The Archaeology of York **The Small Finds** 17/5

Textiles, Cordage and Raw Fibre from 16–22 Coppergate

Penelope Walton

Published for the York Archaeological Trust
by the Council for British Archaeology 1989

The Archaeology of York

Volume 17: The Small Finds
General Editor P.V. Addyman
Co-ordinating Editor V. E Black

First published by
Council for British Archaeology for York Archaeological Trust

ISBN 0 906780 79 9

Cover illustration: Examples of textile from 16–22 Coppergate

Digital edition produced by Lesley Collett, 2013

Volume 17 Fascicule 5

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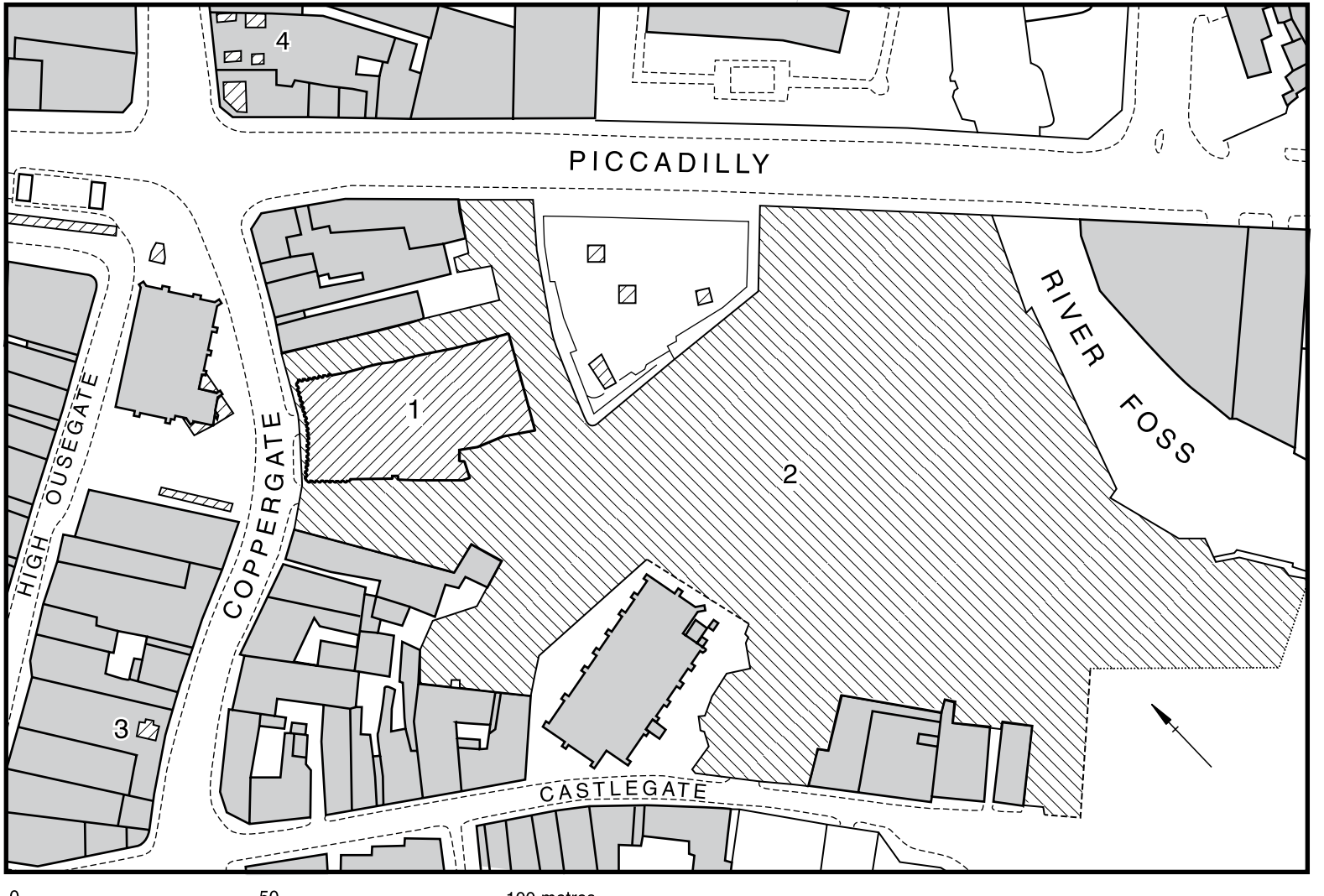


Fig. 120 Plan showing position of (1) 16–22 Coppergate, and (2) area of Watching Brief; (3) 5–7 Coppergate; (4) Lloyds Bank, 6–8 Pavement. (Based on the Ordnance Survey map with the consent of the Controller of Her Majesty's Stationery Office, Crown Copyright reserved) Scale 1:1250

Introduction

The finds discussed in this fascicule are textile, cordage and animal fibre retrieved from the excavation at 16-22 Coppergate between 1976 and 1981, together with a small group recovered from the watching brief during development of the site in 1982. They include all the finds of this type, of whatever period. Occasional reference is made to other textile-related finds from the site, such as spinning and weaving equipment, but these are described in greater depth in *AY* 17/11. Botanical remains such as dye-plants and raw plant fibre will be discussed in *AY* 14/7. The textiles are deposited at the Yorkshire Museum (accession numbers 1976-81.7 and 1982.22); some are on display at the Museum and others are on loan to the Jorvik Viking Centre.

