speculated upon because additional characteristic compounds were not detected, but the suggested sources were widely used for many centuries in Europe.

Two more samples have been submitted for analysis (SH 97.1.2 and SH 412), and it is intended that selected parts of SH 118, SH 121.5 and SH 234 will be re-analysed to try to identify the dye sources.

A summary of results for all the Siller Holes textiles analysed for dyes is given in Table 7.

Table 6 Summary of data

Sample no.	Find no.	Colour	Identified components	Possible sources
1	SH 77	Blue-green	indigotin	woad (*Isatis tinctoria*) or indigo (*Indigofera tinctoria L.*)
2	SH 118	Dark green-brown	indigotin	woad/indigo
3	SH 118 (1)	Dark green-brown	indigotin	woad/indigo
4	SH 118 (2)	Brown	luteolin	flavonoid-containing dye plant, possibly weld (*Reseda luteola L.*)
5	SH 118 (3)	Green-brown	(i) indigotin; (ii) carminic acid	(i) woad/indigo, (ii) anthraquinoid dye insect
6	SH 121.5	Red-brown	no dyes detected	
7	SH 134	Brown	no dyes detected	
8	SH 139	Green-brown	(i) indigotin; (ii) possible flavonoid	(i) woad/indigo, (ii) possible flavonoid-containing dye plant
9	SH 234 (1)	Red-brown	carminic acid	anthraquinoid dye insect
10	SH 234 (2)	Black	(i) indigotin; (ii) carminic acid-like anthraquinone	(i) woad/indigo, (ii) possible anthraquinoid dye insect
11	SH 256	Brown	(i) anthraquinone	anthraquinoid dye plant
12	SH 99.1	Black	no detectable dye components	
13	SH 197.3	Black	no detectable dye components	
14	SH 405	Green-brown	Indigotin	woad (*Isatis tinctoria*) or indigo (*Indigofera tinctoria L.*)
15	SH 412	Black	>10 unidentified chromophoric components	probably synthetic
16	SH 452.2	Brown	4 unidentified chromophoric components	probably synthetic
17	SH 452.1	Black	1 unidentified chromophoric component	probably synthetic
18	SH 663.1	Light brown	anthraquinone; purpurin	red from plant source, possibly wild madder (*Rubia peregrina*)

Table 7 Summary of dye analysis results

*Blue. Indigo could be natural or synthetic.

Sample no.	Find no.	Description	Possible dye source
1	SH 77	blue-green, s-spun	woad or indigo*
2	SH 118	dark green-brown, warp	woad/indigo*
3	SH 118 (1)	dark green-brown, weft	woad/indigo*
4	SH 118 (2)	brown, weft	plant yellow
5	SH 118 (3)	dark green-brown, weft	woad/indigo + insect red
6	SH 121.5	red-brown, weft?	no dye detected
7	SH 134	mid-brown, weft	no dye detected
8	SH 139	dark green-brown, weft?	woad/indigo* + plant yellow
9	SH 234 (1)	red-brown, weft?	insect red
10	SH 234 (2)	black, weft?	woad/indigo* + insect red
11	SH 256	mid-brown, weft?	plant red
12	SH 99.1	black, z-spun	no dye detected
13	SH 107.3	black, z-spun	no dye detected
14	SH 405	green-brown, weft?	woad or indigo*
15	SH 412	black, s-spun	probably synthetic dye
16	SH 452.2	brown, s-spun	probably synthetic dye
17	SH 452.1	black, z-spun	probably synthetic dye
18	SH 663.1	light brown, s-spun	plant red, possibly wild madder

7. THE LEATHER

Clare Thomas

7.1 Introduction

The leather report discusses 97 separate items, comprising mainly shoes (56), but also including six straps, three miscellaneous fragments, 22 offcuts and ten scraps. The shoe leather is represented by soles, uppers and rands, and is distinguished by the excellent state of preservation of thread in the sole–upper seams, and by a complete felt lining. A limited range of sole and upper styles can be recognised; parallels for these suggest a date in the 12th and 13th centuries.

7.2 Shoes

Fragments of possibly 56 different shoes survive, including one boot complete with sole, upper and felt lining, six sole and upper fragments still joined together, and another complete upper. Nine examples have rands attached, and 13 have thread surviving, usually in substantial quantities.

7.2.1 Construction

All the shoes are of turnshoe construction, in which the shoe is made inside out, by stitching the lasting margin of the upper to the edge of a single sole. The shoe is then turned the right way round, with the grain side on the outside and the sole/upper seam on the inside.

The soles have all the characteristics of turnshoe soles: edge–flesh stitching channels with a stitch length of 4–6mm; flesh sides are uppermost. Most of the uppers have typical lasting margins with grain–flesh stitching channels; four examples, however, have an edge–flesh stitching channel (Cat nos 2, 6, 7, 18). This is most unusual. There appear to be only two published parallels – from London and from Schleswig. The examples from London are of early to mid-12th-century date, and were found with shoes with the more normal grain–flesh lasting margin. Grew and de Neergaard suggested that they should be 'regarded as transitional between the earlier thonged and the later sewn traditions' (Grew & de Neergaard 1988: 48, figs 84, 85). Schnack dated the use of such seams at Schleswig to the 11th and 12th centuries. (Schnack 1992: 35–6) The use of narrow, wedge-shaped strips of leather, or rands, to strengthen the sole–upper seam and make it more waterproof is demonstrated by six examples where they survive sandwiched between sole and upper, as well as three instances where a fragment of rand is still attached to a sole (Cat nos 2, 3, 4, 5, 6, 7, 11, 13, 14).

Fragments of upper were joined to each other by butted edge–flesh stitching channels, with a stitch length of 3–4mm. Top edges of uppers were protected by being oversewn or by having topbands or bindings, such as the three fragments found with Cat no. 1, added to them.

The use of low semi-circular heel-stiffeners is indicated on two uppers by tunnel-stitching on the inside of the quarters; in one case, the stiffener itself survives (Cat nos 8 and 19). Such stiffeners were frequently used to reinforce the quarters, although they were often triangular in shape. A study of all the evidence for stiffeners from Perth High Street revealed that the semi-circular ones belonged predominantly to the 12th century, while the triangular ones were mostly of mid-13th- to mid-14th-century date (Thomas & Bogdan 2012: 230).

7.2.2 Repairs

Seven soles have tunnel-stitching, indicating that they have been repaired with clump soles (Cat nos 1, 3, 4, 5, 10, 11, 12). The foreparts of two of these have been repaired at least twice; one example appears to have originally been repaired with two small patches, which were subsequently replaced by one large one (Cat nos 3 and 4). Tunnel-stitching above the lasting margin of an upper suggests that its sole had been patched (Cat no. 21). Eleven other clump soles survive separately (Cat nos 44–54).

Such repairs are a very common feature of medieval soles. Several soles from Perth High Street had cracked further along the edge of a clump sole, and had thus required additional remedial attention.

Tunnel-stitching indicates that two uppers were also patched (Cat nos 3 and 22). Evidence for this form of repair is unusual; Perth High Street for instance only produced four patched uppers, out of a total of 652 upper fragments. There are several explanations. Firstly, uppers would not have

deteriorated as quickly as a single sole. Secondly, such patching would be very visible and obtrusive. Thirdly, by the time an upper required patching, the sole was probably beyond redemption. Fourthly, uppers may have been repaired more subtly, by the insertion of new or reused parts – this may explain some side-pieces.

7.2.3 Thread

Thread survives in the sole-rand-upper seam of 12 items, and in the butted edge–flesh seam which joins two fragments of upper together (Cat nos 2–7, 11, 13, 14, 16, 20, 21, 24). The thread is exceptionally well preserved. Initial examination suggests that this is cowhair, which is most unusual.

The normal thread was linen, but only one possible example of its use was found at Perth High Street. Woollen thread, on the other hand, was found on 42 soles, which ranged in date from the 12th to the mid-14th centuries, with two particularly large groups from the second half of the 12th century and the first half of the 14th century. Examples from London, York and Winchester belong to the 10th and 11th centuries, while the shoes with similar thread from Dungiven date from the late 16th or early 17th century (Henshall & Seaby 1962: 119, 129, 135; McGregor 1982: 138, 140; Thornton 1990: 707–8; Vince 1991: 219, 221; Thomas & Bogdan 2012: 149).

7.2.4 Reuse

Nine fragments of upper had possibly been cut so that the less worn parts could be reused (Cat nos 2, 4, 5, 7, 19, 20, 34, 39, 43). The leather would have been utilised in the manufacture of new shoes from old 'cobbling' – and also in the repair of shoes and other items.

7.2.5 Soles

The 17 soles comprise five complete soles, three foreparts, two seats and seven small fragments. Ten of these can be assigned to the sole types defined in the Perth High Street report, although in some cases this is only tentative. The range of styles is narrow, consisting mainly of Type 1.

7.2.6 Type 1

Six soles are broad and straight, with either no waist or only a very slight narrowing, and with a straight-sided forepart, ending in a broad rounded or oval toe (Cat nos 2, 5, 6, 7, 8, 9). Rather shapeless, they would have been easily cut out. At Perth High Street, they belonged predominantly to the 12th century. Other parallels range between the 12th and 13th centuries, as, for example, 42 St Paul Street and Gallowgate Middle School, Aberdeen (mainly mid-12th to early 13th century) (Stones 1982: 194; Thomas & Bogdan 2012: 164, illus 104, 107, 116, 117, 124, 139, 145, 146 and 147).

7.2.7 Type 2

Two soles are also straight, but are more shapely, with definite waists and with curved foreparts, ending in oval or rounded toes (Cat nos 1, 4). At Perth, they were mainly of 13th-century date; elsewhere, they are of 12th- to 14th-century date, as, for instance, at Kirk Close, Perth (13th to 14th century) and at Aberdeen (42 St Paul Street – mid-12th to early 14th century; 45–75 Gallowgate – 1250–1400; Gallowgate Middle School – 12th to 13th century) (Stones 1982: 194; Thomas 1988; Thomas 2001: 243, illus 183–5; Thomas & Bogdan 2012: 164, illus 118, 124, 137, 140, 146, 147).

7.2.8 Type 1/2

One sole (Cat no. 3) belongs to Type 1 or 2.

7.2.9 Type 6

One forepart with a pointed toe possibly belongs to Type 6 (Cat no. 11). These soles are broad and straight, with a central point, and with little or no waist. Parallels from Perth, Durham and London were mainly of 12th-century date (Carver 1979: 31–3; Grew & de Neergaard 1988: 52, fig 83; Thomas & Bogdan 2012: 172, illus 122).

7.2.10 Types 4/5/6

One forepart with a pointed toe is possibly of Types 4, 5 or 6 (Cat no. 10). Type 4 soles are slender and elegant. At Perth High Street, they were predominantly of 14th-century date. Type 5 soles

are similar to those of Type 4, but are less slender and have broader, more curved foreparts. The Perth examples were almost all of mid-13th- to mid-14th-century date (Thomas & Bogdan 2012: 170–2).

7.2.11 Uppers

The 33 uppers include two complete ones (Cat nos 1 & 18), four with part of vamp and quarters (Cat nos 2, 4, 5, 19), three vamps (Cat nos 3, 20, 21), seven quarters (Cat nos 7, 22–27), one side-piece (Cat no. 28) and 16 fragments (Cat nos 29–44). Twelve of these can be assigned, with varying degrees of confidence, to the Perth High Street upper types.

7.2.12 Type A

One of the complete uppers belongs to Type A (Cat no. 18), which consists of ankle boots of one-piece wraparound design with no surviving thongs or holes for thongs. At Perth High Street they ranged from the early 12th to the late 14th centuries, but were predominantly of 12th-century date (Thomas & Bogdan 2012: 196–200).

7.2.13 Type B

Seven uppers are probably of Type B, which consists of boots of one-piece design, similar in construction to Type A, but with the addition of thongs wrapped around the foot in varying patterns.

7.2.14 Type Bi/ii

Type Bi has one horizontal thong, held in place by tunnel holes and by single thong holes; Type Bii has two or more horizontal thongs. At Perth High Street both variants were mainly of 12th-century date; other parallels range from the 12th to the 14th centuries, for example, Low Petergate, York; London (Bi – first half 12th century to mid-13th century; Bii – early to mid-13th century); Bristol Bridge (13th to 14th century) and Newcastle (Bii – mid-13th to mid-14th century) (Goodfellow & Thornton 1972; Grew & de Neergaard 1988: 9–17; Dixon 1989: 177–9; Thomas & Bogdan 2012: 201–7; Thomas forthcoming).

The best evidence for wraparound thongs is on Cat no. 24, which has clear impressions from a thong on its grain surface, as well as a surviving fragment of thong and a tunnel hole.

No thongs survive on Cat no. 1; instead it has three slits for thongs, on the quarters; traces of stitching round these holes suggests that thongs had been stitched to the inside of the quarters. This upper is now very fragmentary, but most probably originally comprised one large piece, a small leg flap and a topband. It has a matching felt lining, which appears to be made of one piece of felt. Any joins in the felt seem to have been obliterated, possibly by compression of the fibres. The nearest parallel for a felt lining is from Perth High Street, where fragments of felt were found inside a Type J boot. Unfortunately, the latter was unstratified (Thomas & Bogdan 2012: 224–5). There is evidence for linings from Schleswig, but these were of leather, and were only associated with high boots (Schnack 1992: 118). Grew and de Neergaard refer to mentions of shoe linings in medieval wardrobe accounts, but note that 'few such linings survive in archaeological deposits and none from London' (Grew & de Neergaard 1988: 49).

Cat no. 29 also has a thong, which has been threaded through a tunnel hole and a single slit; on the flesh side, it ends in a wide tab. Cat nos 4, 22 and 23 have single thong holes, which are most probably for wraparound thongs.

7.2.15 Type Biii

Cat no. 23 is probably part of a boot with vertical thonging, threaded through tunnel holes. These vertical thongs were apparently used to secure wraparound horizontal thongs. This type of fastening was also mainly of 12th-century date at Perth High Street. Other parallels ranged from the 12th to the 13th centuries, for example, Aberdeen, London and King's Lynn (Clarke & Carter 1977: 352–4, fig 165, nos 19, 23, 24; Grew & de Neergaard 1988: 14–15, fig 15–16; Thomas 2001: 243; Thomas & Bogdan 2012: 207–10).

7.3 Straps

The six straps include four bindings or topbands, a thong and a strap of single thickness (Cat nos 57–62).

7.3.1 Bindings or topbands

The bindings are narrow strips of leather folded once and stitched where the edges meet (Cat nos 57–60). They are very similar to the fragments of topband belonging to Cat no. 1. Such bindings were commonly used not only on the top edges of uppers but also on the edges of items of leather clothing.

7.3.2 Thong

The thong consists of a tapered strip, with a slit at the wider end; it is most probably some form of fastening (Cat no. 61).

7.3.3 Strap of single thickness

The strap is made of a single thickness of leather, and has an irregular row of slits parallel to each long edge (Cat no. 62). These slits were purely decorative and may have been further enhanced by being stitched. Such straps had many uses; some may have been joined together to form girdles.

7.4 Waste material – offcuts and scraps

The assemblage also contains 22 offcuts and ten scraps.

7.4.1 Offcuts

The offcuts consist of six thin strips, three triangles, four rectangles, one circle, one trapezium, one vamp-shaped item and six irregularly shaped fragments (Cat nos 63–84). Thickness, apart from delaminated pieces, varied between 1mm and 4mm; most were 2–3mm thick. Over half the items were worn. At least four offcuts appear to have been made from reused leather; one of these, Cat no. 77, is probably part of an upper which has been made into a repair patch. None of the offcuts resemble typical shoe-cutting waste.

7.4.2 Scraps

The ten scraps are all irregularly shaped and worn (Cat nos 85–94). One is possibly a delaminated sole fragment, while another three may originally have been parts of uppers (Cat nos 86–9).

7.5 Miscellaneous fragments

Three stitched fragments could be parts of either shoes or other items (Cat nos 95–7).

7.6 Conclusion

The parallels for the sole and upper styles quoted above suggest that the assemblage is of 12th-century date. This argument is reinforced by the presence of the unusual edge–flesh lasting margins. On the other hand, the Type 2 sole and the Type Bii uppers could extend the date span to the 13th century. The narrow range of styles indicates that the leather is probably all of the same date.

This assemblage is distinguished by the felt lining and by the excellent state of preservation of the thread in the sole–upper seams. Only one parallel is known for the felt lining, and no other use is recorded of cowhair as shoe thread.

The leather is all very worn, with much evidence for repairs. Repairs are a common feature of medieval turnshoes; the single sole would not have lasted long. However, the extent to which these shoes had been patched is most striking. It is also noticeable that all the waste material is worn. None of it suggests working of new leather, only the reuse of old material.

This assemblage is almost unique, in that it is not from an urban site. The only other Scottish medieval assemblage from a non-urban site is that from Threave Castle, and that was of later date – late 14th to early 15th century (Thomas 1981: 123–6). It is just possible that the simple form of the shoes, especially the wide, shapeless soles, may be attributable to the presumed occupation of the owners – mining – in which case the date could be later than 12th century. Shoe styles, especially sole styles, vary and recur; accordingly, the dates quoted above should be taken as a guideline only, not as fixed certainties.

8. CATALOGUE

8.1 Shoes

8.1.1 Complete shoe and lining

▸ [1] Find no. 110.5.1: Sole (Type 2), upper (Type Bii) with topband and felt lining (Illus 10; Illus 12, nos 1a-1d)

Complete left sole, with short seat, slight narrowing for waist and broad, gently curved forepart, centrally aligned, ending in rounded toe – Type 2. Edge–flesh stitching channel, stitch length 5mm. Worn, with small hole in front forepart, and with cracks in centre forepart, waist and front of seat. Partially delaminated. Tunnel-stitch holes indicate that both seat and forepart have been repaired with clump soles. Length 231mm, width of seat 63mm, width of waist 61mm, width of forepart 90mm. Thickness not measured because of delamination.

Nine fragments of upper, comprising vamp, quarters, leg flap and topband. Probably originally one large fragment, plus leg flap and topband – one-piece wraparound design. Vamp has lasting margin with grain–flesh stitching channel, stitch length 5mm, and edge–flesh stitching channels at vamp throat and vamp wing, stitch length 3mm. Very worn and fragile, with large crack down centre of vamp and several smaller ones. Quarters consists of several exceedingly fragile pieces, but these were most probably all part of same piece as vamp. One fragment has lasting margin, as above. Two fragments have edge–flesh stitching channel, as above, for front of leg on one side and for attachment to vamp wing and leg flap on other side. One fragment also has three slits for thongs, with stitching around and beneath two; also traces of stitching for another thong hole. This stitching suggests that the ends of three thongs were attached to inside of quarters. Leg flap is small, approximately trapezoidal, with one oversewn edge and two edge–flesh stitching channels, as above. Surviving height of quarters (incomplete) *c* 75mm. Follicle pattern is very worn but appears to be cattlehide. Three fragments of topband or binding, originally one, formed by folding a strip of leather once. Hem-stitching and tunnel-stitching along top of fold indicate how the binding was attached to the upper. Two approximately parallel grooves on one side of each fragment may have been for decoration. This was most probably a low ankleboot of one-piece construction, fastened with two or three wraparound thongs – Type Bi. No fragments of rand survive.

Almost complete felt lining for boot, comprising sole, vamp and quarters, all in one piece, and topband. Impression of stitching along top edge of quarters/leg. Also trace of stitching on topband. Crack down centre of vamp identical to one on vamp, suggesting that this might have been a deliberate slit, to relieve pressure caused by too tight a shoe. No apparent join in felt – possibly join has been pressed out.

8.1.2 Sole and upper fragments

▸ [2] Find no. 110.5.3: Sole (Type 1) with rand and with strip of upper (Type A or B?) and with thread (Illus 12, no. 2)

Sole complete except for worn holes. Probably left foot, judging from hole at big toe area. Short, broad seat, only slight narrowing for waist, wide, straight forepart, tapering to an oval toe, centrally aligned – Type 1. Edge–flesh stitching channel, stitch length 5–6mm. Worn, with large holes in seat and in centre forepart and with smaller hole in front of forepart, in big toe area. Also small cracks at rear of seat and at front of forepart. Length *c* 280mm, width of seat *c* 65mm (distorted), width of waist *c* 64mm, width of forepart *c* 88mm. Thickness *c* 1–2mm. Rand sandwiched between sole and upper, only around forepart, from front of waist on each side. No rand at waist or seat. Triangular cross-section. Upper survives as 10–25mm wide strip, 2–3mm thick, in two pieces. Larger extends from inside vamp wing, to inside edge of quarters, comprising both vamp and quarters. Smaller consists of triangular-shaped fragment, filling gap between vamp wing and front of quarters. Lasting margin is securely attached to sole with thread, thus stitching channel itself not visible. What is visible is very similar to that of no. 6, accordingly probably edge–flesh stitching channel; stitch length 5–6mm. Sideseam linking vamp wing and side-piece survives for *c* 20mm; edge–flesh stitching channel, stitch length 3–4mm. Edge–flesh stitching channel also links side-piece to diagonal edge of quarters, stitch length 3–4mm. This appears to be a wraparound upper of one-piece design – probably Type A or B. Rest of upper has been cut away, possibly for reuse. Worn, especially at front

of vamp. Thread survives in sole/rand/upper seam, good example of inside of seam, knot at inside waist. Follicle pattern worn.