A total of 211 finds of textile, yarn, rope and raw fibre were recovered. The majority are from the mid 9th to the mid 11th century, a period which saw extensive settlement of Scandinavians in York. From this Viking Age or Anglo-Scandinavian period there are 106 woven textiles, one needle-worked object, 26 pieces of yarn or cordage and 29 examples of raw fibre. There is also a small but useful group of finds dated to the period from the mid 11th to the 14th century: 13 woven, 32 yarn or cordage and two raw fibre. Two textiles are unstratified.

All the finds are described in the catalogue on pp.432-43. Those from the 1976-81 excavation are arranged in order of the site's phases, the Viking Age finds (Periods 3, 4A, 4B, 5Aand 5B) catalogue numbers, *1254-1411*, and the medieval (Period 6), *1412-58*. The six finds, *1459-64*, from the 1982 post-excavation watching brief (catalogued at end), could not be closely dated, but three of the textiles, *1460-2,* could be ascribed to the Anglo-Scandinavian period. Unstratified finds from the watching brief are numbers *1463-4*.

Each textile was examined in detail and a record made of the raw material, yarn type, weave, dyestuff and stitching. In the following pages, each of these features is taken in turn and discussed with reference to the comparative material, first from Britain and then from the rest of north-west Europe. This discussion is preceded by an archaeological description of the site and a review of the comparative material. A final chapter attempts to place the textile finds within the broader framework of social organisation and trade in Viking and medieval times.

Archaeological Introduction

By R.A. Hall

The important collection of Anglo-Scandinavian and medieval textiles, cordage and raw fibre catalogued and discussed here includes the first large group of cloth fragments to be discovered in York. The survival of these environmentally sensitive items in such numbers in and around 16-22 Coppergate is due to the high level of moisture and correspondingly low oxygen content in the organic-rich soil which typifies the Anglo-Scandinavian and, to

Table 11 Summary of archaeological development at 16-22 Coppergate

Period	Date	Characteristics
1	late 1st-late 4th century	Roman timber and stone buildings; late Roman cemetery. Limited survival of later organic materials*
2	5th-mid 9th century	Apparent desertion. Homogeneous loamy deposits which did not preserve organic materials
3	mid 9th-late 9th/ early 10th century	Rubbish disposal, suggesting occupation close by. Post/stake and wattle alignments, possibly boundaries. Organic materials preserved only in pit cuts
4A	late 9th/early l0th century- c.930/5	Realignment of boundaries, suggesting that Coppergate was laid out by this period. Possible buildings at Coppergate frontage. Organic materials preserved mainly in pit cuts
4B	c.930/5-c.975	Four tenements distinguishable, with post and wattle buildings at Coppergate frontage. Evidence for iron-working and other trades on a commercial scale. Organic-rich deposits nearer to Coppergate; organic content thinning to zero towards R. Foss
5A	c.975	Near Coppergate frontage only. Layers between structures of Periods 4B and 5B; probably mixture of dump deposits and soil from 5B semi-basements
5B	c.975–early/mid 11th century	Perpetuation of boundaries. Introduction of 'sunken featured' structures in double row at street frontage. Organic-rich deposits as in Period 4B
5Cf	mid-later 11th century	Organic-rich deposits at street frontage, associated with buildings which survive only in Tenement D
5Cr	mid–later 11th century	Post-built structure sealed by succession of dump deposits. Little organic material surviving
6	later 11th-16th century	No remains surviving at street frontage, but area to rear increasingly built up. New methods of building and rubbish disposal, leading to reduction in organic content of deposits

*Bone and antler generally survived well in all periods even where preservation of other organic materials was poor

a lesser extent, the subsequent medieval deposits in this part of the city. In spite of these favourable conditions, however, textiles were apparently not noticed or recovered during large-scale redevelopment projects nearby at 25-7 High Ousegate and 2-6 Coppergate in the first decade of the 20th century when other archaeological items, including some of perishable materials, such as wood, were recorded (Benson 1902; 1906). Even in more recent controlled archaeological excavations at Hungate in 1949-50, where broadly similar