▸ [3] Find no. 110.5.2 and Find no. 110.5.3.2: Sole (Type 1 or 2) with rand and with vamp and with thread (Illus 12, no. 3)

Sole, complete apart from large hole in seat. Right foot. Short, broad seat, slight narrowing for waist, wide forepart, ending in centrally aligned rounded toe – Type 1 or 2. Edge–flesh stitching channel, stitch length 5–6mm. Exceedingly worn and partially delaminated, with holes in big toe area and in rear of forepart; also very large hole in seat, where stitching channel is tom. Traces of tunnel-stitch holes indicate that both seat and forepart have been repaired, forepart probably twice. Length *c* 265mm (distorted by wear in seat); width of seat *c* 72mm; width of waist 63mm; width of forepart *c* 82mm. Thickness not measured because of delamination. Rand survives, in situ, as three separate sections, from middle of inner edge of seat to outer waist. Triangular in cross-section. Two fragments of vamp survive; originally one piece. Small portion of vamp is still attached to rand and sole. Lasting margin with grain–flesh stitching channel, stitch length 5–6mm. Other edges torn. Larger fragment matches torn edges of smaller one. Lasting margin as above. Also vertical edge–flesh stitching channel on vamp wing, stitch length 3mm. Tunnel-stitch holes around a crack which runs inwards from vamp wing indicate that upper has been patched. Vamp throat cut but apparently not stitched. Worn and partially delaminated. Grain surface is very worn. Cattlehide. Thread survives in sole/rand/upper seam, and in lasting margin of larger fragment of vamp, but not as well as in nos 2 and 6. Length of vamp *c* 160mm; surviving height of vamp wing 60mm; thickness 2–3mm. Shoe is incomplete, as the quarters are missing. The curved nature of the vamp throat, with no apparent stitching, suggests that this might have been a low shoe. See also no. 25, fragment of quarters or leg from same context. Does not join vamp but possibly part of same shoe.

▸ [4] Find no. 31: Sole (Type 2 ?), rand, part of vamp, part of quarters, side-piece, leg flap (Type Bi?) and thread (Illus 12, nos 4a–b)

Sole, probably left foot, judging by hole in big toe area; complete except for holes. Short, broad seat; slight narrowing for waist on inside of sole; long straight forepart, ending in central toe. Sole is now very distorted; probably Type 2. Edge–flesh stitching channel, stitch length 6mm. Exceedingly worn, with holes in big toe area, outer rear of forepart and in seat. Partially delaminated. Tunnel-stitch holes indicate that both forepart and seat have been repaired with clump soles. Forepart has been repaired more than once, possibly originally with two separate clump soles, then with one large one. Length *c* 245mm; width of seat 73mm; width of waist 65mm; width of forepart *c* 87mm; thickness not measured because of delamination. Rand survives around forepart, as three separate fragments, from outer waist to middle of inner forepart. No sign of rand where fragment of quarters is still attached to sole. Triangular cross-section. Two fragments of upper are still attached to sole – vamp and quarters. Vamp is exceedingly worn, and is detached from sole at front. Surviving fragment is only *c* 25–30mm wide. Rest appears to have been cut away, possibly for reuse. Quarters is also exceedingly worn, and is partially detached from lasting margin. Vertical edge–flesh stitching channel, stitch length 4mm, on inside of quarters, for attachment to vamp wing. All other edges of quarters have been torn, not cut. Both vamp and quarters have lasting margin with grain–flesh stitching channel, stitch length 6mm. Cattlehide.

Also two separate fragments of upper – side-piece and leg flap. Side-piece is small, approximately trapezoidal, with lasting margin, as above, with thread; edge–flesh stitching channels on other three sides, stitch length 3–4mm. Small oval thong hole, 4 × 2mm, *c* 4mm from front edge and *c* 16mm from top edge. Leather bears a distinct mark from a horizontal thong. Rear edge–flesh stitching channel matches that on quarters, while top one fits corresponding channel on leg flap. Worn, with crack. Height 100mm; width 23mm at base, 41mm at top; thickness 3mm. Cattlehide.

Leg flap is much larger, also approximately trapezoidal, with two edge–flesh stitching channels, as above, and with two oversewn edges. Worn, with large tear. Fits above side-piece, and presumably above vamp throat.

This is probably a wraparound upper of one-piece design, with horizontal thongs – Type Bi? Height

142mm; width 85–122mm; thickness 3mm. Cattlehide.

▸ [5] Find no. 55: Sole fragment (Type 1) with rand portion of upper (Type A or B) and thread (Illus 13, no. 5)
Fragment of sole, with part of seat, waist and forepart. Probably short seat, slight narrowing for waist, straight-sided forepart ending in rounded toe – Type 1. Torn lengthways. Edge–flesh stitching channel, stitch length 6mm. Very worn and delaminated. Tunnel-stitch holes indicate that both seat and forepart have been repaired with clump soles. Surviving length *c* 270mm; surviving width 80mm. Thickness not measured because of delamination. Rand survives, sandwiched between sole and lasting margin of upper. Triangular cross-section. Lasting margin of vamp still attached. Small portion of quarters or side-piece, probably the latter, survives, also attached to sole/rand. Both vamp and quarters have lasting margin with grain–flesh stitching channel, stitch length 6mm. Side-piece also has faint trace of side-seam. Vamp torn above lasting margin. Rest of side-piece cut away, possibly for reuse. Surviving height of side-piece *c* 70mm. Probably wraparound upper of one-piece design, Type A or B. Follicle pattern worn. Thread survives. Also, separate small fragment comprising sole and rand with thread. Maximum dimensions 55 × 15mm. Also small fragment of sole, 55 × 28mm. See also peculiarly-shaped clump sole (Cat no. 27) and offcut (Cat no. 80).

▸ [6) Find no. 110.5.4: Sole fragment (Type 1?) with rand, strip of upper and with thread (Illus 13, no. 6)
Fragment of sole, possibly comprising portion of waist and forepart. Probably broad and straight with little or no indentation at waist – Type 1? Edge–flesh stitching channel, stitch length 5–6mm. Surviving length *c* 210mm; width *c* 60mm; thickness 3mm. Fragment of rand, sandwiched between sole and upper, only around forepart, not in waist. Triangular cross-section. Strip of upper, still attached to sole and sole/rand by thread which survives in situ. Upper lasting margin with edge–flesh stitching channel, stitch length 5–6mm. Upper also has 10mm long stretch of side seam, with edge–flesh stitching channel, stitch length 4mm. Sole follicle pattern exceedingly worn. Upper also worn but possibly cattlehide.

▸ [7] Find no. 84: Seat of sole (Type 1?) with rand and with quarters and vamp wing (Type A or B) and with thread (Illus 13, no. 7)
Seat of sole, short and broad, cut across rear of waist – probably Type 1. Edge–flesh stitching channel, stitch length 5–6mm. Stitching channel also survives on each side for *c* 90mm. Very worn, with large hole. Surviving length of seat *c* 75mm, total surviving length *c* 190mm; width *c* 85mm; width at cut *c* 80mm; thickness 2–3mm. Three fragments of rand sandwiched between sole and upper, but not around rear of seat. Flat cross-section. Probably cattlehide. Strip of quarters and of vamp wing – two separate fragments – attached to sole/rand. Lasting margin appears to have edge–flesh stitching channel, stitch length 5–6mm. Butted edge–flesh seam, stitch length 3–4mm, links quarters to vamp wing. Surviving height of vamp/quarters *c* 30mm. Rest of upper has been cut away. Probably wraparound upper of one-piece design – Type A or B. Follicle pattern worn. Thread survives.

8.1.3 Soles: complete

▸ [8] Find no. 110.5.3: Sole (Type 1?) (Illus 13, no. 8)
Left sole, complete except for holes. Short, broad seat, only very slight narrowing for waist, wide, straight forepart, centrally aligned, ending in broad rounded toe probably Type 1. Edge–flesh stitching channel, stitch length 4–5mm. Worn, with large holes in front of forepart and in seat. Length 263mm; width of seat 78mm; width of waist 78mm; width of forepart 105mm; thickness *c* 2mm.

8.1.4 Soles: foreparts

▸ [9] Find no. 271: Sole/fragment – forepart – (Type I?) (Illus 13, no. 9)
Fragment of broad, oval forepart of sole, possibly right foot – probably Type 1. Edge–flesh stitching channel, stitch length 5mm. Torn irregularly across tread. Very worn, distorted and delaminated. Surviving length *c* 155mm; width *c* 105mm; thickness not measured because of delamination.

▸ [10] Find no. 136: Sole fragment – forepart (Type 4/5/6?) (Illus 13, no. 10)
Small fragment of forepart, with pointed toe – possibly Type 4 or 5 or 6. Edge–flesh stitching channel, stitch length 5mm. Other edges torn. Worn, cracked and delaminated. Faint suggestion of stitching for clump sole. Length 57mm; width *c* 47mm; thickness not measured because of delamination.

▸ [11] Find no. 40: Sole fragment – forepart – (Type 6) with rand and with thread (Illus 13, no. 11)
Wide forepart of left sole, ending in broad point – possibly Type 6. Edge–flesh stitching channel, stitch length 4 mm. Cut across rear. Traces of tunnel-stitch holes indicate that it has been repaired with a clump sole. Exceedingly worn, with holes in front and centre of forepart. Partially delaminated. Rand, with flat cross-section, still attached by thread to sole. Length *c* 139mm; width 97mm; thickness *c* 2mm.

8.1.5 Soles: seat

▸ [12] Find no. 165: Sole fragment (not illustrated)
Fragment of sole, probably seat, exceedingly worn and delaminated. Edge–flesh stitching channel, stitch length 5.5mm. Also trace of tunnel-stitching for clump sole. Maximum dimensions *c* 90 × 38mm.

8.1.6 Soles: fragments

▸ [13] Find no. 106: Sole fragment with rand and thread (not illustrated)
Small fragment of sole, with edge–flesh stitching channel, stitch length 5mm. Maximum dimensions *c* 30 × 50 × 3mm. One edge cut, rest torn. Fragment of rand attached to sole, approximately rectangular cross-section. Thread survives in situ.

▸ [14] Find no. 158: Sole fragment with rand and thread (not illustrated)
Tiny fragment of sole, with edge–flesh stitching channel, stitch length 4.5mm. Worn and delaminated. Maximum dimensions 35 × 7mm; thickness not measured because of delamination. Rand attached; flat cross-section. Thread survives in situ.

▸ [15] Find no. 94: Sole fragment (not illustrated)
Very small sole fragment. Edge–flesh stitching channel, stitch length 5mm. Other edges torn. Delaminated. Surviving length *c* 50mm, surviving width 15mm; thickness not measured because of delamination.

▸ [16] Find no. 123: Sole fragment with thread (not illustrated)
Small, worn and delaminated fragment of sole, with edge–flesh stitching channel, stitch length not measurable. Other edges torn. Maximum dimensions *c* 40 × 30 × 2mm.

▸ [17] Find no. 209: Sole fragment (not illustrated)
Most probably fragment of sole, with traces of edge–flesh stitching channel. Exceedingly worn and delaminated. Maximum dimensions *c* 90 × 75mm.

8.1.7 Uppers: complete

▸ [18] Find no. 110.5.4: Upper with side-piece and stiffener – PHS Type A (Illus 14, nos 18a–e)
Almost complete upper of one-piece, wraparound design, missing only a leg flap. Large fragment comprises vamp with broad oval toe and with vamp wing and vamp throat, and quarters with leg flap. Separate side-piece fills gap between vamp wing and quarters, extending from lasting margin to top edge. Both fragments have an unusual lasting margin, with an edge–flesh stitching channel, stitch length 4mm. Edge–flesh stitching channels, stitch length 3mm, on vamp wing, vamp throat, vertical edge of quarters and on both vertical edges of side-piece. Top edges of quarters and side-piece oversewn. Tunnel-stitching on inside of quarters indicates position of low semi-circular stiffener, which survives separately. Stiffener has lasting margin with normal grain–flesh stitching channel, stitch length 4mm. No tunnel holes for thongs; no impressions from thongs – hence Type A. Worn, with split at vamp throat. Follicle pattern indistinct. Length (front of vamp to rear of quarters) 249mm; length of vamp 135mm; height of side-piece 97mm; thickness 2mm.

8.1.8 Uppers: vamp and quarters

▸ [19] Find no. 43: Upper – vamp and quarters (Type A or B?) (Illus 14, no. 19)
Fragment of upper, comprising vamp and quarters. Vamp has broad, oval toe. Lasting margin with grain–flesh stitching channel, stitch length 5–6mm.

Lasting margin is very worn, missing in parts and in other parts bears extra, repair stitch holes, especially on inner vamp and on rear of seat. Tunnel-stitching on inside of quarters for low, semi-circular heel stiffener. No surviving edge–flesh seams. Upper has been cut or torn *c* 30–70mm above lasting margin. Probably wraparound upper of one-piece design – Type A or B. Worn, with crack towards rear of vamp. Surviving length of vamp *c* 90mm; approximate length of upper (front of vamp to middle of stitching for stiffener) *c* 260mm; surviving height of quarters 36mm. Thickness 3mm. Cattlehide.

8.1.9 Uppers: vamp

▸ [20] Find no. 45: Upper – vamp with thread (Illus 14, no. 20)
Front of vamp, with broad oval toe. Lasting margin with grain–flesh stitching channel, stitch length 5–6mm; thread survives in some stitch holes. Worn, with a large crack. Rest of vamp has been cut or torn away. Cattlehide. Surviving length *c* 148mm; surviving width *c* 90mm; thickness 2mm.

▸ [21] Find no. 156: Vamp of upper, with thread (not illustrated)
Fragment of vamp of upper, consisting of a strip *c* 5–10mm wide, with lasting margin with grain–flesh stitching channel, stitch length 5–6mm. Thread survives in some stitch holes. Extra stitch holes above lasting margin, especially at front of vamp, suggest repair, probably the attachment of a clump to the sole. Rest of upper has been cut away. Surviving length of vamp 175mm; thickness 2.5–3mm. Cattlehide.

8.1.10 Uppers: quarters

▸ [22] Find no. 29: Upper fragment – quarters? – (Type Bi?) (Illus 14, no. 22)
Approximately rectangular fragment of upper, probably quarters of side-piece, with two edge–flesh stitching channels, stitch length 3mm, and with oversewn top edge. Fourth edge torn, possibly originally lasting margin. Above torn edge and adjacent to one edge–flesh stitching channel, tunnel-stitching for repair patch. Small, oval thong hole, 4 × 1mm, *c* 30mm above tunnel-stitching. Worn. If quarters, separate from vamp. Probably part of wraparound upper with horizontal thong, possibly Type Bi. Cattlehide. Height 118mm; width 114mm; thickness 3mm.

8.1.11 Uppers: quarters/leg

▸ [23] Find no. 68: Upper fragment – leg (Type Bi?) (Illus 14, no. 23)
Approximately trapezoidal fragment, probably part of leg of boot. Edge–flesh stitching channels on four sides; stitch length on the three longer sides 3–4mm; on shorter edge 5–6mm. Side edge and part of longest edge–flesh side oversewn. Single thong hole, 3 × 2mm, *c* 4mm above shortest edge–flesh side. Length 120mm; height 65mm; thickness 3–4mm – unusually thick for an upper. Probably cattlehide. Stitch length on shortest edge–flesh side raises possibility that this might be a lasting margin, as in no. 6; however, the thong hole makes this most unlikely. The short oversewn stretch is most unusual; it is conceivable that it is not really oversewn but a worn stretch of edge–flesh seam. Possibly part of upper of one-piece design with wraparound thong – type Bi.

▸ [24] Find no. 391: Upper fragment – quarters and leg? (Type Bi?), with thread (not illustrated)
Two upper fragments, one tiny and triangular, other long and narrow, stitched together with butted edge–flesh seam, stitch length 3–4mm. Tiny fragment also has oversewn edge, third edge cut. Larger fragment has a 70mm long edge–flesh stitching channel – vamp throat? Other edges cut. Thong through slit in corner between the two edge–flesh stitching channels, knotted on flesh side. Tunnel hole for thong parallel to end of longer edge–flesh stitching channel and 9mm from edge.

Clear marks on grain side indicate that thong had long unsecured stretches. This suggests that it was a horizontal wraparound thong and not a vertical one. Hence the oversewn edge on the smaller fragment must be a vertical one. This in turn implies that the longer edge–flesh stitching channel may have been the higher portion of a vamp throat seam. Possibly part of a boot of one-piece design with wraparound thong – Type Bi? Cattlehide. Length 185mm; height 26mm; thickness 2mm.

▸ [25] Find no. 110.5.5: Upper fragment – quarters or leg? (Type Bi?) (not illustrated)
Small, approximately triangular fragment of

upper, possibly part of quarters or leg. Edge–flesh stitching channel, stitch length 4mm on one side, second side oversewn, third torn. Also two small oval thong holes, 3 × 1mm. Possibly part of upper of one-piece design with wraparound thong – Type Bi. Might be part of same upper as 3, but grain surface is significantly less worn. Cattlehide. Maximum dimensions 80 × 60 × 2mm.

▸ [26] Find no. 83: Upper fragment – leg? (not illustrated)
Small fragment of upper with two oversewn edges meeting in a right-angle. Worn and partially delaminated. Cattlehide. Maximum dimensions 90 × 50 × 3mm.

▸ [27] Find no. 157: Upper fragment – leg? (not illustrated)
Small, approximately trapezoidal upper fragment, with two oversewn edges and one edge–flesh stitching channel, stitch length 4mm. Fourth edge cut. Part of leg? Cattlehide. Maximum dimensions 30 × 37 × 3mm.

8.1.12 Uppers: side pieces

▸ [28] Find no. 52: Two upper fragments – side-pieces – one with vertical thong (Type Biii) (Illus 14, no. 28)
Larger fragment consists of trapezoidal side-piece, with three edge–flesh stitching channels, stitch length 3mm; fourth edge oversaw. Stretch of vertical thong threaded through three tunnel holes and single slit. Thong appears to have crossed down to lower piece of upper. Top end of thong secured through tunnel hole on flesh side. Thread fibre held in place by thong. Bottom end of thong torn. Worn. Possibly goatskin (upper and thong). Height 115mm; width 60–65mm; thickness 2mm. Length of thong (on grain side) *c* 55mm; width 4–7mm; thickness *c* 1mm.

Smaller fragment possibly fits first near top edge. Edge–flesh stitching channel, matching that on larger fragment. Top edge oversewn. Rest of fragment torn. Very worn. Surviving height 47mm; surviving width 57mm; thickness *c* 2mm.

8.1.13 Uppers: fragments

▸ [29] Find no. 54: Upper fragment with thong (Type Bi) (Illus 14, no. 29)
Irregularly shaped upper fragment with two edge–flesh stitching channels, stitch length 3–4mm, one diagonal, *c* 85mm long, the other horizontal ?*c* 160mm long – unusual in an upper. Also, short length of thong threaded through tunnel hole and single slit adjacent to diagonal stitched edge. Thong ends in wide tab on flesh side. End of thong on grain side torn. Also trace of tunnel hole for thong adjacent to torn edge. Bottom edge of fragment cut. Probably part of upper of one-piece design with wraparound thong – Type Bi. Worn, with torn edge and cracks. Cattlehide. Surviving length 179mm; surviving height 77mm; thickness 2mm.

▸ [30] Find no. 91: Upper fragment (Illus 14, no. 30)
Triangular fragment, with one edge–flesh stitching channel, stitch length 3–4mm, and with one, possibly two oversewn edges. Worn. Cattlehide? Length 45mm; height 48mm; thickness 2mm.