conditions were encountered and small objects of both wood and leather were found, no traces of textiles, yarns or fibres were reported, with the exception of some wool fibres, found in the caulking of fragmentary medieval ships' timbers (Richardson 1959, 67). A plain weave fragment was recovered from what was interpreted as a pre-Conquest level in excavations at the south comer tower of the Roman fortress, Feasegate (Stead 1958,525); but L.P. Wenham's excavations at 65 Petergate in 1957-8 were the first in York to bring to light a range of textile remains. Wools from the site are reported by Ryder (1970, 426), and the textiles have been briefly mentioned (Wenham 1972, passim) and are to be reconsidered by Walton (in prep. a). In the excavation and watching brief in 1972-4 at Lloyds Bank, 6-8 Pavement, and the 1974 watching brief at 5-7 Coppergate, a range of wool textiles, principally of Anglo-Scandinavian date, was recorded *(AY* 17/3); both groups also included a piece of silk. Probably because of their vulnerability to bacterial and fungal attack when discarded in damp, rather than truly waterlogged (anoxic), conditions (see below), no vegetable-based textiles, such as linen, were recovered in either investigation, although both charred and unburned samples are represented in the assemblage discussed here.

The site at 16-22 Coppergate, excavated under this writer's direction in 1976-81, lies on the spur of land between the Rivers Ouse and Foss (Fig.120). It is bounded to the west by Coppergate, a street leading towards the only bridge across the Ouse in the medieval period, and to the east by the banks of the Foss. Because of a shortage of funding, the earliest levels, dating from the Roman period to the early/mid 10th century (i.e. up to and including what is described below as Period 4A), were not examined right across the c.1000m 2 open in the subsequent levels; instead, a strip measuring approximately 20 x 7.5m across the Coppergate street frontage and a contiguous strip up to 12m wide and 37m long, running down the southern half of the site towards the River Foss, were excavated to natural soils (Figs.121-3, Table 11). Layers attributable to Periods 1 and 3 were recorded throughout these strips. A well-defined Period 2 horizon existed only in the street frontage strip; elsewhere, because of stratigraphic interruptions and an overall thinning of these earlier layers as they ran eastwards from the street frontage, Period 2 contexts could not be isolated with certainty. Therefore, although some deposition of soil must have taken place throughout Period 2, remains of this period are shown as of limited extent. Likewise, the Period 4A horizon, while extending right across the frontage, could not be traced convincingly down the southern strip beyond a point where diagnostic features petered out, although a pit containing textile fragments, which lies some way east of the frontage strip, is attributed to this period. It is thus conceivable that a small amount of soil build-up which took place during Period 4A on that part of the southern strip to the east of the limit of identifiable 4A features has been subsumed into Period 4B. For reasons outlined below, the deposits designated as Period 5A were limited in extent to the front part of the site, those of Period 5Cf and 5Cr, from which no textiles were recovered, were respectively limited to the front- and rear-most portions of the excavation, and no contemporary levels could be stratigraphically isolated in the central part of the excavation. These variations in the size of area excavated must be borne in mind in any chronological/ quantitative analysis of the textile finds.