▸ [31] Find no. 98: Upper fragment (not illustrated)
Upper fragment with edge–flesh stitching channel, stitch length 3.5–4mm. Other edges torn. Cattlehide. Maximum dimensions 90 × 35 × 3mm.

▸ [32] Find no. 99: Upper fragment (not illustrated)
Small upper fragment with edge–flesh stitching channel, stitch length 3.5mm. Faint traces of tunnel-stitching on flesh side, possibly for stiffener. Goatskin? Maximum dimensions *c* 62 × 45 × 2mm.

▸ [33] Find no. 106: Upper fragment (not illustrated)
Small upper fragment, with edge–flesh stitching channel, stitch length not measurable. Cattlehide. Maximum dimensions 94 × 17 × 2.5mm.

▸ [34] Find no. 106: Upper fragment (not illustrated)
Small upper fragment, with trace of oversewn edge. Possibly cut to allow reuse of remainder. Delaminated. Cattlehide. Maximum dimensions 50 × 55 × 1.5mm.

▸ [35] Find no. 113: Upper fragment (not illustrated)
Small upper fragment with lasting margin with grain–flesh stitching channel, stitch length 4–5mm. Thread survives. Cattlehide. Maximum dimensions 65 × 15 × 2mm.

▸ [36] Find no. 132: Upper fragment (not illustrated)
Completely delaminated upper fragment, with grain layer only surviving. Faint trace of edge–flesh stitching channel. Exceedingly worn. Maximum dimensions 108 × 35 mm.

▸ [37] Find no. 138: Upper fragment (not illustrated)
Completely delaminated upper fragment, with flesh layer only surviving. Trace of edge–flesh stitching channel, stitch length 3mm. Maximum dimensions 107 × 58mm.

▸ [38] Find no. 157: Upper fragment (not illustrated)
Small, approximately oblong upper fragment, with one edge–flesh stitching channel, stitch length 2.5–3mm, and with three grain–flesh stitching channels, grain bent slightly as if to form edge, stitch length 2.5–3 mm. Not lasting margin, substitute for edge–flesh stitching channel. Faint suggestion of tunnel-stitching on flesh side. Worn and partially delaminated. Probably cattlehide. Maximum dimensions 51 × 40 × 1.5mm.

▸ [39] Find no. 104: Upper fragment? (not illustrated)
Approximately seat-shaped fragment, with trace of edge–flesh stitching channel, stitch length 5mm. Exceedingly worn and delaminated. Possibly cut for reuse as clump. Probably cattlehide. Maximum dimensions 100 × 75mm.

▸ [40] Find no. 183: Upper fragment (not illustrated)
Upper fragment, with lasting margin with grain–flesh stitching channel, stitch length 6mm. Worn and completely delaminated, only grain layer survives. Cattlehide. Length 125mm; height 38mm.

▸ [41] Find no. 196: Upper fragment (not illustrated)
Small upper fragment with oversewn edge. One edge cut, others torn. Cattlehide? Maximum dimensions 44 × 21 × 2mm.

▸ [42] Find no. 212: Upper fragment (not illustrated)
Tiny upper fragment with oversewn edge. Two other edges cut, fourth torn. Goatskin? Maximum dimensions 25 × 15 × 1.5mm.

▸ [43] Find no. 224: Upper fragment (not illustrated)
Upper fragment, with lasting margin with grain–flesh stitching channel, stitch length 5mm. Cut with an irregular line *c* 20–47mm above lasting margin – to allow reuse of remainder? Cattlehide. Length *c* 210mm, height 47mm, thickness 1.5mm.

▸ [44] Find no. 81: Upper fragment (not illustrated)
Small fragment of upper, with one edge–flesh stitching channel, stitch length 3–4mm. Rest of fragment torn. Worn and partially delaminated. Cattlehide. Maximum dimensions 73 × 43 × 2mm.

8.1.14 Uppers: clump soles and upper repair patches

▸ [45] Find no. 28: Clump sole or upper repair patch with thong (Illus 15, no. 45)
Approximately triangular fragment, with tunnel-stitching along long, straight edge and with hem-stitching on the other edges. Short fragment of thong, with knot, threaded through slit near apex of triangle. Also small slit – for thong? – *c* 9mm from long, straight edge. Worn. Possibly made from reused fragment of upper. Length 120mm; width 73mm; thickness 2–3mm.

▸ [46] Find no. 277: Clump sole or upper repair patch (Illus 15, no. 46)
Approximately oval fragment, with one long straight edge formed by an edge–flesh stitching channel, stitch length 5mm; tunnel-stitching on curved edges. Either upper repair patch or part of clump sole. A clump sole from Perth High Street was made of two reused pieces of upper joined together with

a butted edge–flesh seam. Worn. Length 73mm; width 27mm; thickness 2–3mm.

▸ [47] Find no. 55: Clump sole or upper repair patch? (not illustrated)
Approximately rectangular fragment, with tunnel-stitching. Also oval thong hole, 6 × 2mm. Grain surface is distorted but not badly worn – probably cattlehide. This suggests that it was not used as a clump sole; possibly upper repair patch. Possibly reused fragment of upper. Length 100 × 32 × 4mm.

▸ [48] Find no. 36: Clump sole – forepart (Illus 15, no. 48)
Forepart-shaped clump with broad oval toe, with tunnel-stitching for attachment to sole. Worn. Length 118mm; width 95mm; thickness *c* 2mm.

▸ [49] Find no. 106: Clump sole – forepart? (not illustrated)
Fragment of clump sole, probably for forepart. Exceedingly fragmentary, worn and delaminated. Length *c* 125mm; surviving width 65mm; thickness not measured because of delamination.

▸ [50] Find no. 52: Clump sole – forepart (not illustrated)
Clump sole for forepart, with tunnel-stitching. Very worn and delaminated. Length 110mm; width 80mm.

▸ [51] Find no. 222: Clump sole – seat? (not illustrated)
Almost rectangular clump sole, probably for seat. Tunnel-stitching for attachment to sole. Worn. Length 75mm; width 61mm; thickness 2mm.

▸ [52] Find no. 49: Clump sole (Illus 12, no. 52)
Clump sole with tunnel-stitching for attachment to sole. Worn and delaminated. Length *c* 110 mm; width *c* 90mm.

▸ [53] Find no. 51: Clump sole (Illus 12, no. 53)
Very irregularly shaped clump sole, with tunnel-stitching for attachment to clump sole. Worn and delaminated. Length 94mm; width 58mm.

▸ [54] Find no. 70: Clump sole (Illus 12, no. 54)
Approximately oval clump sole, with one flattened end and one pointed end. Tunnel-stitching for attachment to sole. Worn and delaminated. Length 91mm; width 75mm; thickness 2mm.

▸ [55] Find no. 165: Clump sole (not illustrated)
Two fragments of clump sole, with faint trace of tunnel-stitching. Very worn and delaminated. Maximum dimensions *c* 70 × 38mm.

8.1.15 Uppers: rand

▸ [56] Find no. 113: Rand (not illustrated)
Short strip of rand, with grain–flesh stitching channel, stitch length 5mm. Length 100mm; width 5–9mm; thickness *c* 2mm.

8.2 Straps

8.2.1 Topbands (not illustrated)

▸ [57] Find no. 98: Topband
Strip folded once and stitched where edges meet. Partially delaminated, slightly worn. Goatskin? Length *c* 115mm, width (folded) 10mm, thickness *c* 1mm.

▸ [58] Find no. 109: Topband
Strip folded once and stitched where edges meet. Very worn and partially delaminated, grain too worn for follicle analysis. Maximum dimensions *c* 143 × 7–12mm.

▸ [59] Find no. 136: Topband
Strip folded once and stitched where edges meet. Worn and incomplete. Cattlehide? Maximum dimensions 135 × 14 (unfolded) × 1mm.

▸ [60] Find no. 233: Topband
Strip folded once and stitched where edges meet. Worn. Length 185mm; width (folded) 6mm; thickness 1mm.

8.2.2 Thong

▸ [61] Find no. 275: Thong? (Illus 15, no. 61)
Strip, tapering slightly towards one end; wider end spilt lengthways; trace of grain–flesh holes. Thong or other fastening? Worn. Length *c* 200mm; width 5–7mm; thickness 2mm.

8.2.3 Strap of single thickness

▸ [62] Find no. 252: Strap of sing1e thickness (Illus 15, no. 62)
Strap of single thickness, consisting of a strip of leather, with an irregular row of grain–flesh slits parallel to one long edge, and faint trace of similar slits parallel to the other long edge. Short edges torn. Also row of slits crossing strap near one end. At other end, two parallel rows of slits, *c* 4mm long; four of these slits have been elongated and are at least 15mm long. Two slits have merged into one. Worn and delaminated. Cattlehide? Length 110mm; width 23mm.

8.3 Waste material – offcuts and scraps (not illustrated)

8.3.1 Offcuts

▸ [63] Find no. 23: Offcut
Irregularly shaped, with two cut edges, rest torn. No stitching but two faint semicircular marks on flesh side. Grain worn. Goatskin? Maximum dimensions 105 × 60 × 1mm.

▸ [64] Find no. 31: Offcut
Long thin strip, with long edges cut, short edges torn. Cattlehide. Maximum dimensions *c* 190 × 10–15 × 2mm.

▸ [65] Find no. 52: Offcut
Long thin strip, tapering to a point at one end; other end also tapered but blunt. Grain slightly worn. Cattlehide. Maximum dimensions 204 × 1–112 × 2mm.

▸ [66] Find no. 71: Offcut
Approximately triangular, with one cut and two torn edges. Possibly reused although does not look worn. Goatskin? Maximum dimensions 47 × 40 × 1mm.

▸ [67] Find no. 90.1: Offcut
Rectangular, now folded. Delaminated. Cattlehide. Maximum dimensions (before folded) 50 × 38–42 × 0.5mm.

▸ [68] Find no. 98: Offcut
Irregularly shaped. Probably reused leather. Delaminated. Cattlehide. Maximum dimensions *c* 44 × 25mm.

▸ [69] Find no. 106: Offcut
Small, approximately rectangular, probably from reused leather. Worn and partially delaminated. Cattlehide. Maximum dimensions 30 × 12 × 3mm.

▸ [70] Find no. 116: Offcut
Small, rectangular, now folded. Cattlehide? Maximum dimensions 52 × 19 × 1.5mm.

▸ [71] Find no. 164: Offcut
Approximately rectangular, worn. Cattlehide? Maximum dimensions 100 × 20–30 × 3mm.

▸ [72] Find no. 164: Offcut
Irregularly shaped. One cut edge, rest torn; worn. Maximum dimensions 36 × 30 × 3 mm.

▸ [73] Find no. 168: Offcut
Irregularly shaped. Worn. Maximum dimensions 109 × 10 × 3mm.

▸ [74] Find no. 170: Offcut
Triangular; slightly worn. Cattlehide. Maximum dimensions 47 × 20 × 2mm.

▸ [75] Find no. 184: Offcut
Long thin strip; all edges cut. Cattlehide. Maximum dimensions 144 × 10–22 × 3mm.

▸ [76] Find no. 189: Offcut
Approximately forepart- or vamp-shaped. Faint trace of tunnel-stitching. One straight edge and one curved edge, both cut; other edge torn. Worn. Possibly cut from upper for reuse as patch. Cattlehide. Maximum dimensions 60 × 59 × 2mm.

▸ [77] Find no. 190: Offcut
Thin strip. All edges cut. Worn and partially delaminated. Maximum dimensions 83 × 3 × 1mm.

▸ [78] Find no. 223: Offcut
Approximately circular. Edges cut. Worn. Maximum dimensions 39 × 39 × 4mm.

▸ [79] Find no. 228.1: Offcut
Triangular, worn and delaminated. Cattlehide. Maximum dimensions 48 × 25mm.

▸ [80] Find no. 23.1: Offcut
Approximately trapezoidal. All edges cut. Cattlehide. Maximum dimensions 63 × 47 × 4mm.

▸ [81] Find no. 23.1: Offcut
Thin strip, tapering to one end. All edges cut. Cattlehide. Maximum dimensions 60 × 2–10 × 2mm.

▸ [82] Find no. 233: Offcut
Short strip. All edges cut. Cattlehide. Maximum dimensions 58 × 11–23 × 2mm.

▸ [83] Find no. 94: Offcut
Irregularly shaped. Cattlehide. Maximum dimensions 75 × 110 × 3mm.

▸ [84] Find no. 55: Offcut
Irregularly shaped. Worn. Maximum dimensions *c* 130 × 25 × 2mm.

8.3.2 Scraps

▸ [85] Find no. 94: Scrap
Possibly delaminated sole fragment. Maximum dimensions 44 × 43mm.

▸ [86–88] Find no. 118: Three scraps
Three scraps of irregular shape, probably all originally fragments of upper. All worn and partially delaminated. Cattlehide. Maximum dimensions 75 × 42 × 2mm; 65 × 32 × 2mm; 27 × 5 × 2mm.

▸ [89] Find no. 148: Scrap
Irregularly shaped. Very worn, especially grain surface. Maximum dimensions 103 × 60 × 1.5mm.

▸ [90] Find no. 178: Scrap
Irregularly shaped. Worn. Maximum dimensions 40 × 37 × 2mm.

▸ [91–93] Find no. 220: Three scraps
Three delaminated and worn scraps, all of irregular shape. Maximum dimensions 65 × 70mm; 40 × 40mm; 15 × 15mm.

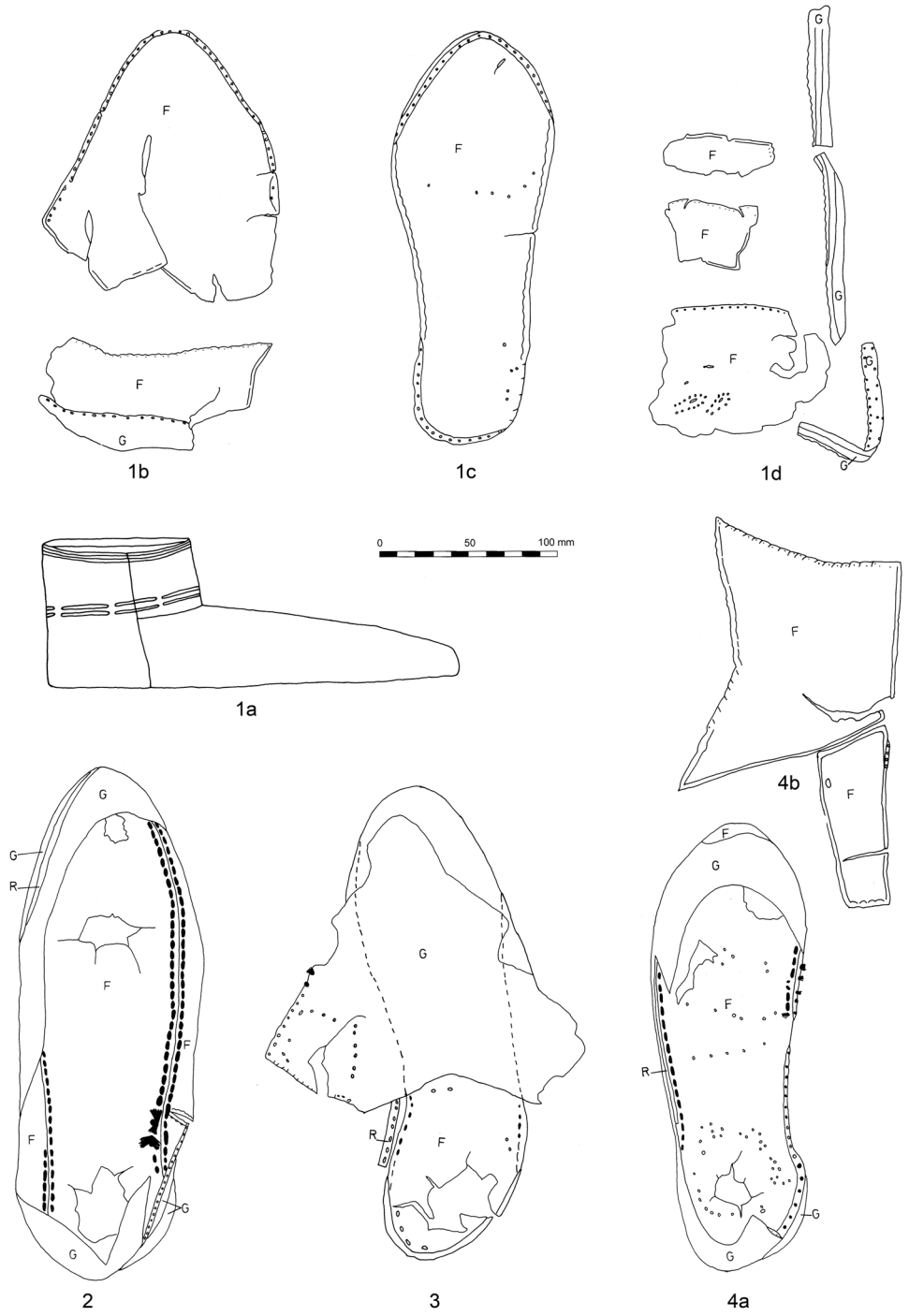
▸ [94] Find no. 227: Scrap
Irregular shape. Exceedingly worn. Maximum dimensions *c* 90 × 105mm.

8.4 Miscellaneous fragments

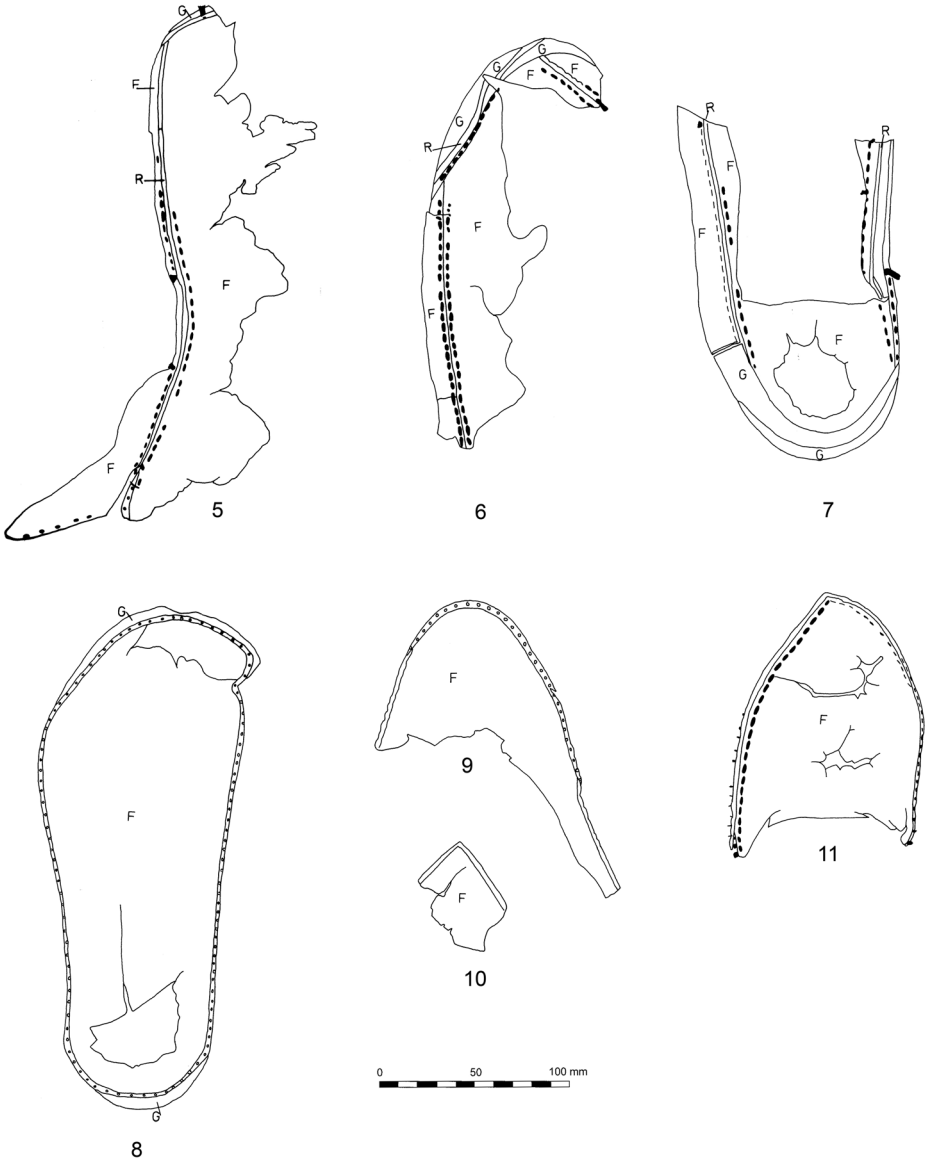
▸ [95] Find no. 39: Miscellaneous fragment (not illustrated)
Irregularly shaped fragment, with traces of tunnel-stitching and of oversewn edge. Possibly part of heel stiffener. Worn. Maximum dimensions 60 × 30 × 2mm.

▸ [96] Find no. 166: Miscellaneous fragment (Illus 12, no. 96)
Fragment with two right angles and three straight sides, probably originally square or rectangular. Fourth edge now torn. Traces of tunnel-stitching along two edges. Worn and delaminated. Maximum dimensions 78 × 60 × 1.5mm.

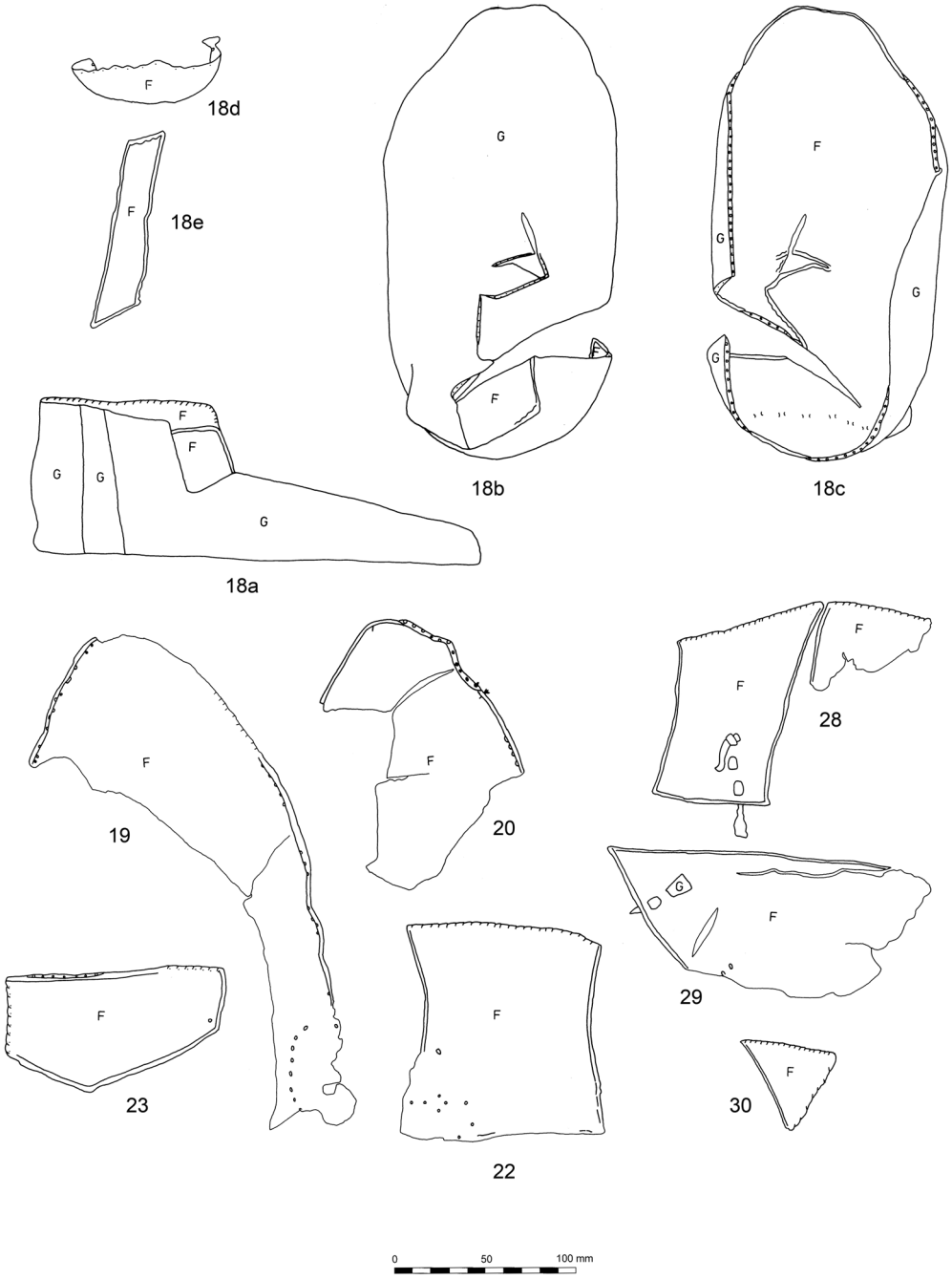
▸ [97] Find no. 183: Miscellaneous fragment (not illustrated)
Irregularly shaped, with trace of an oversewn edge. All other edges cut. Very worn and delaminated. Maximum dimensions 75 × 72mm.



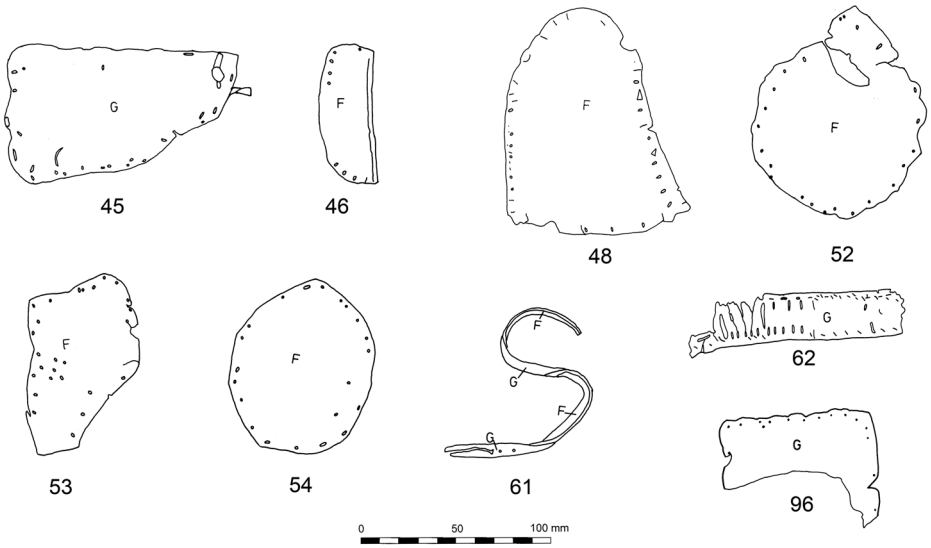
Illus 12 Complete shoe (Cat no. 1), soles and upper fragments (Cat nos 2–4)



Illus 13 Sole (Cat no. 8), sole fragments (Cat nos 5–7, 9–11)



Illus 14 Uppers and fragments (Cat nos 18–20, 22–3, 28–30)



Illus 15 Uppers: clump soles and upper repair patches (Cat nos 45–6), clump soles (Cat nos 48, 52–4), thong? (Cat no. 61), strap (Cat no. 62), miscellaneous fragment (Cat no. 96)

9. THE LEAD

Valerie E Dean and Maureen Young

Geologically, Siller Holes lies within the Midland Valley, slightly north of the Southern Uplands fault line.

Some 243 pieces of slag and 20 pieces of ore (galena) were retrieved from the site along with the fragments of leather, pottery and textiles. It was noticeable that most of the lead finds were from the disturbed areas around the north-eastern end of the pond.

With the generous assistance of Dr Maureen Young of Historic Environment Scotland's Conservation Centre, 19 random samples were analysed by qualitative X-ray fluorescence to ascertain the presence of silver (see Appendix 2).

From the spectra the samples could be differentiated into two groups – ore and slag (Table 8).

Lead and/or zinc were the main elements of the group deduced as being ore, one sample was barium-rich and another had a large amount of copper. Ten of these eleven samples had traces, probably less than 0.1%, of silver. Eight samples contained trace elements, less than 1%, of cadmium and tin. None of these samples contained iron.

Table 8 Selected notable elements observed in the spectra

Find no.	Sent for XRF (visual ID of sample)	Major element(s)	Main secondary elements	Minor elements	Trace elements (<*c* 1%)	Sample type (deduced from spectrum)
Siller Holes 74	1 ore/rock	Fe			Sr	slag/stone
Siller Holes 117	1 slag+ore	Fe	Pb, Zn		Cd	slag/stone
Siller Holes 286	1 slag	Fe	Pb, Zn		Cd	slag
Siller Holes 332	1 slag + very little ore	Fe	Pb	Zn		slag/stone
Siller Holes 354	1 slag	Fe	Pb	Zn		slag
Siller Holes 381	1 slag	Fe, Zn	Pb		Cd	slag
Siller Holes 433	1 ore (surface melted)	Fe		Pb, Zn		slag/stone
Siller Holes 614	1 slag	Fe	Pb	Zn		slag
Siller Holes 320	1 ore	Zn	Pb		Cd, Ag	ore
Siller Holes 346	1 ore	Pb		Zn	Sn, Cd, Ag	ore
Siller Holes 395	2 ore	Zn, Pb			Sn, Cd, Ag	ore
Siller Holes 641	1 ore	Zn		Pb	Cd	ore
Siller Holes 647 bag 2 of 2	1 ore	Pb	Zn		Sn, Cd, Ag	ore
Siller Holes 677 bag 1 of 2	1 ore	Pb, Zn, Ba			Sr, Cd	ore (Ba-rich)
Siller Holes 677 bag 2 of 2	1 ore	Pb		Zn	Sn, Cd, Ag	ore
Siller Holes 687	1 ore	Pb, Zn			Sn, Cd, Ag	ore
Siller Holes 689	1 ore	Cu	Zn, Pb		Hg, Cd	ore
Siller Holes 690	1 ore	Zn, Pb			Sn, Cd, Ag	ore
Siller Holes Geol. 4	1 thin blob melted lead	Pb			Sn, Cd, Ag	ore

The eight samples of slag contained significant amounts of iron and lead and varying amounts of zinc. No samples of this group had traces of silver; given the frequency of silver traces in the ore, this indicates efficient transfer of the silver to the lead.

Sample Geol 4, deduced as ore, was an anomaly, being a thin, melted blob comprising almost pure lead. Its find spot at Siller Holes was not known.

Lead isotope analysis had previously been done on other samples of galena from Siller Holes (Rohl 1996: 178). The results are shown below (Table 9).

Analysis of the lead beads from the Bronze Age site at the nearby West Water Reservoir has shown their lead provenance to be in the Central Midland Valley or Southern Uplands of Scotland, although the isotope ratios are not consistent with those for the medieval lead-mining site at Siller Holes (Hunter et al 2000: 139).

It would be a useful future project if core samples from the boggy area could be analysed to identify the timing of any lead pollution.

Table 9 Lead isotope analysis

Sample	Region	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{206}Pb/^{204}Pb$
SIL 1	Midland valley	2.10309	0.86110	18.029
SIL 2	Midland valley	2.10426	0.86146	18.033
SIL 3	Midland valley	2.09876	0.85826	18.084

10. DISCUSSION

Although essentially unstratified, the 12th- to 14th-century material recovered at Siller Holes has provided sufficient evidence to establish its medieval origins and that it is a site of considerable importance. Until now, it has been difficult to find dating evidence for lead mining in the medieval period. Dating of the visible remains is difficult and unfortunately there is no stratigraphic association between the finds and the spoil heaps from the mining operations. Table 10 shows the distribution of the various categories of finds as related to the disturbed areas in Illus 5. The quantities are based on the information available.

However, the ceramic assemblage and the excellent preservation of the organic items show evidence for an early date for lead mining in Scotland. Further evidence for this was obtained by the Peeblesshire Archaeological Society from lead-smelting sites located in the Manor Valley south-west of Peebles. Three of these yielded radiocarbon dates in the late 10th and 11th centuries (Pickin 2010: 83).

It is noteworthy that the Stonypath Roman temporary camp and road respect – and are respected by – the visible mineworkings (Illus 5). The north-east corner of the camp is situated immediately south of the pits. Does this mean that the Romans might have used it as a work camp even though its location on the steep slope of Lead Law would have made it extremely uncomfortable for a sizeable army unit to pitch its tents? However, the full extent of the camp is not known and it may well have stretched across the line of the road to the more level area opposite.

It is unlikely that the lead vein, situated as it is just 750m north of Tocherknowe fortlet at Lynedale House and alongside the Roman road leading from Biggar to Carlops and eventually to Elginhaugh,

Table 10 Distribution of finds related to shaded areas in Illus 5

Type	A	B	C	D	E	Island	Unstratified	Totals
Bone	59	38	18	5	1			121
Brick		1	1					2
Charcoal	5	1	1					7
Coin							1	1
Fibres	8	5	2	1				16
Flint, chert	2	12						14
Leather	63	30	13	1				107
Metal	4	1				1	10	16
Nut	8	5						13
Ore	8	1		1				10
Pipe	1							1
Pot	125	242	88	82	8	2	14	561
Cord, rope	3	3				1		7
Slag	29	35		3	1	1		69
Soil sample	1	1	1					3
Stone	1	3	1					5
Teeth	7	9	1	3				20
Wood		1	1			1		3
Wovens	61	62	7	5	4	2	3	144
Totals	385	450	134	101	14	8	28	**1120**

could have been overlooked by the Romans, especially if earlier lead working in southern Scotland had been established by prehistoric peoples, as indicated by the recovery of Bronze Age lead beads at the nearby West Water reservoir (Hunter et al 2000: 140). Unexpectedly, these beads are of Southern Uplands origin whereas the isotope ratios for Siller Holes relate to the Midland Valley (Rohl 1996: table 12; Rohl & Needham 1998: 33–4). Hints of early lead workings at Wanlockhead and Leadhills are given by the finding there of stone and bronze tools (Hunter 1885: 376).

Recent work on finds from Strageath fort (Hunter 2006: 85) has indicated that the source of the lead ingot found there is also likely to be in the Southern Uplands. The obvious source is in the Leadhills/Wanlockhead area although no evidence for a Roman presence there has so far been found.

The Romans came to Scotland with a view to exploiting its resources, and the proliferation of forts and fortlets embracing the Lowther Hills would suggest their awareness of the gold, silver and lead deposits in that area. Inchtuthill legionary fortress (Canmore ID 28592) also was apparently near mineral sources, including those of silver (Woolliscroft & Hoffman 2011: 26).

However, study of the leather, textile and ceramic remains has provided evidence for the exploitation of the mineral resources from at least the 12th century. This date for the medieval workings would tie in with the appearance of the first Scottish coinage which David I was then having minted at Carlisle. The need for silver, previously obtained from Cumberland or from melting down such items as bullion, foreign coins or plate, would lead to prospecting for native sources (Nicholas Holmes, pers comm).

Where did the medieval workforce live? The area to the immediate north of the lower line of pits was probably boggy. Did they also use the interior of the marching camp or did they have their huts on the rising ground on the west side of the road? Judging by the amount of domestic debris recovered from the pond, they must have lived close by, but there is as yet no evidence of any structures.

Everything had been well used, with textiles and shoes showing patching and other repairs, suggesting that these were working garments. The simplest forms of weaving and the occurrences of mistakes imply that the textiles could have been locally made by relatively unskilled workers. Many items were well worn and several had been repaired for reuse. Other uses could be for padding, insulation or for industrial purposes. More than 80% of the textiles were of 2:1 twill weave, which was prevalent during the 13th and early 14th centuries. Colour had been used in many of the fragments, either by the use of natural wool colours or by the use of widely available natural dyestuffs, such as indigotin (blue), luteolin (yellow) or carminic acid (red). Three samples had been coloured with probable synthetic dyes; further work on dye analysis would be needed to identify more precise dye sources and likely dates.

The leather items were all very worn and there was extensive evidence for the patching and repair of shoes. Even waste material was very worn; the presence of this might suggest that repairs were being done on site if new shoes were hard to come by. Textile fragments would provide padding and warmth for the feet. Shoe styles suggest 12th- to 13th-century date.

Pottery, too, is very utilitarian, with little evidence for 'better' ware. There was extensive sooting of cooking pots, which suggested that care was taken to see that they survived for reuse. Vessel forms suggest a 12th- to 14th-century date. There was nothing earlier or later, apart from a few sherds of industrial pottery of the mid-18th century or later.

This all adds up to poor living and working conditions, with a low-status work force having to 'make do and mend'.

Pay then would possibly have been on a daily or output rate, as was the case in the 17th century. The Hope family, who operated the Leadhills mines at that time, began to apply discipline to their workforce there – on remote sites boredom would have generated fighting and drinking (Smout 1967: 124).

It is interesting that pottery, textiles and shoes recovered are dated to between the 12th and 14th centuries. Although there is documentary evidence for the working of the lead and silver deposits in the 16th century, no pottery of this date has so far been found.

Water was essential – for washing the ore, for working pumps and for waterwheels used to operate the smelt mill's bellows (Smout 1967: 108). Certainly excavations by Edinburgh

University found a series of ditches in a later phase, evidence of water control measures likely to have been part of the ore processing (Coles 1995: 38). These cut a number of pits containing fragments of animal bone, worked wood, cloth, leather and feathers. The Harlawmuir or Back Burn, which runs north-east to join the River North Esk, originally had its origins in this area (Armstrong 1775) and its water may have been diverted for use. Similar water control features were seen in other lead mining areas such as Mulreesh on Islay, where they were dated to the late 18th and early 19th centuries (Caldwell forthcoming). At Siller Holes, they may relate to the periods when Ronald Crawford & Co or the Earl of Wemyss and March were operating there (Buchan & Paton 1927: 98). The later phase of ditching may have been attempts to improve the agricultural potential of the site (Coles 1995: 39). Unfortunately, no artefactual evidence was recovered from the ditches. Disuse of these measures may be the cause of waterlogging of the site; the pond and marshy ground were indicated on mid-19th-century maps (Smith 1849).

Water may have caused problems in the mine workings and it is possible that scraps of textiles could have been used in rag and chain pumps, as shown by Agricola (Hoover & Hoover 1950: 188–96). Ventilation would have been essential and this could have been achieved by the constant shaking or flapping of linen cloths to circulate the air (ibid: 210–12).

Lead ore, slag and small pieces of smelted lead have been found, mostly around the north-east end of the pond, which suggests that smelting was done on site. Traces of silver, less than 0.1%, were noted in some samples of ore, but not in the slag samples, hinting at its efficient removal. However, there is as yet insufficient evidence to say whether cupellation for silver was also carried out there. It could be, as has been hinted at, that this was done abroad (Nicol 1843: 180). Certainly Eustachius Roche had permission to do so should he be unable to undertake this process at the mines themselves (Cochran-Patrick 1878: 55).

Wood would have been required for fuel, building purposes, pit props and to make charcoal for smelting. There are records of estate owners selling woods in the 17th century and also of them treating timber as a crop. Where available, peat and coal were also used for smelting towards the end of the century (Smout 1967: 108–9).

Shallow coal measures exist south of Carlops and were believed to have been worked as early as the 13th century, possibly by the monks of Newhall (Oakes nd), but there seems to be no documentary evidence to support this suggestion. However, it is possible that an assumption has been made, as the word *Monks* appears in place names around Newhall, but it may also refer to General Monck's army's passage through the countryside in the mid-17th century.

Landowners generally found it less risky to lease out the mining rights on a royalty basis, taking a proportion of the lead raised, although they sometimes operated the mines themselves (Smout 1967: 113). In the later years, Siller Holes would have been a small-scale operation compared to the likes of Wanlockhead, Leadhills and Tyndrum, with a smaller margin of profit preventing it from becoming a profitable enterprise.

The big question is *Who was running these early lead mining operations*? Dating for medieval lead mining sites is sparse; so far, documentary evidence for this has not been traced back to before the late 16th century, although when Roche had the contract for Siller Holes in 1592 it was for 'the semes of mettelis discoverit and wrocht *of auld*' (Cochran-Patrick 1878: 55).

The early 12th century was a time when the Border abbeys were exploiting the countryside and becoming major players in the wool trade with the products of their large-scale sheep farming. Mining and quarrying were important industries, as were woodland management and agriculture. Although the monks of Newbattle were responsible for the lead mining on Crawford Muir, it has not been possible to link them with the operations at Siller Holes; but, given that they appeared to be the only Scottish abbey involved in the mining of lead, they could be considered as possible candidates for the exploitation of Siller Holes.

Other candidates are the Comyn family, which seems to have held lands in the Linton area in the mid-12th and 13th centuries, followed by the Douglases in the early 14th century. However, proving a lead mining connection may be impossible to establish.

Perhaps further research may throw more light on the mystery.