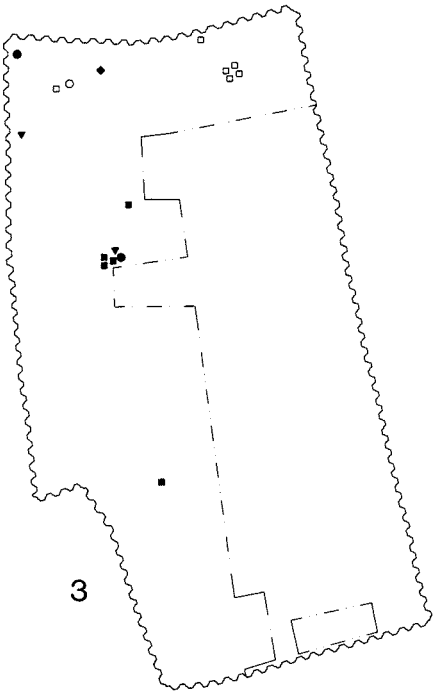
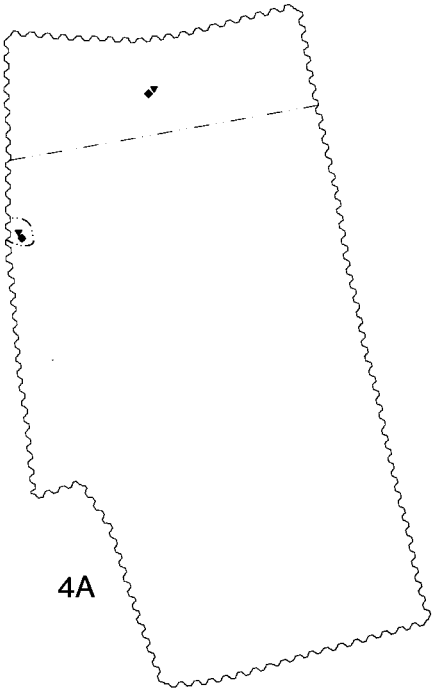
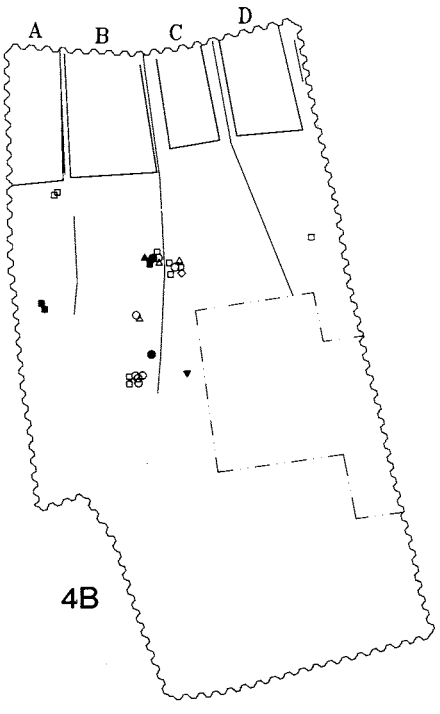
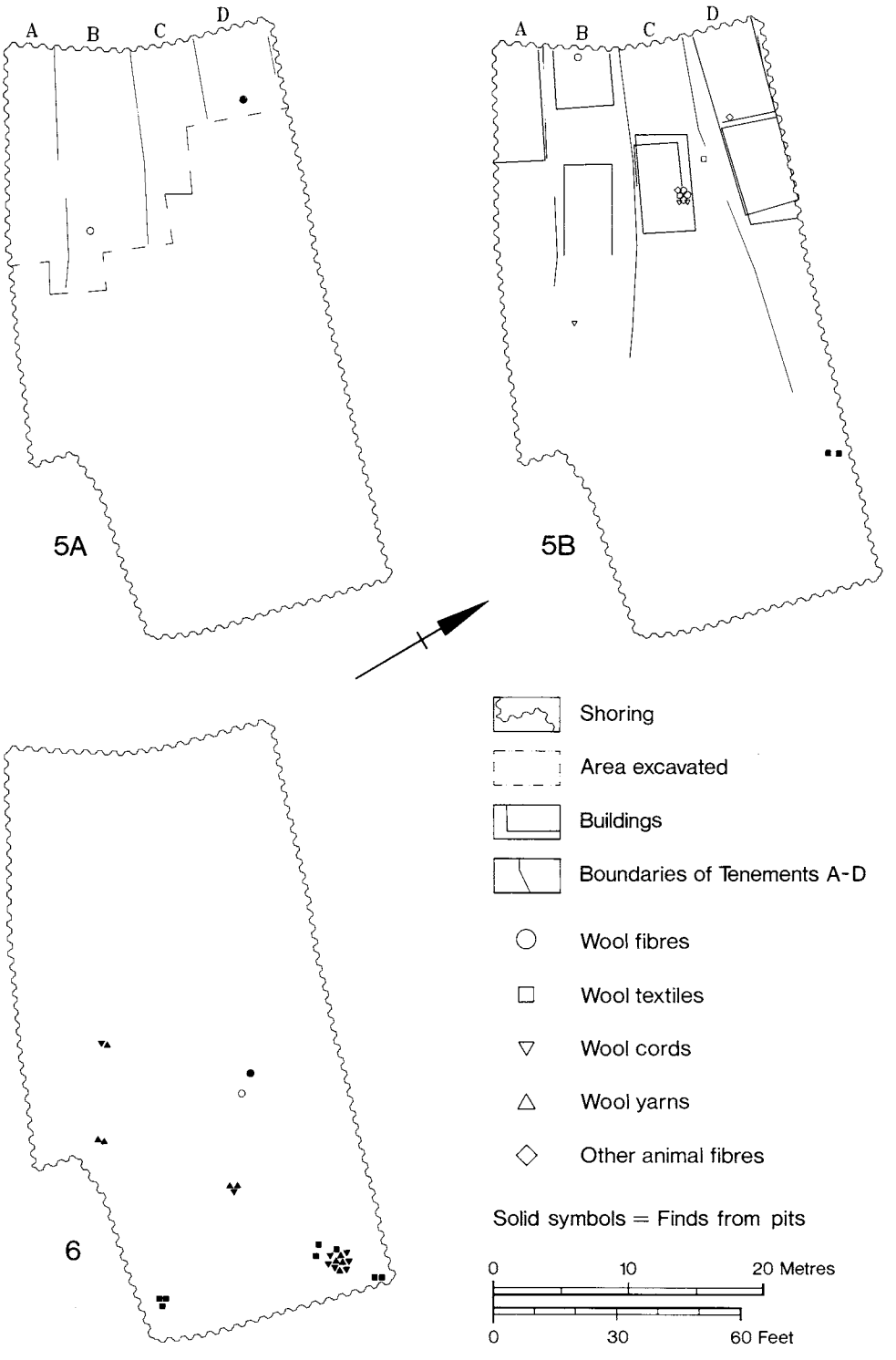


Fig. 121 Period plans of the site at 16–22 Coppergate showing the distribution of wool textiles, cordage and raw fibre. Scale 1:500