APPENDIX 1. PDA HPLC METHOD

A.1.1 pda HPLC method

All solvents were HPLC grade and water of deionised, distilled quality. Glassware was cleaned with detergent, rinsed thoroughly with purified water then methanol, and dried.

A.1.2 Sample preparation

The sample was weighed to the nearest 0.1mg on an electronic microbalance, then hydrolysed with 400µl of 1:1:2 (v/v/v) 37% hydrochloric acid:methanol:water in 2ml glass conical test tubes for precisely 10 mins at 100°C. After rapid cooling, the extract was filtered through 5mm Analytichem polypropylene frits under positive pressure, the test tube rinsed with 2 × 200ml 1: 1 (v/v) methanol:water and the combined filtrates dried by rotary vacuum evaporation at 40°C. The dry residue was then reconstituted with 25ml of methanol followed by 25ml water immediately before analysis.

A reagent blank was also prepared with the sample to identify contamination arising through sample preparation.

A.1.3 Instrumental method

A Waters 660 gradient pump and a Waters 996 PDA detector were controlled by Waters Millennium version 2.1 software, which also collected and manipulated the data.

The reversed-phase Spherisorb ODS2 5mm particle size analytical column, 150 × 4.6mm (length × i.d.), was enclosed in a heat-controlled chamber and maintained at 25±1°C. Sample extracts were injected onto the column via a Rheodyne injector with a 20ml sample loop.

A tertiary solvent gradient eluent system of A: pure methanol, B: 25mM aqueous sodium orthophosphate buffer and C: 5% (w/v) aqueous phosphoric acid was used at a flowrate of 1.2ml min^{-1}. The elution programmes followed:

0–2 min isocratic elution 34A:66B:10C

2–30 min linear gradient elution to 90A:0B:10C 30–33 min isocratic elution 90A:0B:10C

Systems were re-equilibrated at the starting composition for 5 mins before next injection. Solvents were sparged on-line with helium at 30ml min^{-1}.

Chromatographed peaks were monitored at 254nm although the PDA detector measured all spectral information between 250 and 750nm. The bandwidth (resolution) was 2.4nm, and response time set to 1s.

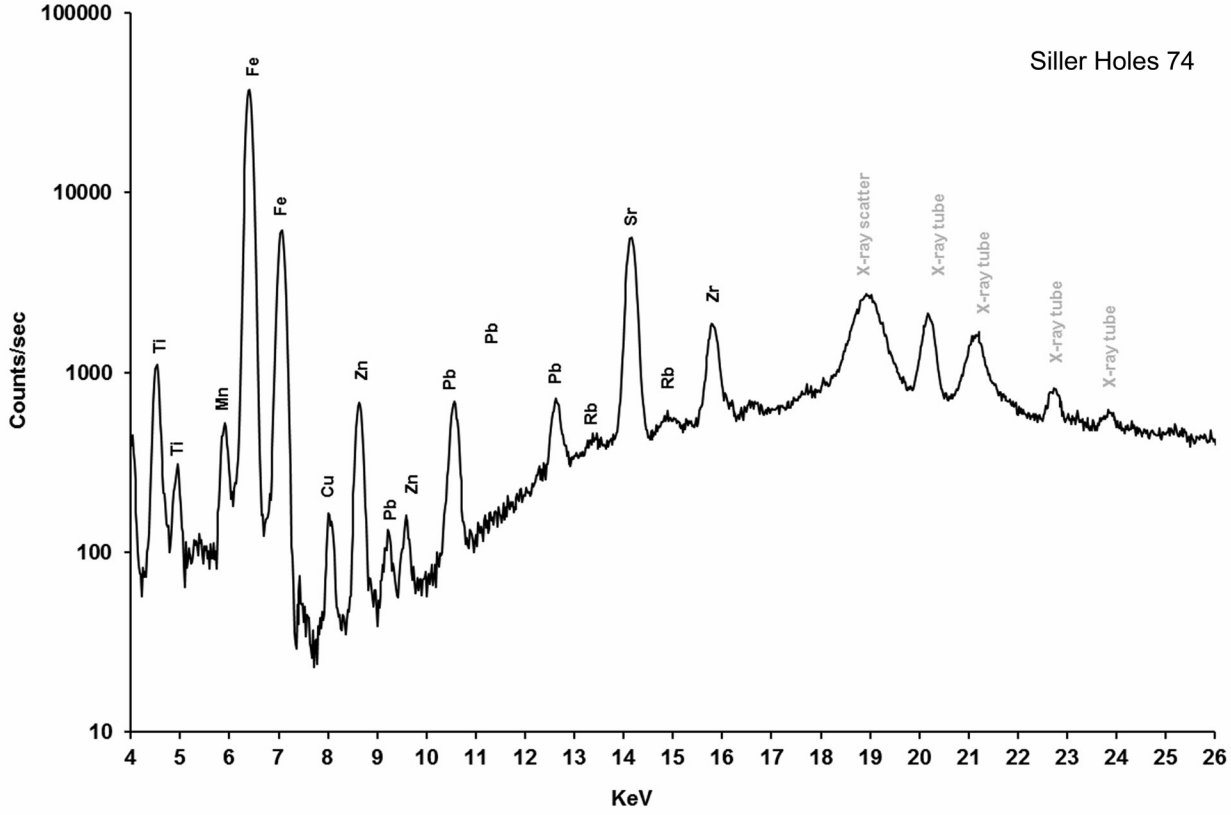
Major and minor colouring components were identified by matching their retention times and spectra with reference solutions and extracts of reference dyed fibres.

Full results of the High Performance Liquid Chromatography with Photodiode Array Detection can be consulted. They will be held with the original data, currently at the National Museums of Scotland Collections Centre.

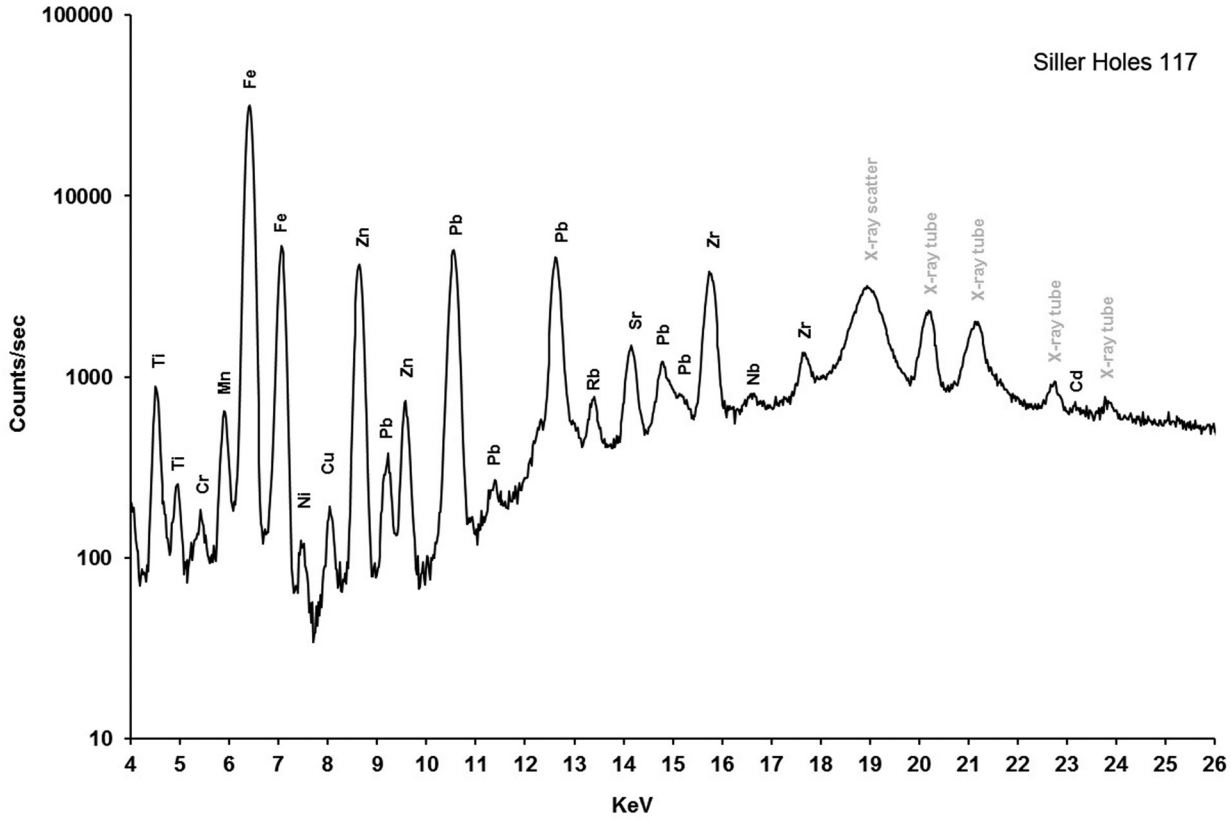
APPENDIX 2. SPECTRA OF X-RAY FLUORESCENCE ANALYSIS

Maureen Young

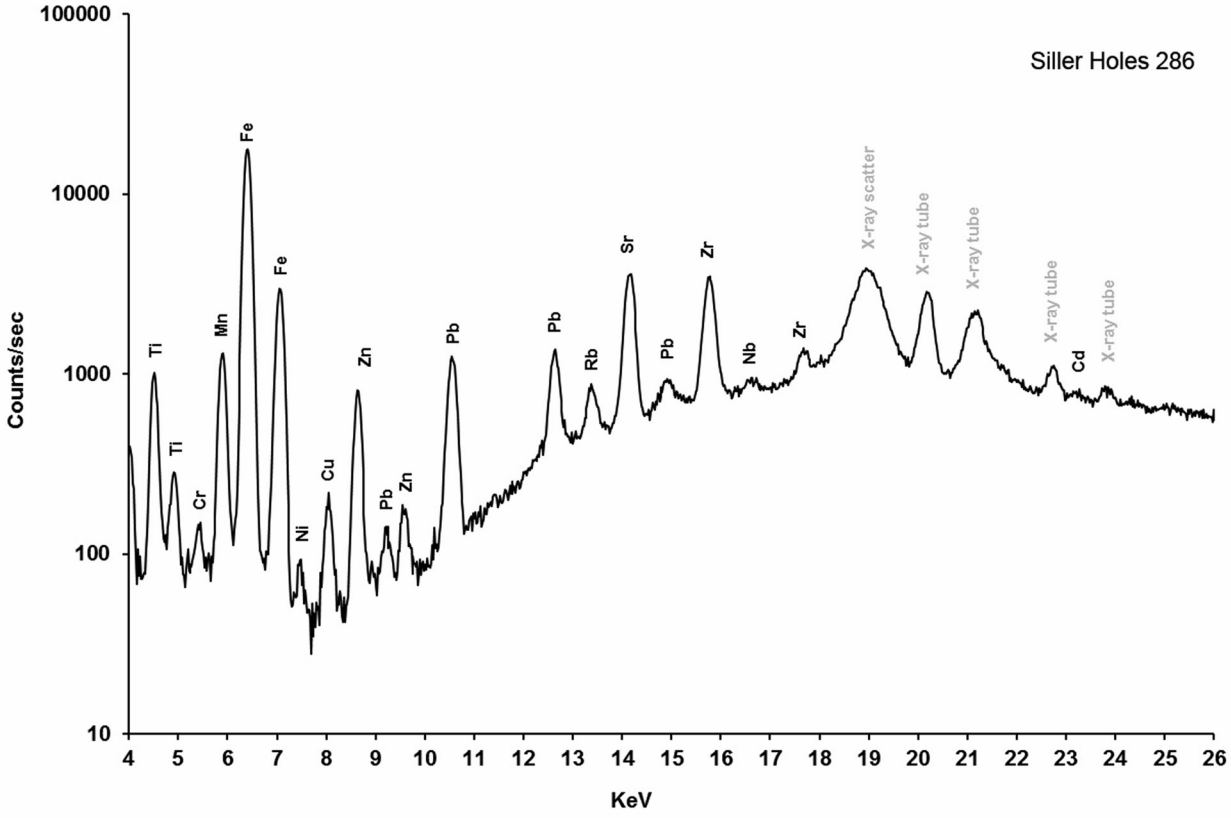
A2.1 Spectra of X-ray fluorescence analysis (refer to Table 8)



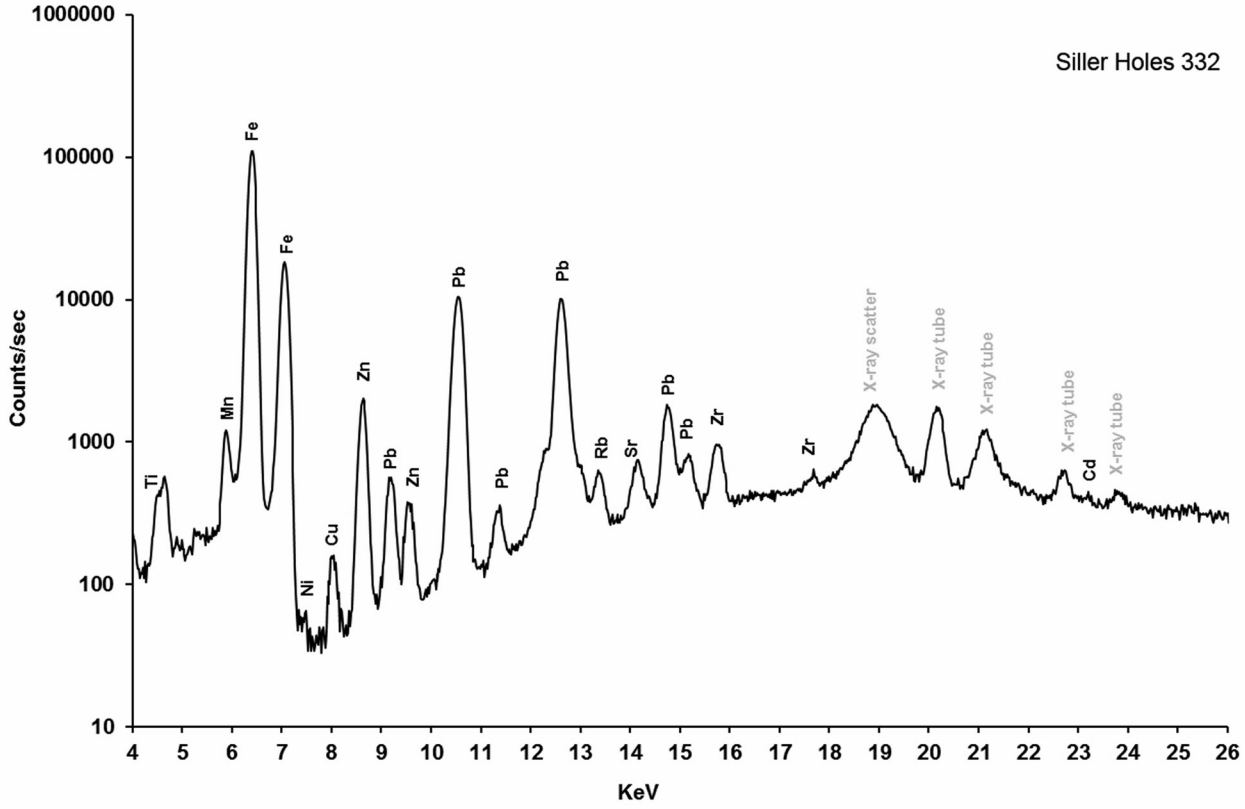
Illus A2 01 Siller Holes 74



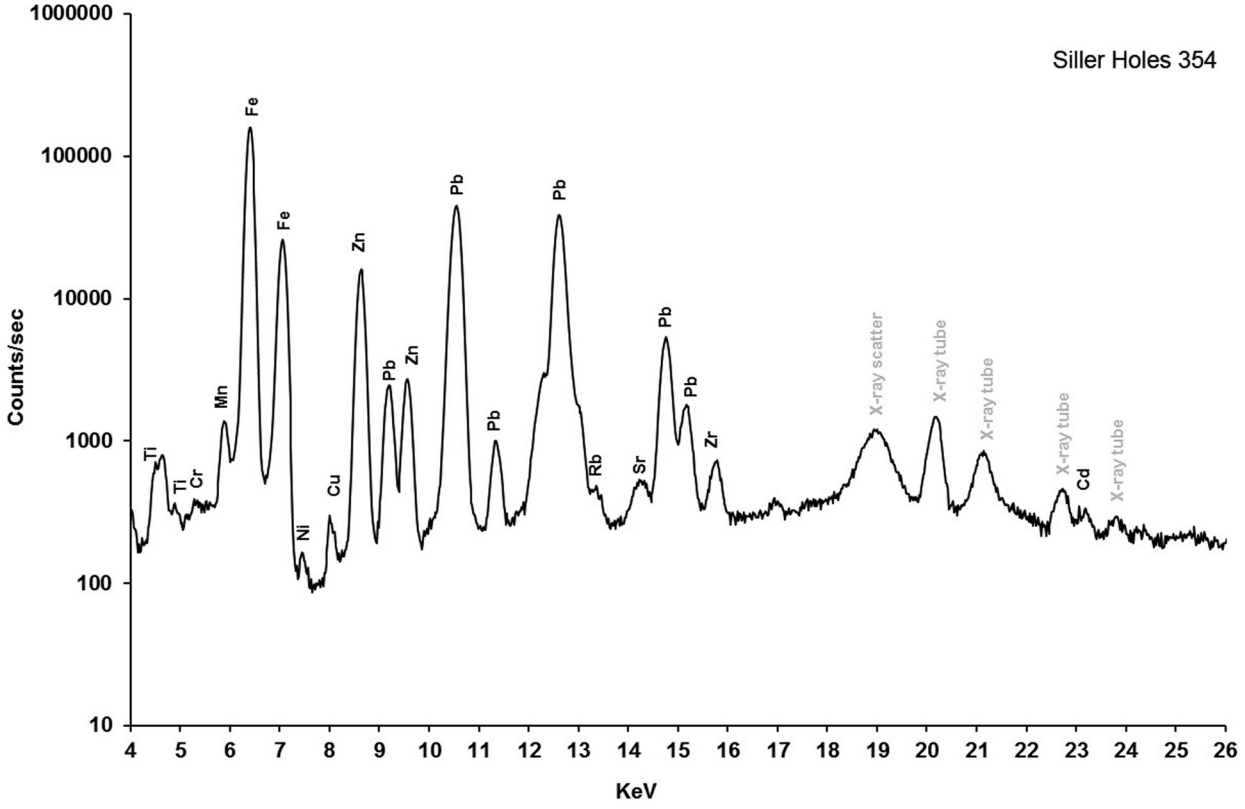
Illus A2 02 Siller Holes 117



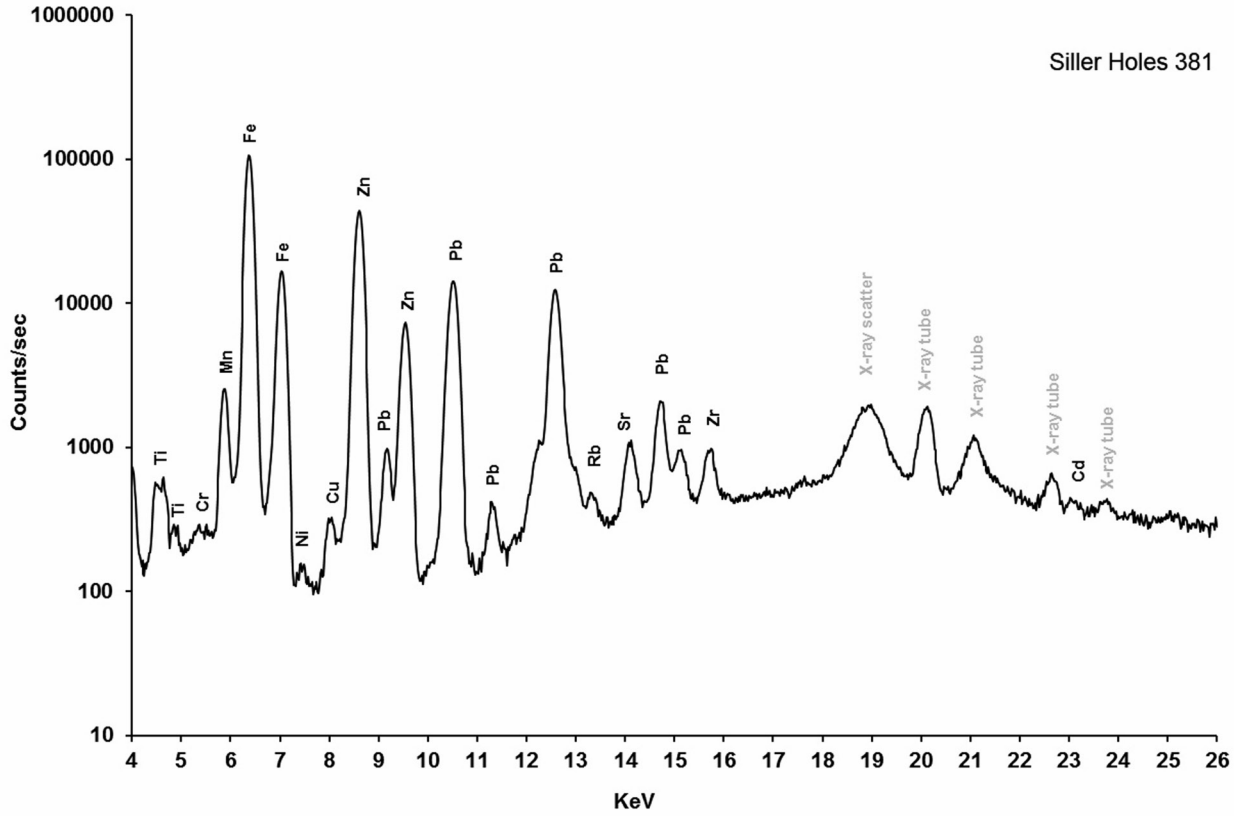
Illus A2 03 Siller Holes 286



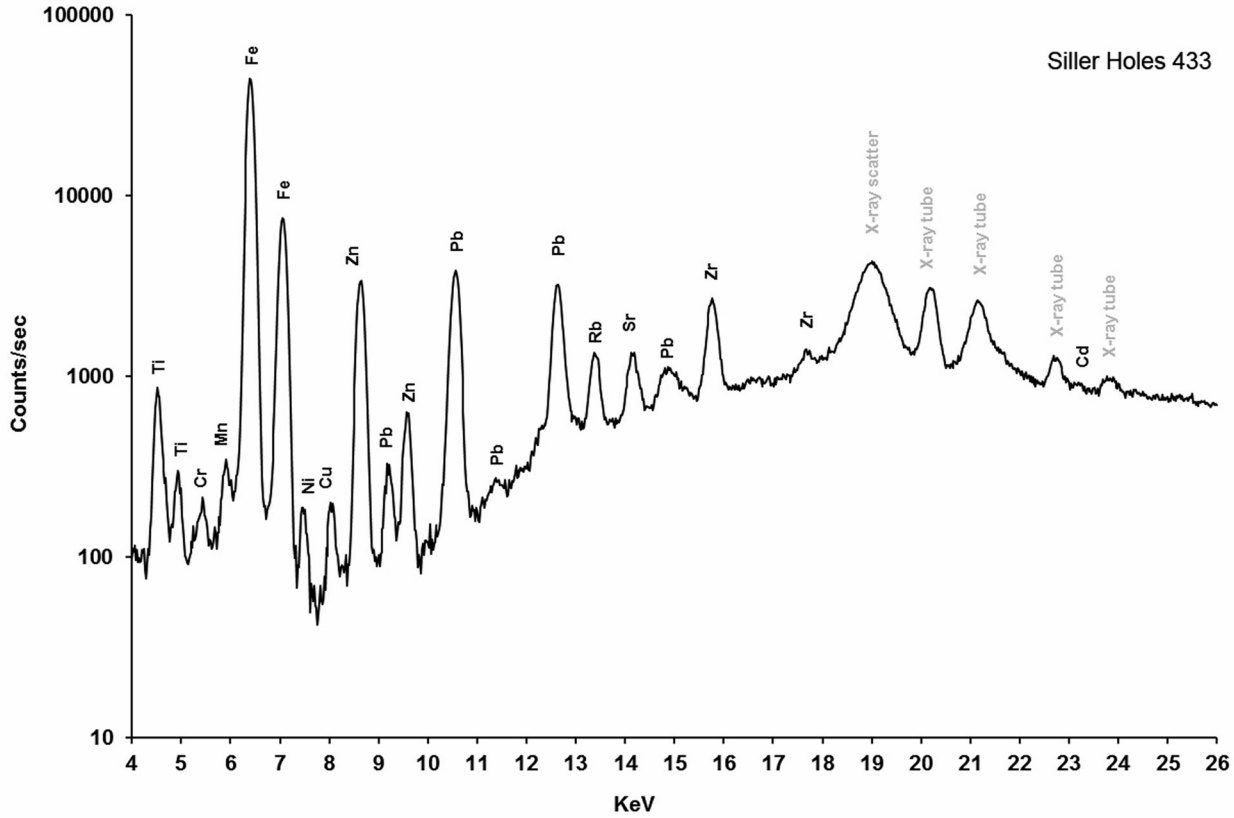
Illus A2 04 Siller Holes 332



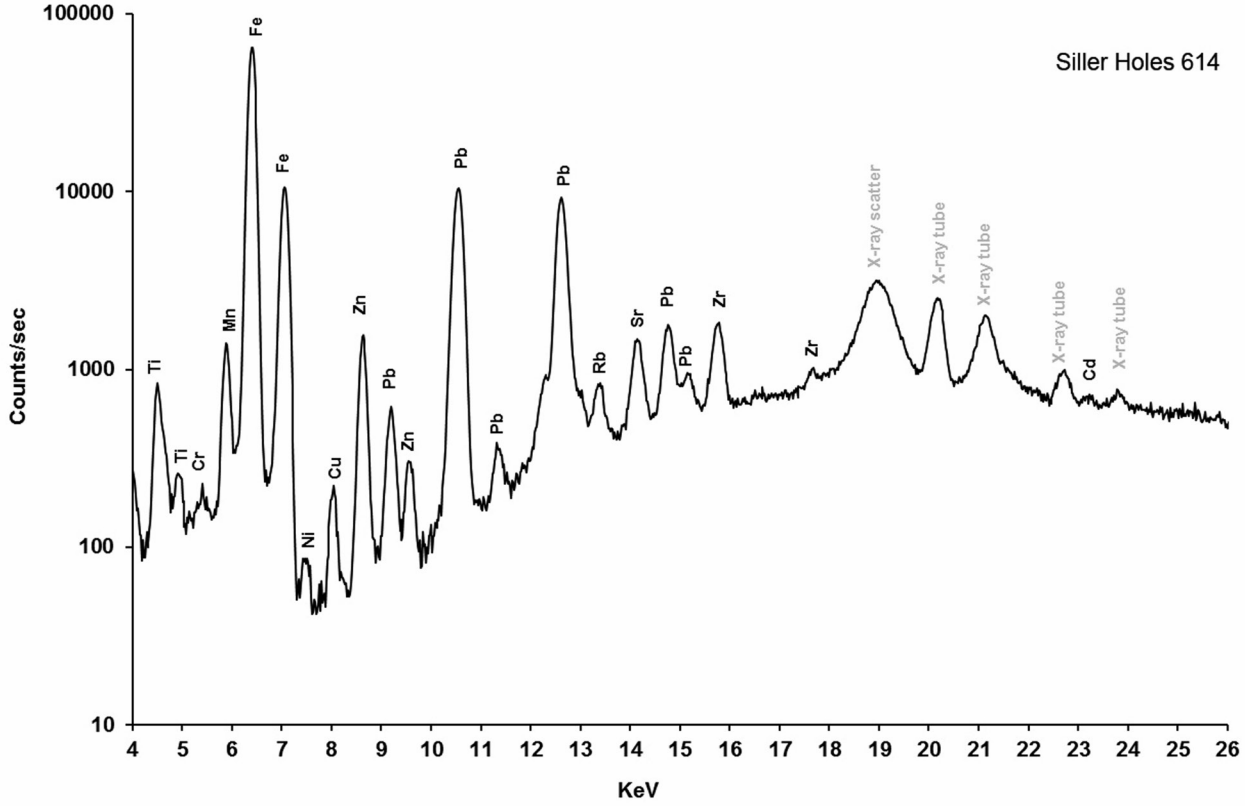
Illus A2 05 Siller Holes 354



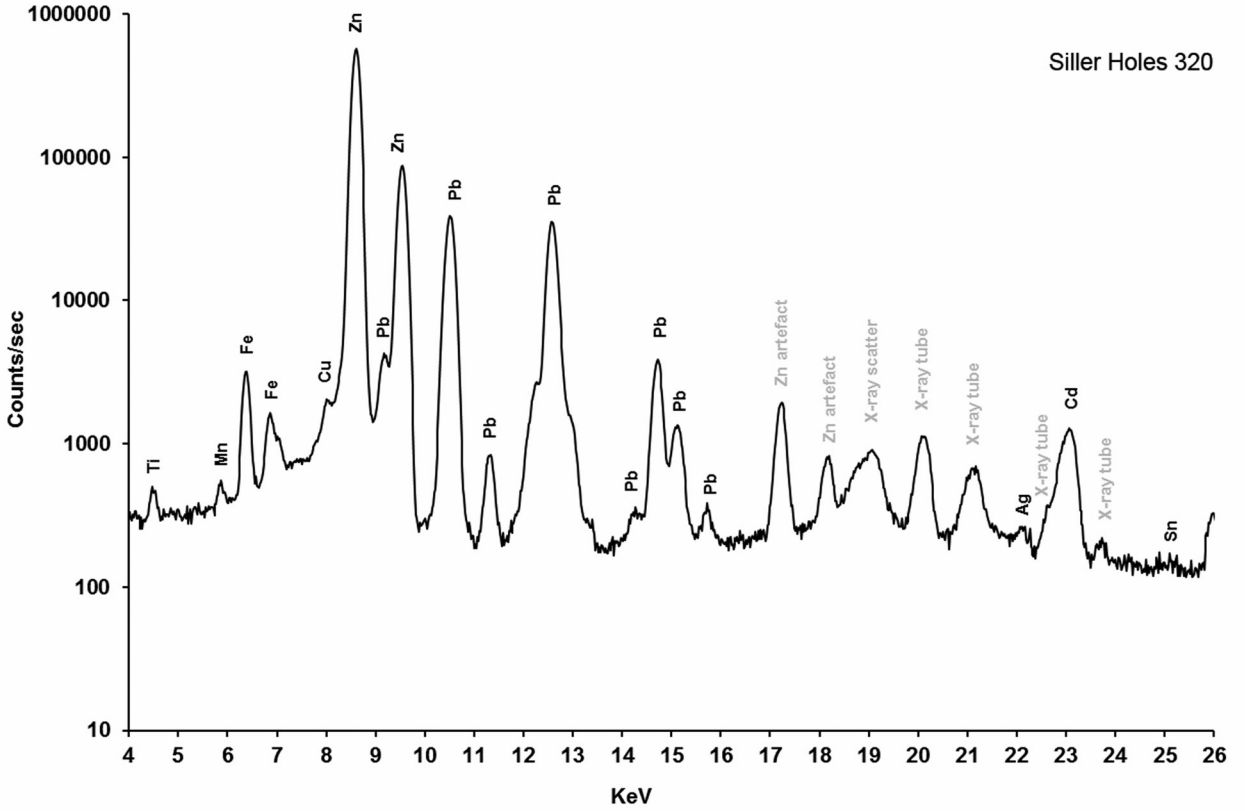
Illus A2 06 Siller Holes 381



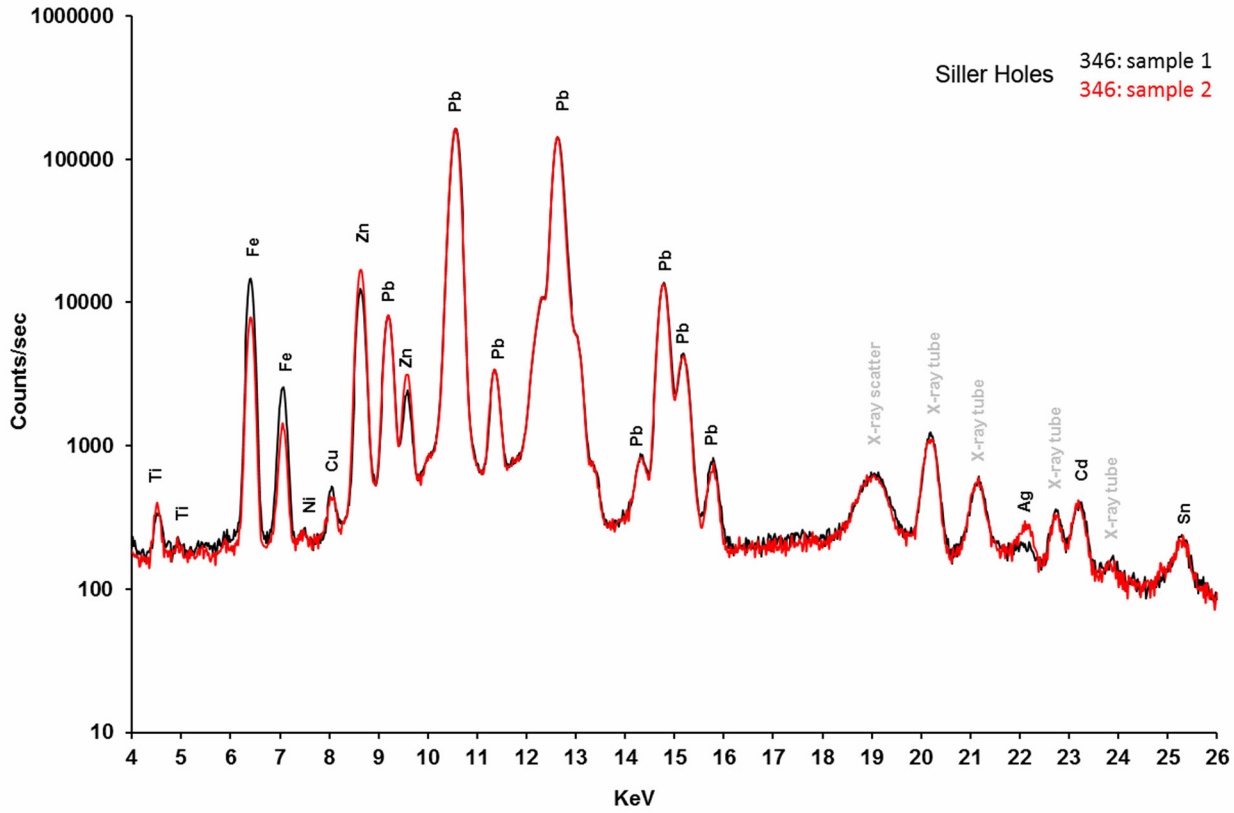
Illus A2 07 Siller Holes 433



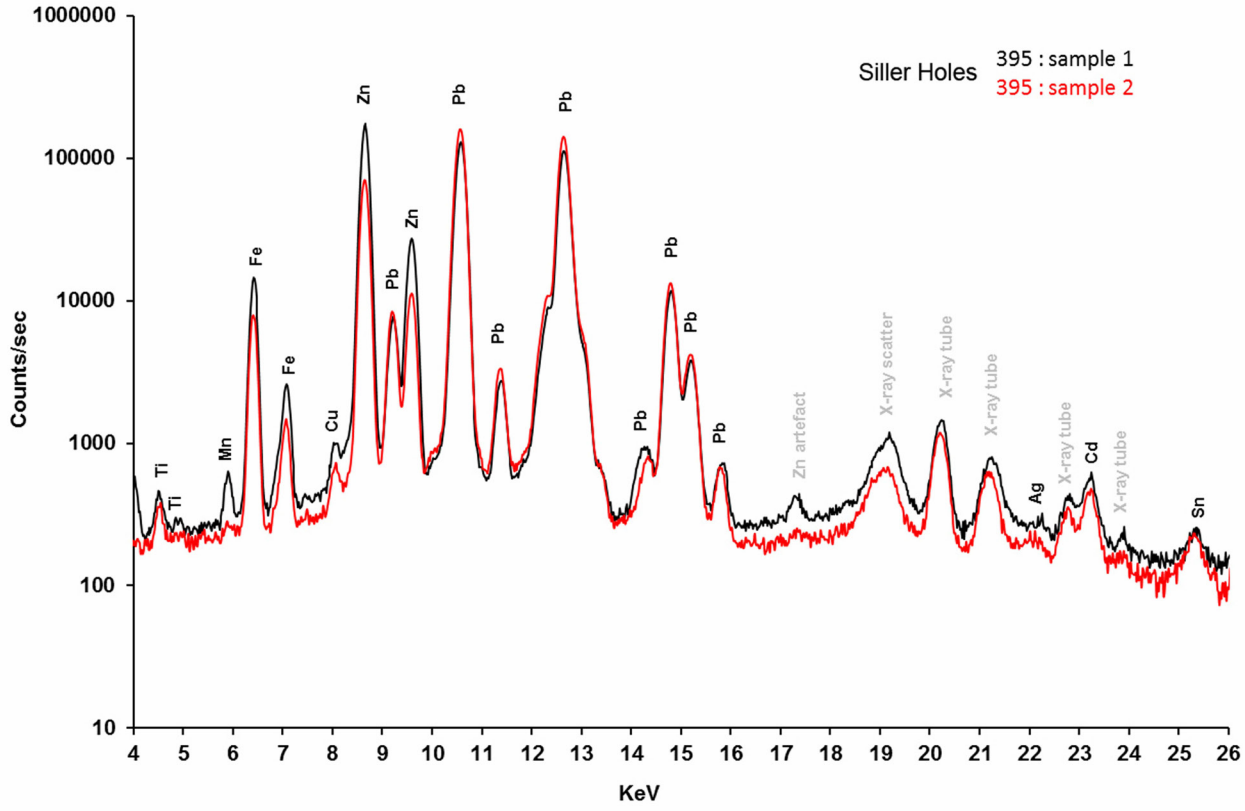
Illus A2 08 Siller Holes 614



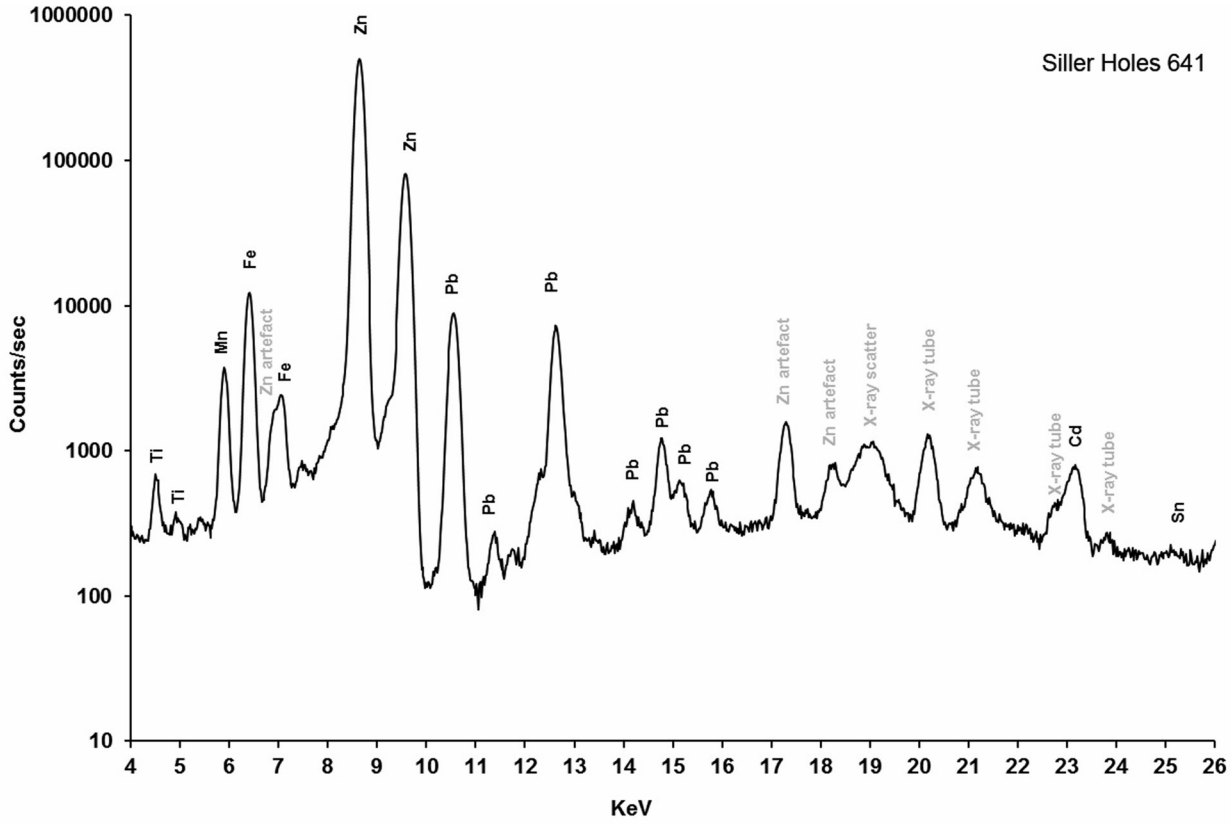
Illus A2 09 Siller Holes 320



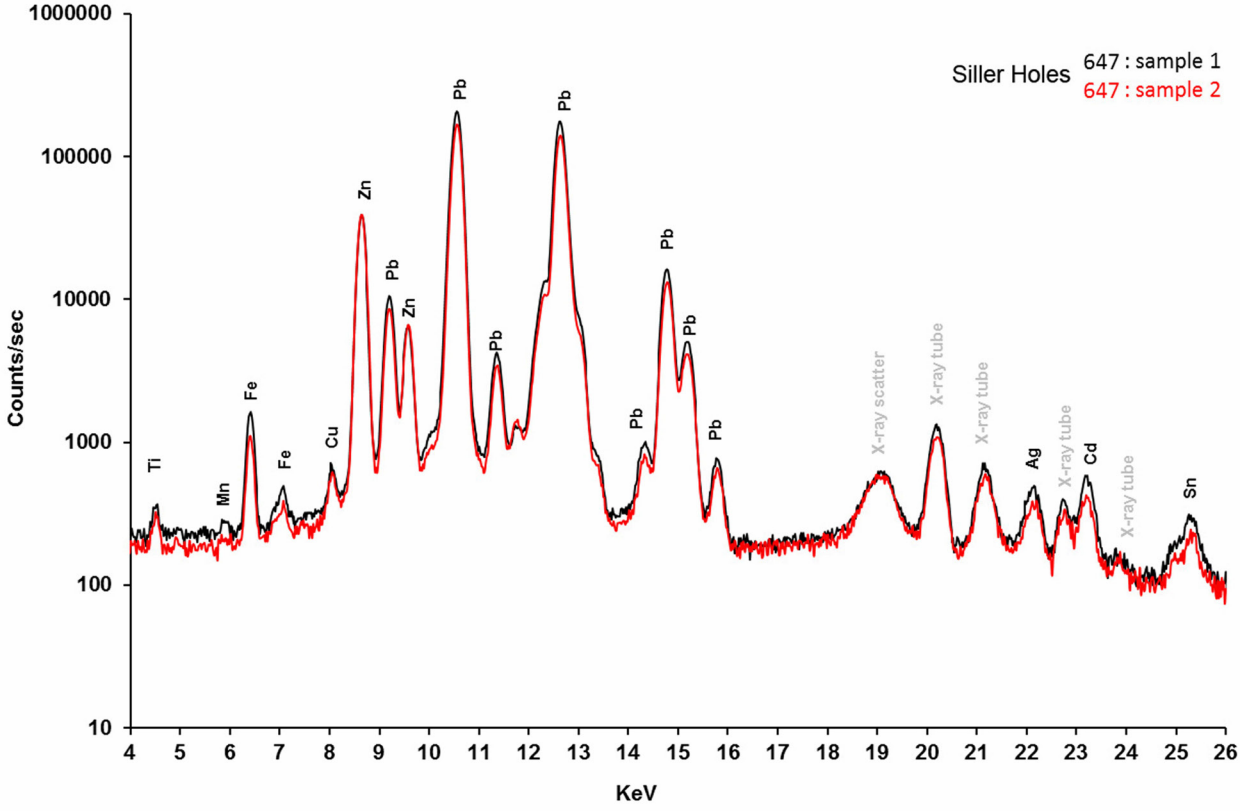
Illus A2 10 Siller Holes 346



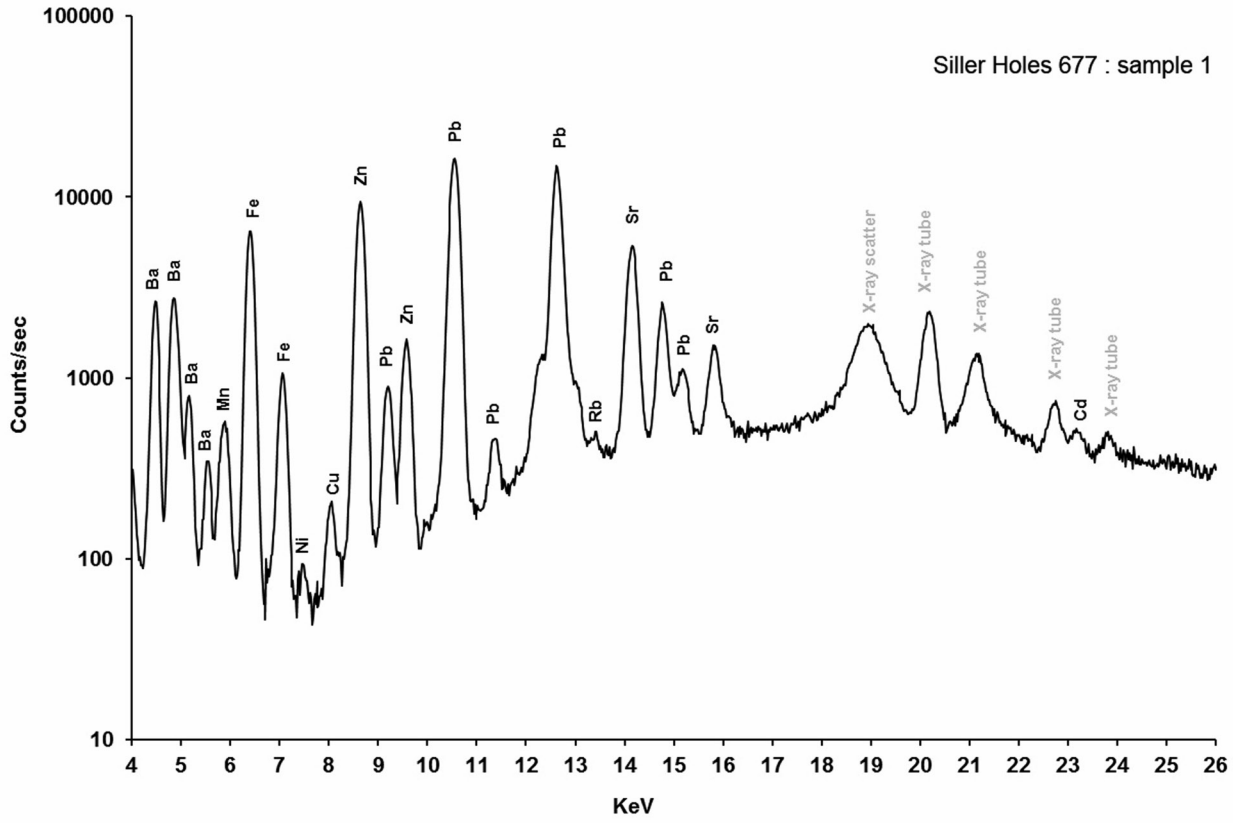
Illus A2 11 Siller Holes 395



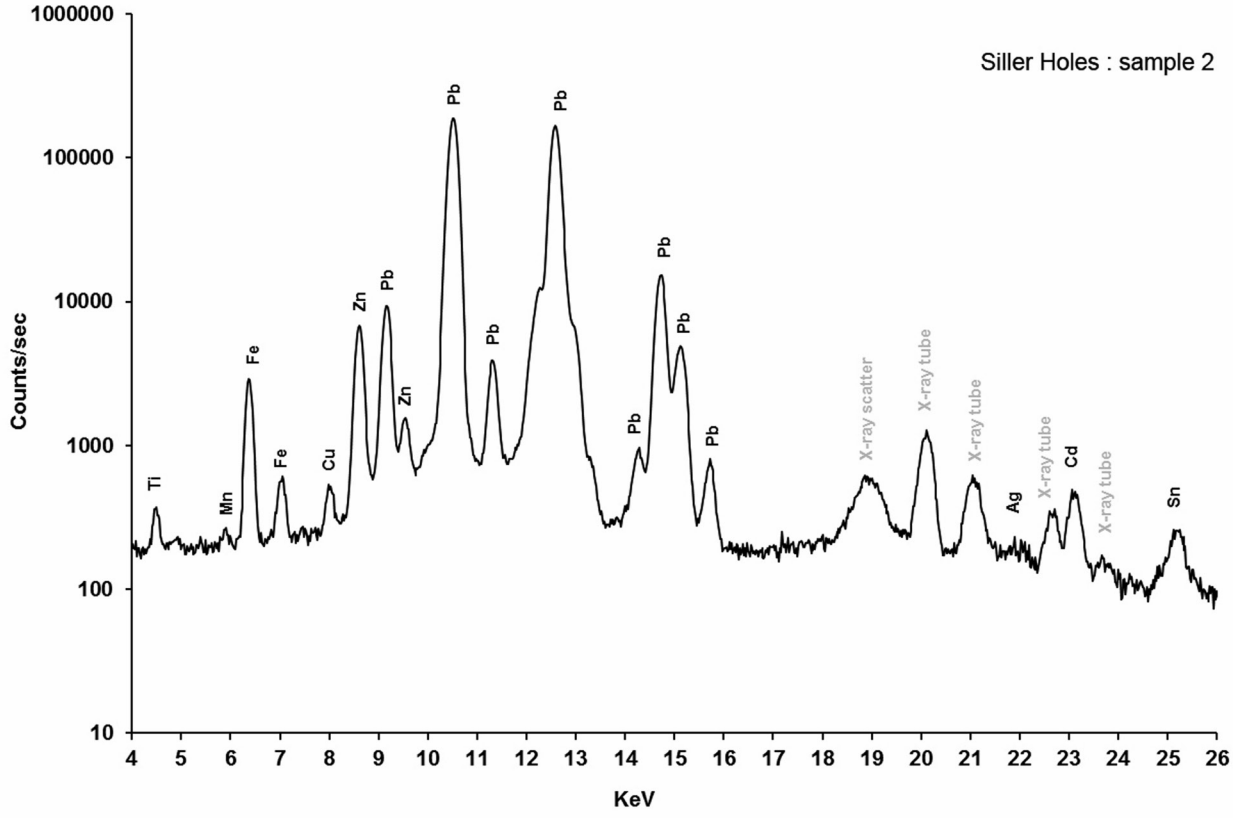
Illus A2 12 Siller Holes 641



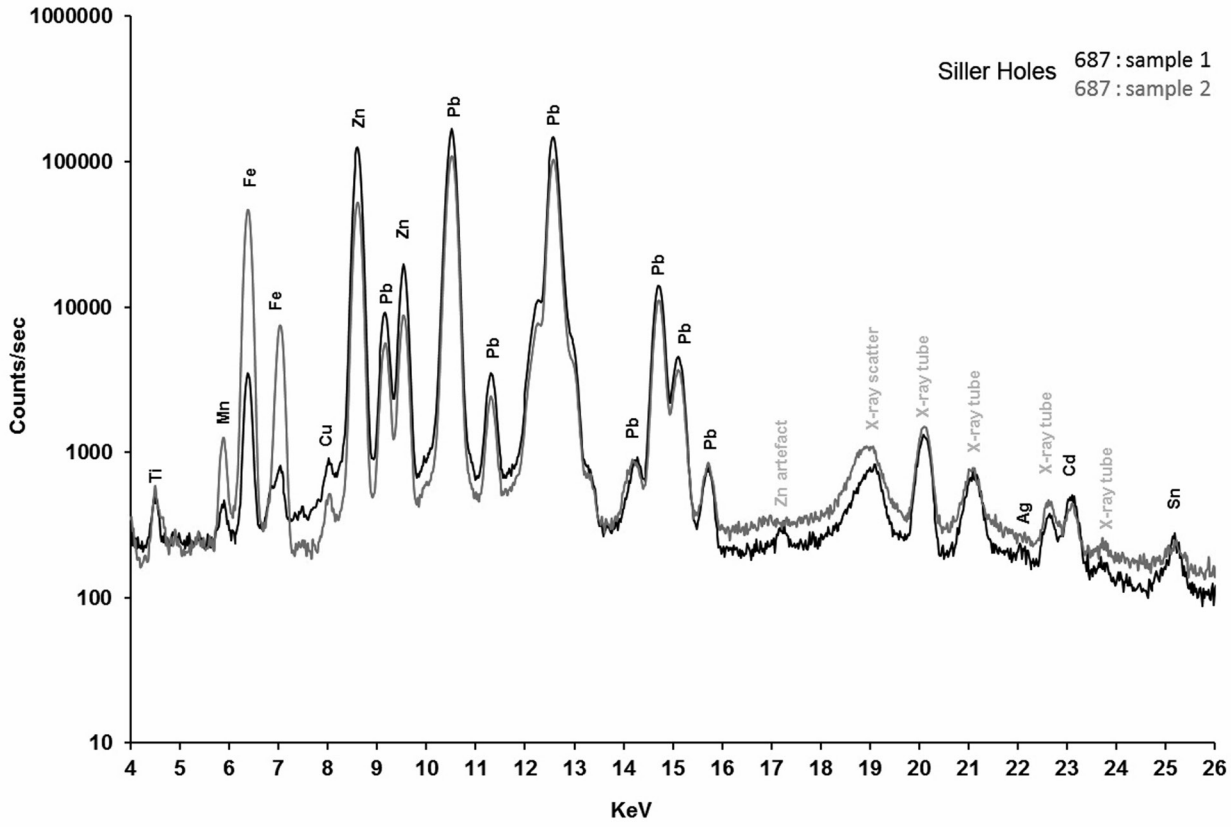
Illus A2 13 Siller Holes 647



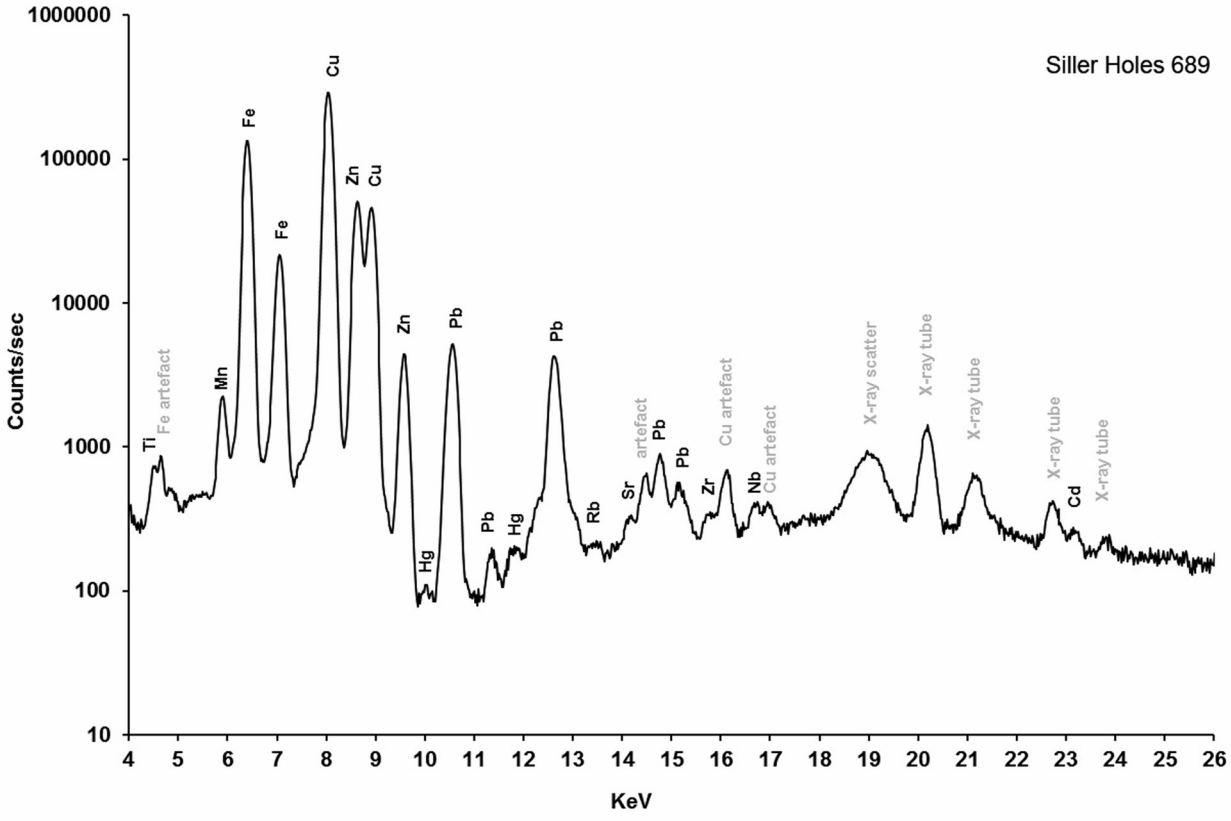
Illus A2 14 Siller Holes 677 sample 1



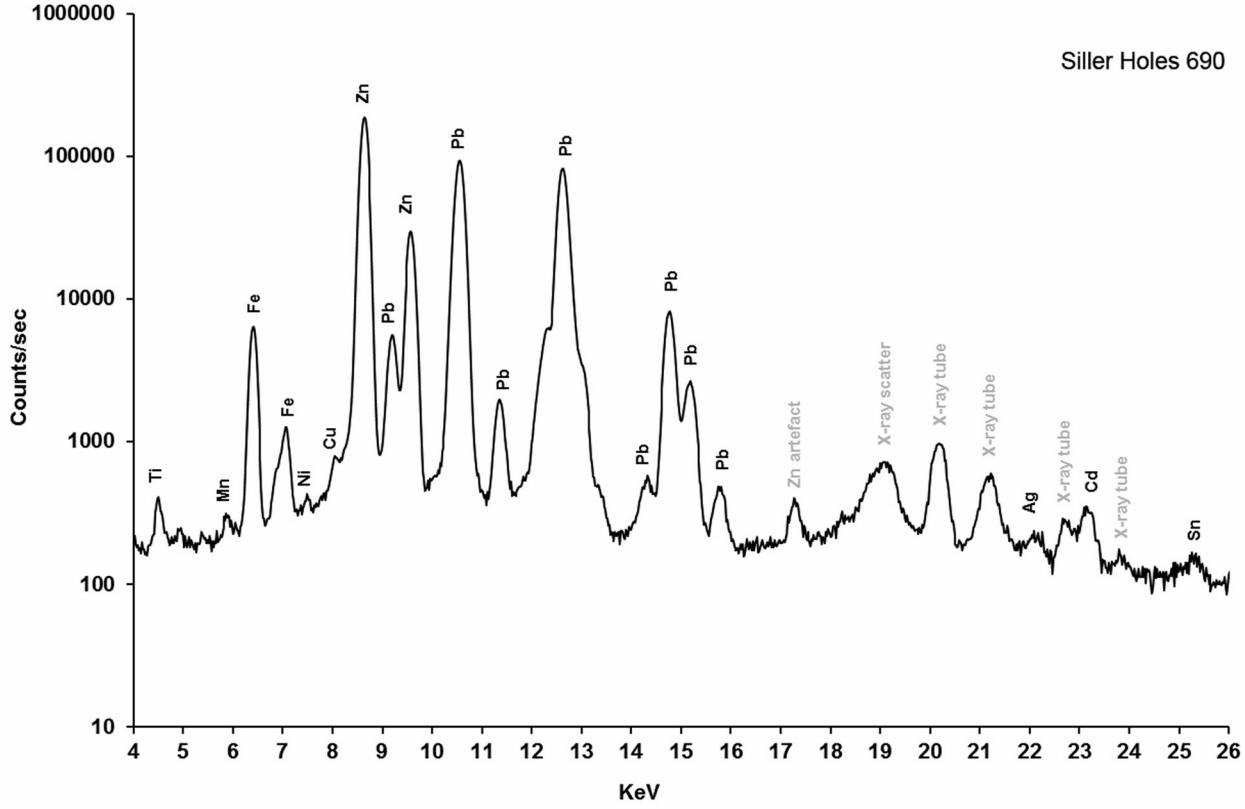
Illus A2 15 Siller Holes 677 sample 2



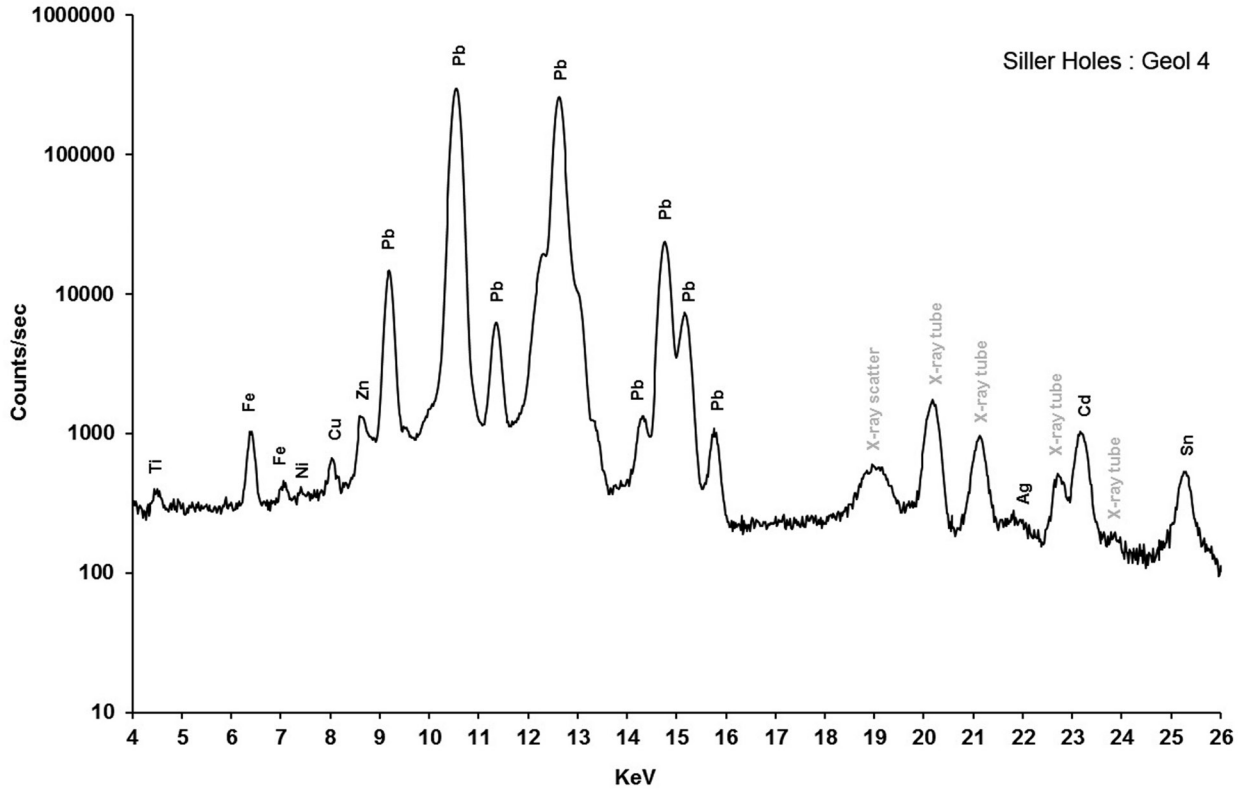
Illus A2 16 Siller Holes 687



Illus A2 17 Siller Holes 689



Illus A2 18 Siller Holes 690



Illus A2 19 Siller Holes Geol 4

11. ACKNOWLEDGEMENTS

My most grateful thanks are due to Dr David Caldwell, who encouraged and supported my production of this report.

Susan Oakes was instrumental in drawing attention to the site and in retrieving the vast quantity of organic and other material.

National Museums of Scotland generously provided funding and help in kind for fieldwork, research, conservation and the dye analysis, as well as funding specialist reports on the leather and textiles.

Thea Gabra-Sanders undertook the initial analysis of the textiles and drew attention to the unique composition and potentially early date of the assemblage. Sadly she was unable to complete her work due to illness and ultimate death. Our most grateful thanks are due to Dr Carol Christiansen, who took on the task of revising and bringing the report to fruition.

Dr Anita Quye analysed dye samples from the textiles. Clare Thomas provided a comprehensive report on the leather items. Dr Maureen Young of Historic Environment Scotland very kindly gave her time and expertise in analysing samples of lead and ore.

Jacqueline Moran, National Museums of Scotland, was particularly helpful in many ways with the preparation of this report.

Appreciation is due to Peter Davidson, George Haggarty, Derek Hall, Nicholas Holmes, Simon Howard, Dr Fraser Hunter and Nigel Ruckley for their advice and helpful comments. Thanks are also due to Anne Arrigoni of Wanlockhead Museum Trust for her assistance with research.

12. REFERENCES

Bick, D 1990 'Observations on Ancient Mining in Wales', *in* Crew, P (ed.) *Early Mining in the British Isles. Proceedings of the Early Mining Workshop at Plas Tan y Bwlch, Snowdonia National Park Study Centre, 17–19 November 1989*, 75–68. Plas Tan y Bwlch National Park Study Centre.

Brooks, C M 1981 'Medieval pottery from the kiln site at Colstoun, E Lothian', *Proc Soc Antiq Scot* 110: 364–403.

Buchan, J W and Paton, H 1927 *A History of Peeblesshire*, Vol 3. Glasgow: Jackson, Wylie & Co.

Caldwell, D H 2008 *Islay: The Land of the Lordship*. Edinburgh: Birlinn.

Caldwell, D H (forthcoming) *Finlaggan, Islay*.

Cardon, D 1990 *Guide des teintures naturelles*. Paris: Delachaux et Niestlé.

Carver, M O H 1979 'Three Saxo-Norman Tenements in Durham City', *Medieval Archaeology* 23: 26–35.

Christiansen, C and Hammarlund, L 2014 'The holistic nature of textile knowledge: fulling cloth in the sea', *in* Bergerbrant, S & Fossøy, S H (eds) *A Stitch in Time: Essays in Honour of Lise Bender Jørgensen*, 111–28. Gothenburg: Gothenburg University.

Clarke, H and Carter, A 1977 'Excavations in King's Lynn 1963–1970', Society for Medieval Archaeology Monograph, Series No. 7. London: Society for Medieval Archaeology.

Coatsworth, E 2012 'Broadcloth', *in* Owen-Crocker, G R, Coatsworth, E & Hayward, M (eds) *Encyclopedia of Medieval Dress and Textiles in the British Isles c. 450–1450*, 97. Leiden: Brill.

Cochran-Patrick, R W 1878 *Early Records Relating to Mining in Scotland*, Vol 49. Edinburgh: David Douglas.

Coles, G 1995 'Sillerholes, West Linton, Borders Region', *University of Edinburgh Department of Archaeology, 41st Annual Report*, 37–9.

Cox, E, Haggarty, G and Hurst, J G 1985 'Ceramic material', *in* Tabraham, C J 'Excavations at Kelso Abbey', *Proc Soc Antiq Scot* 114: 381–98.

Crowfoot, E, Pritchard, F and Staniland, K 1992 *Textiles and Clothing: c. 1150–c. 1450*. London: HMSO.

Dahl, C L 2009 'Mengiað klæthe and tweskifte klædher: marbled, patterned and parti-coloured clothing in medieval Scandinavia', *in* Vestergård Pedersen, K & Nosch, M-L B (eds) *The Medieval Broadcloth*, 122–38. Oxford: Oxbow Books.

Dixon, S 1989 'The Leatherwork', *in* O'Brien, C 1989 'Excavations at Newcastle Quayside: The Crown Court Site', *Archaeologia Aeliana* 5th series 17: 141–205.

Dransart, P Z, Bennett, H, Bogdan, N Q and Ryder, M L 2012 'The textiles', *in* Thoms, L M *Perth High Street Archaeological Excavation 1975–1977. Fascicule 3: The Textiles and the Leather*, 3–62. Perth: Tayside and Fife Archaeological Committee.

Emery, I 1994 *The Primary Structures of Fabrics*. New York & Washington DC: Watson-Guptill Publications.