A
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C
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5A
A
B
C
D
5B
6
Shoring
Area excavated
Buildings
Boundaries of Tenements A-D
Wool fibres
Wool textiles
Wool cords
Wool yarns
Other animal fibres
Solid symbols = Finds from pits
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10
20 Metres
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30
60 Feet

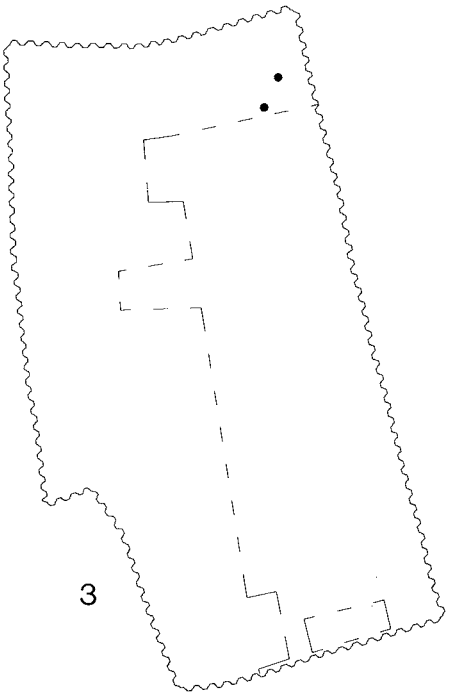
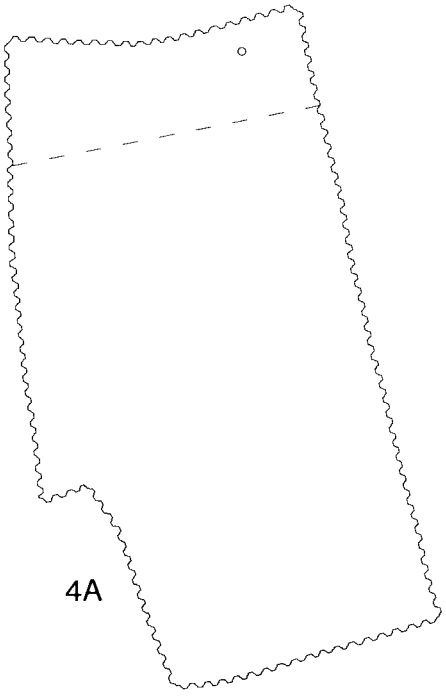
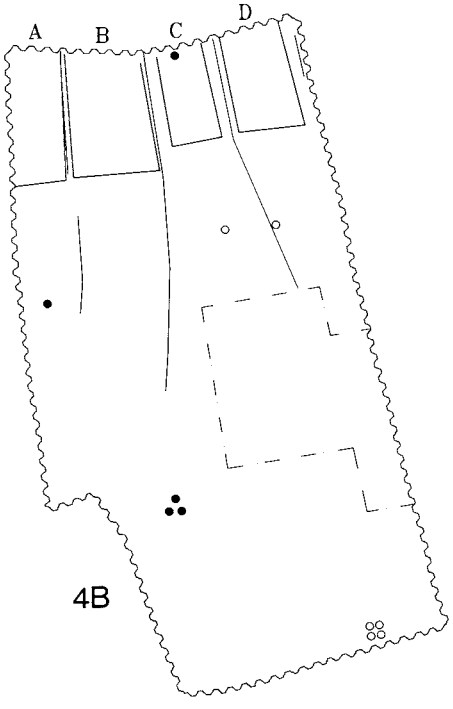
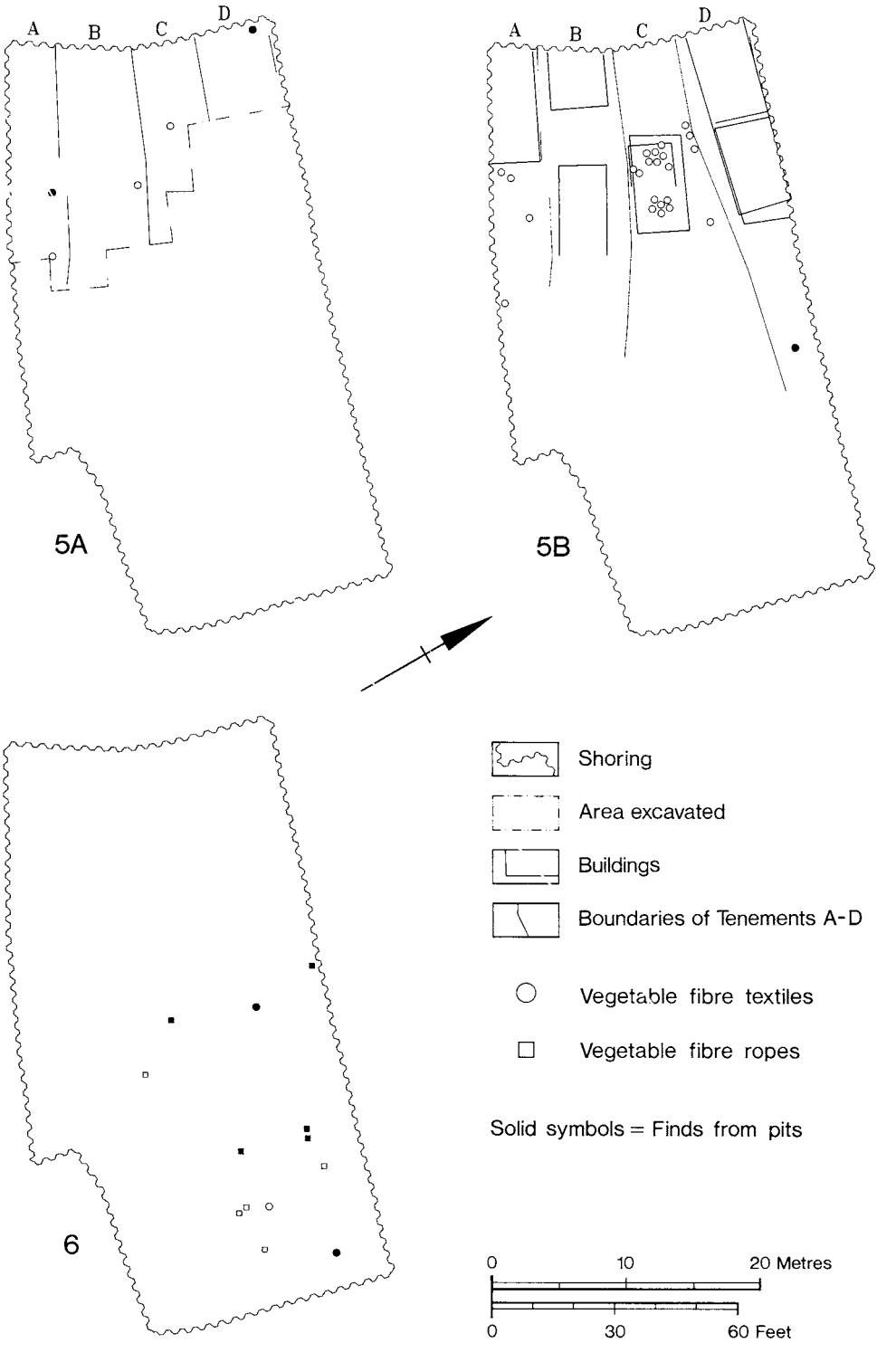


Fig. 122 Period plans of the site at 16–22 Coppergate showing the distribution of textiles and ropes made of vegetable fibre. Scale 1:500






A
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5A
A
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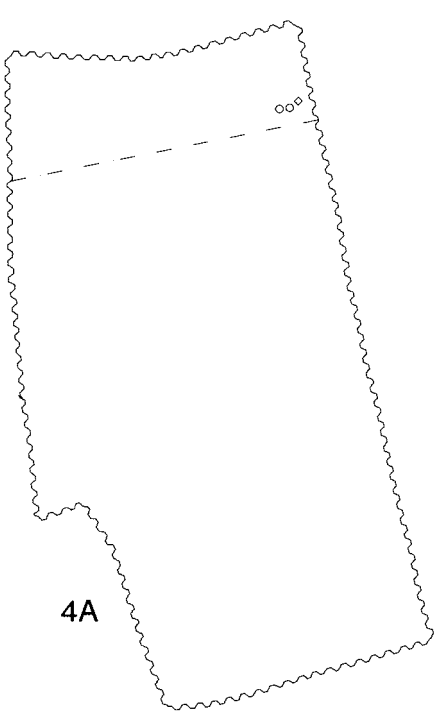
6
Shoring
Area excavated
Buildings
Boundaries of Tenements A-D
Vegetable fibre textiles
Vegetable fibre ropes
Solid symbols = Finds from pits
0
10
20 Metres
0
30
60 Feet

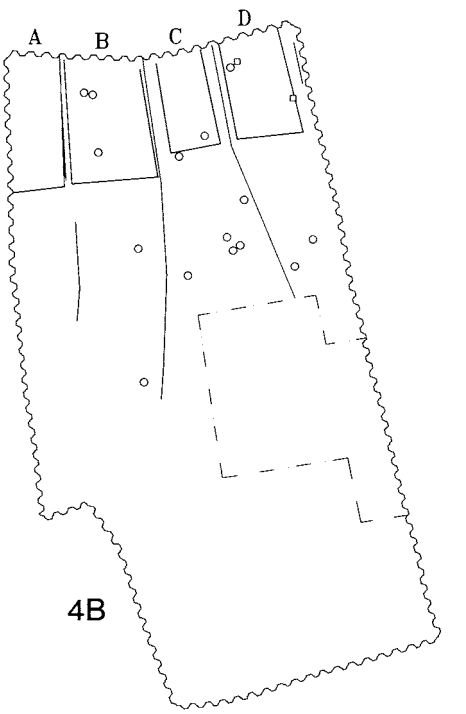
During the redevelopment of 1981-3 a continuous watching brief over an extended area, running down to the present edge of the River Foss (Fig. 120,2), was maintained under the direction of N.F. Pearson. The results of this exercise are incorporated into the reports mentioned below, and the textiles recovered in the watching brief are included here.