Frere, S S, Welander, R and Gale, N 1989 'The Lead Pig', *in* Frere, S S & Wilkes, J J *Strageath. Excavations within the Roman Fort 1973–86*, 174–5. Britannia Monograph Series, No. 9. London: Society for the Promotion of Roman Studies.

Gabra-Sanders, T 2001 'Textiles', *in* Cameron, A S & Stones, J A (eds) *Aberdeen: An In-depth View of the City's Past: Excavations at Seven Major Sites within the Medieval Burgh*, 222–32. Edinburgh: Society of Antiquaries of Scotland.

Goldmann, A 2007 'Erste Versuche beim Aufrauen von Wollgeweben', *in* Rast-Eicher, A & Windler, R (eds) *Archäologische Textilfunde = Archaeological Textiles*. Proceedings of the North European Symposium for Archaeological Textiles (NESAT) IX: 224–29. Ennenda: Archaeo Tex.

Goodfellow, A V and Thornton, J H 1972 'Leather Shoe Parts from Excavations in Low Petergate, York, 1957–8', *Yorkshire Archaeological Journal* 44: 97–105.

Grew, F and de Neergaard, M 1988 *Shoes and Pattens: Medieval Finds from Excavations in London* 2. London: HMSO.

Grömer, K, Kern, A, Reschreiter, H and Rösel-Mautendorfer, H (eds) 2013 *Textilien aus Hallstatt = Textiles from Hallstatt*. Budapest: Archaeolingua.

Hall, D 1998 'The Scottish medieval pottery industry: a pilot study', *Tayside & Fife Archaeological Journal* 4: 170–8.

Hall, D 2006 *Scottish Monastic Landscapes*. Stroud: Tempus.

Hall, D 2007 'Excavations at the pottery production centre of Colstoun, East Lothian, 1939, 1969, 1971 and 1999/2000', *Medieval Ceramics* 28: 35–73.

Hammarlund, L 1998 *Textiliernas fjärde dimension: Hantverkarens kunskap och redskap: En studie av romerska tuskaftsvävar från Mons Claudianus*. Unpublished HSFR (Swedish Research Council for the Humanities and Social Sciences) report project D-nr F517/95: 10–12.

Hammarlund, L 2005 'Handicraft knowledge applied to archaeological textiles – visual groups and the pentagon', *Archaeological Textiles Newsletter* 41: 13–19. Copenhagen: Centre for Textile Research.

Hammarlund, L, Kirjavainen, H, Vestergård Pederson, K V and Vedeler, M 2008 'Visual Textiles: a study of appearance and visual impression in archaeological textiles', *in* Netherton, R & Owen-Crocker, G R (eds) *Medieval Clothing and Textiles* 4: 69–98. Woodbridge: Boydell Press.

Henshall, A S and Seaby, W A 1962 'The Dungiven Costume', *Ulster Journal of Archaeology* 24–5 (1961–2): 119–42.

Hofenk de Graaff, J 1983 'The chemistry of red dyestuffs in medieval and early modern Europe', *in* Harte, N B & Ponting, K G (eds) *Cloth and clothing in Medieval Europe*, 71–9. London Heinemann Educational Books & The Pasold Research Fund Ltd.

Hoover, H C and Hoover, L H 1950 *Agricola, G: De re metallica. Translated from the first Latin edition of 1556.* New York: Dover Publications, Inc.

Hunter, F 2000, with contributions by Carter, S, Davis, M, Finlayson, B, Hallén, Y, Lunt, D, Saville, A, Sheridan, A & Tipping, R, 'Excavation of an Early Bronze Age cemetery and other sites at West Water Reservoir, West Linton, Scottish Borders', *Proc Soc Antiq Scot* 130: 115–82.

Hunter, F 2006 'Recent finds from Strageath Roman Fort', *Tayside & Fife Archaeological Journal* 12: 81–8.

Hunter, J R S 1885 'The Silurian Districts of Leadhills and Wanlockhead', *Transactions of the Glasgow Geological Society* 7 (1881–4): 373–92.

Jones, R, Will, R, Haggarty, G and Hall, D 2006 'Sourcing Scottish White Gritty Ware', *Medieval Ceramics* 26 & 27: 45–84.

Kelso Abbey 1846 *Liber S Marie de Calchou*, Vol 1. Edinburgh: Bannatyne Club Vol 82.

Lewis, J H and Ewart, G J 1995 *Jedburgh Abbey: The Archaeology and Architecture of a Border Abbey*. Edinburgh: Society of Antiquaries of Scotland.

Macfarlane, W 1908 *Geographical collections relating to Scotland made by Walter Macfarlane*, Vol 3. Edinburgh: Scottish History Society 53.

McGregor, A 1982 'Anglo-Scandinavian Finds from Lloyds Bank, Pavement and Other Sites', *The Archaeology of York: The Small Finds* 17.3. London: Council for British Archaeology for York Archaeological Trust.

McMillan, R A 2012 *Teazles and Teazle Men*. Robert A McMillan.

Macpherson, D 1805 *Annals of Commerce* 1, 324. London: Nichols & Son.

Munro, J 2009 'Three centuries of luxury textile consumption in the Low Countries and England, 1330–1570: trends and comparisons of real values of woollen broadcloths (then and now)', *in* Vestergård Pedersen, K & Nosch, M-L B (eds) *The Medieval Broadcloth*, 1–73. Oxford: Oxbow Books.

Murray, J C 1993 'The Pottery', *in* Murray, H K & Murray, J C, 'Excavations at Rattray, Aberdeenshire. A Scottish Deserted Burgh', *Medieval Archaeology* 37: 148–69. https://doi.org/10.1080/00766097.1993.11735559

Newbattle Abbey 1849 *Registrum St Marie de Neubotle*. Edinburgh: Bannatyne Club Vol 89.

Nicholls, H G 1858 *The Forest of Dean: An Historical and Descriptive Account*. London: John Murray.

Nicol, J 1843 'Geology of Peeblesshire', *Transactions of the Highland Society* 14.

Nutz, B 2015 'Mining for textiles – textiles for mining', *in* Grömer, K, Pritchard, F (eds) *Aspects of the Design, Production and Use of Textiles and Clothing from the Bronze Age to the Early Modern Era*. Proceedings of the North European Symposium of Archaeological Textiles (NESAT) XII. Budapest: Archaeolingua Main Series 33.

Oakes, S 1994 'Siller Holes', *Discovery & Excavation in Scotland* 1994: 7.

Oakes, S nd 'A survey of old mines and quarries in the West Linton area'. Unpublished report.

Pennant, T 1776 *A Tour in Scotland 1769*. London: Benjamin White.