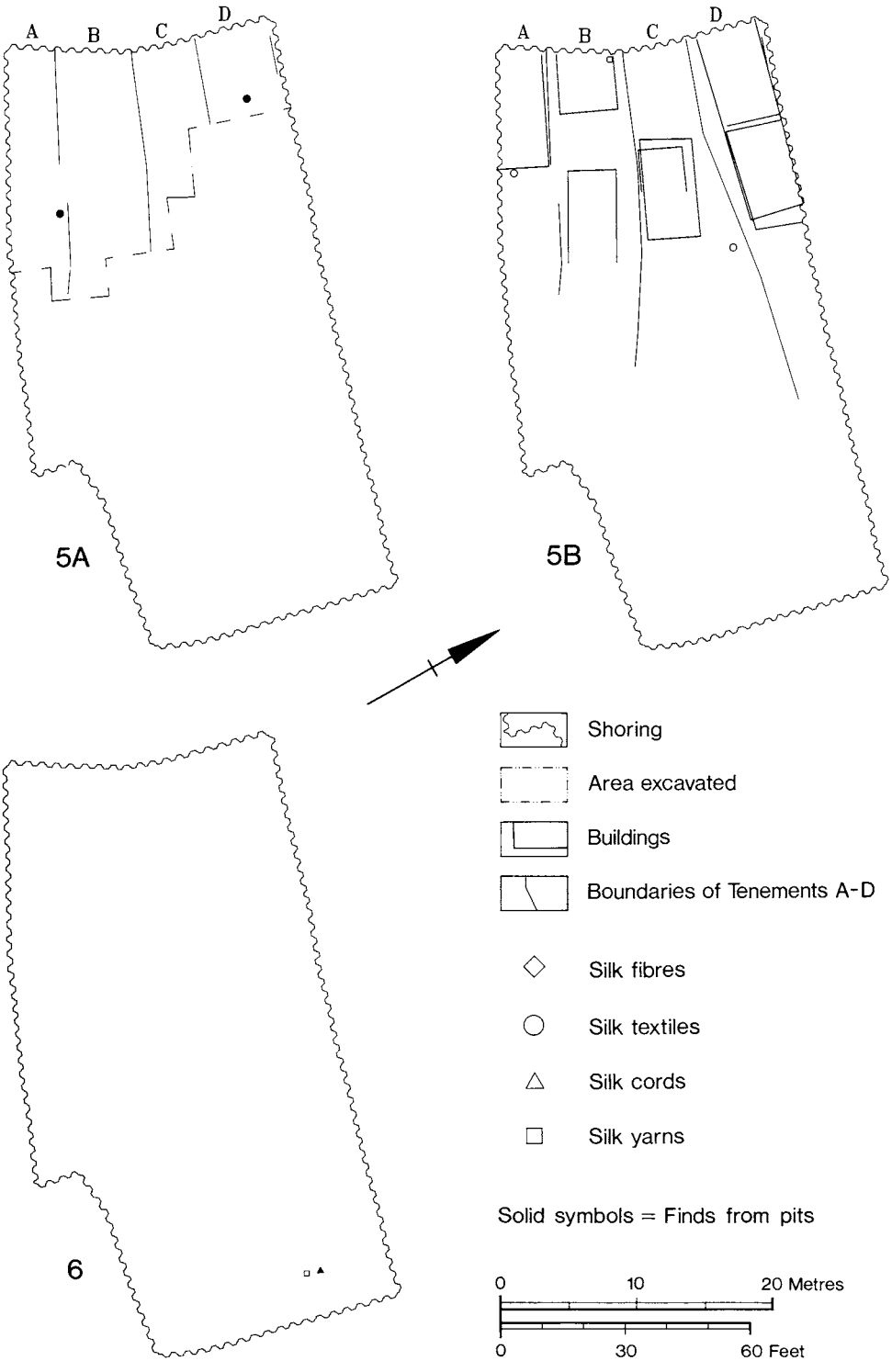
The Coppergate excavations will be published in *AY* 6, 7, 8 and 10; environmental evidence and animal bones in *AY* 14 and 15; pottery in *AY* 16; and small finds in *AY* 17. The post-Roman coins and numismatica are included in *AY* 18/1; Roman coins will appear in *AY* 18/2.