Pickin, J 2010 'Early lead smelting in southern Scotland', *Historical Metallurgy* 44.2: 81–4.

Pritchard, F 1990 'Patterned cloths from 14th-century London', *in* Walton, P & Wild, J-P (eds) *Textiles in Northern Archaeology*. Proceedings of the North European Symposium for Archaeological Textiles (NESAT) III. London: Archetype Publications.

Reichert, A 2013 'Textile techniques of the Stone Ages', *in* Hopkins, H (ed.) *Ancient Textiles, Modern Science*, 79–101. Oxford: Oxbow Books.

Rohl, B M 1996 'Lead isotope data from the isotrace laboratory, Oxford: *Archaeometry* data base 2, galena from Britain and Ireland', *Archaeometry* 38(1): 165–80. https://doi.org/10.1111/j.1475–4754.1996.tb00769.x

Rohl, B and Needham, S 1998 'The circulation of metal in the British Bronze Age: the application of lead isotope analysis', *British Museum Occasional Paper* 102: 19, 33–6, 66, 175, 216.

Royal Commission on the Ancient and Historical Buildings of Scotland (RCAHMS) 1995 'Scotland: Monuments on Record', *Annual Review 1994–5*.

Schnack, C 1992 'Die Mittelalterlichen Schuhe aus Schleswig: Ausgrabung Schild 1971–1975', *Ausgrabungen in Schleswig*, *Berichte und Studien* 10. Neumünster: Wachholtz.

Schweppe, H 1989, 'Identification of red madder and insect dyes by thin-layer chromatography', *in* Zeronian, S H & Needles, H L (eds) *Historic Textile & Paper Materials II: Conservation and Characterisation*, 188–219. Washington: American Chemical Society Symposium, Series No. 410.

Smout, T C 1967 'Lead mining in Scotland', *in* Payne, P (ed.) *Studies in Scottish Business History*, 102–35. London: Frank Cass & Co Ltd.

Statistical Account of Scotland 1796, 17. Edinburgh: Wm Creech.

Stöllner, T 2005 'More than old rags: textiles from the Iron Age salt-mine at the Dürrnberg', *in* Bichler, P, Grömer, K, Hofman-de Keijzer, R, Kern, A & Reschreiter, H (eds) *Hallstatt Textiles*: *Technical Analysis*, *Scientific Investigation and Experiment on Iron Age Textiles*, 161–74. Oxford: Archaeopress.

Stones, J 1982 'Leather objects', *in* Murray, J C (ed.) *Excavations in the Medieval Burgh of Aberdeen 1973–81*, 191–7. Edinburgh: Society of Antiquaries of Scotland.

Thomas, C 1981 'Leatherwork', *in* Good, G L & Tabraham, C J 1981 'Excavations at Threave Castle, Galloway, 1974–78', *Medieval Archaeology* 25: 90–140. https://doi.org/10.1080/00766097.1981.11735432

Thomas, C 1988 'The Leather', *in* Holdsworth, P (ed.) *Excavations in the Medieval Burgh of Perth 1979–81*, 176–7. Edinburgh: Society of Antiquaries of Scotland.

Thomas, C 2001 'The leather', *in* Cameron, A S & Stones, J A (eds) *Aberdeen: An In-depth View of the City's Past: Excavations at Seven Major Sites within the Medieval Burgh*, 241–58. Edinburgh: Society of Antiquaries of Scotland.

Thomas, C forthcoming 'The Leather from Bristol Bridge, Bristol 48/81', *in* Williams, B 'Excavations at Bristol Bridge, Bristol', Bristol & Region Archaeological Services, Bristol City Museums & Art Gallery, unpublished excavation report.

Thomas, C and Bogdan, N Q 2012 'The leather', *in* Thoms, L M (ed.) *Perth High Street: Archaeological Excavation 1975–1977. Fascicule 3: The Textiles and the Leather*, 147–362. Tayside & Fife Archaeological Committee Monographs.

Thornton, J H 1990 'Leather Balls', *in* Biddle, M *Artefacts from Medieval Winchester: Object and Economy*, 707–8. Winchester: Clarendon Press.

Turnau, I 1994 *European Occupational Dress from the Fourteenth to the Eighteenth Century*. Warsaw: Polish Academy of Sciences.

Vestergård Pedersen, K 2009 'Archaeological evidence of multi-coloured cloth and clothing', *in* Vestergård Pedersen, K and Nosch, M-L B (eds) *The Medieval Broadcloth*, 139–51. Oxford: Oxbow Books.

Vince, A G 1991 *Aspects of Saxon and Medieval London 1: Finds and Environmental Evidence*. London: London & Middlesex Archaeological Society.

Walton, P and Eastwood, G 1988 *A Brief Guide to the Cataloguing of Archaeological Textiles*. London: Institute of Archaeology.

Wanlockhead Museum Trust 1975 *Wanlockhead: Scotland's Highest Village*, 3.

Wincott Heckett, E 2013 'The Lady of Cloonshannagh Bog: an Irish 7th-century

AD bog body and the related textiles', *in* Banck-Burgess, J and Nübold, C (eds) *Proceedings of the North European Symposium for Archaeological Textiles (NESAT) XI,* 167–72. Rahden: Verlag Marie Leidorf.

Woolliscroft, D and Hoffman, B 2011 'Inchtuthil: a legion in the landscape', *Current Archaeology* 254: 26

Wouters, J and Verhecken, A 1989. 'The coccid insect dyes: HPLC and computerised diode-array analysis of dyed yarns', *Studies in Conservation* 34: 189–200.

Young, A 1997 *Robert the Bruce's Rivals, the Comyns: 1212–1314*. East Linton: Tuckwell Press.

12.1 Maps

Armstrong, M J 1775 'Map of the County of Peebles or Tweedale', with notes. National Library of Scotland, Map Library no. 74414121.

Historic Environment Scotland 1994 'Field survey plan 1994 S C357795'.

Ordnance Survey 1858 'Peebles-shire', Sheet V, 1:10,560 (six-inch).

Smith, D 1849 'Plan of the Estate of Lynedale and Leadlaw belonging to W Forbes of Medwyn', National Archives of Scotland, RHP 3140.

12.2 Internet

Google Maps: https://www.google.co.uk/maps/@55.7663242,-3.3621871,594m/data=!3m1!1e3. Accessed 1 October 2018.

Britannica Online Encyclopedia: https://www.britannica.com/technology/lead-processing. Accessed 1 October 2018.

Historic Environment Scotland – Canmore: https://canmore.org.uk. Accessed 1 October 2018.