The earliest occupation on the site, designated Period 1, was in the Roman era. At that time the legionary fortress lay 160m to the north-west; the immediate vicinity was certainly occupied by temples, and it probably also contained a variety of commercial establish- ments. Evidence for Roman buildings constructed of both timber and stone was recovered, but the functions of these structures could not be deduced. The site also contained a small late Roman cemetery. The admixtures of silt, clay and loam which characterised soil conditions associated with Period 1 did not permit the survival of any organic-based artefacts except the very fragmentary remains of some wooden coffins and items made of bone; no textile fragments of Roman date were recovered.

Fig. 123 Below and facing: Period plans of the site at 16–22 Coppergate showing the distribution of silk textiles, cordage and yarns. Scale 1:500



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Shoring
Area excavated
Buildings
Boundaries of Tenements A-D
Silk fibres
Silk textiles
Silk cords
Silk yarns
Solid symbols = Finds from pits
0
10
20 Metres
0
30
60 Feet

At the present stage of research there seems no reason to suppose that Romano-British activity continued here beyond the conventional date of c. AD 400 or shortly after, and from then until the mid 9th century the site seems to have been unoccupied (Period 2). This period was marked stratigraphically by the accumulation of up to 1m of grey silty clay loam soils, interpreted as the result of natural agencies: there was no evidence for structures, domestic or otherwise. All of the pottery in these layers was Roman. Although, once again, soil conditions would not have preserved organic-based artefacts other than those made of bone, and no textiles of this period were found, the dearth of other, more durable, artefactual evidence for contemporary activity indicated that this absence reflects accurately the site's apparent desertion at this time. An 8th century helmet and spearhead or weaver's batten, found in a wood-lined shaft only 9m beyond the excavation's perimeter during construction work in 1982 were, however, in conditions where organic materials were preserved (and see 1459); the absence of any trace of a textile or skin lining for the helmet suggests therefore that the required protection against the helmet chafing was provided by a separate item of head wear (Tweddle in *AY* 17/8.).

Above the clean grey loams which mark the four and a half centuries interpreted as Anglian desertion of the site, a band of dirtier grey silty clay loams was recognised. Into these was cut a series of features, including a sequence of hearth/oven/kiln bases perhaps used in glass-making, as well as several pits containing domestic debris; one also contained a skeleton with remains of textile adhering to it. The latest features of this period were a series of post-holes, some apparently forming alignments at an angle to the later tenement lines, and an accompanying cobble spread at the south-west of the area. This entire horizon, Period 3, is dated c. AD 850–900 on the basis of a combination of archaeomagnetic and numismatic evidence; in later Periods, dendrochronological data help to achieve the chronological precision which characterises the interpretation of the Anglo-Scandinavian levels.

It is a function of the soil conditions in the Period 3 levels that almost three-quarters (thirteen examples from a total of twenty) of the textiles and fibres etc. recovered were from pits and other cuts, which contained a higher density of organic waste than the deposits which they penetrated, and correspondingly preserved more organic material.

Sealing the post-holes, cobble spread and other features of Period 3 were deposits into which were inserted wattle alignments which anticipated the alignment of the subsequent tenements and structures, but which do not themselves form obviously coherent structures. These alignments and both their underlying and associated layers and features are assigned to Period 4A and dated c. AD 900–930/5. Characteristic of the layers of this period were dark grey silty clay loams, very similar to those of Period 3, but differentiated by the inclusion of patches of grey clay, brown ash, scatters of charcoal and occasional very small fragments and slivers of wood. These conditions, like those of Period 3, were not particularly conducive to the survival of organic artefacts, and of the small number of textiles etc. found from this period — a total of nine — five were recovered from pits.

The next phase on the site, Period 4B, is marked by the division of the area into four tenements, designated A-D, and if the street Coppergate was not in being before it must

have been laid out at this time. The tenements were defined by wattle fences, whose lines fluctuated only very slightly over the succeeding millennium; each tenement contained buildings of post and wattle construction, positioned with their gable-ends facing the street. The buildings had to be repaired or replaced frequently, for they were vulnerable to fire as well as to natural decay, but successive refurbishments varied little in their dimensions and position. Only one rank of buildings stood in each tenement and their lengthy backyards were not built up but used for rubbish disposal and other ancillary functions. Metalworking seems to have been the predominant activity, with the manufacture of items in iron, copper-alloy, lead-alloy, silver and gold. Occupation was evidently intensive, generating organic-rich occupation deposits which accumulated rapidly, in particular in and around the buildings, and which accounted for a continual rise in ground level. Deposits which were rich in organic remains extended to approximately half-way down the excavated area in the direction of the River Foss. From this point their organic component lessened until, in the south-easternmost quarter of the excavation furthest from the Coppergate street frontage, organic materials other than bone/antler did not survive except in the fills of pits and other cuts. Elsewhere, however, these soils provided conditions favourable to the preservation of wool and other organic materials, and it is in Period 4B and throughout Period 5 that the great majority of textiles, cordage and raw fibre come from surface deposits rather than from pits and other cuts (only nine examples were recovered in cuts in Period 4B from a total assemblage of 78 pieces; eleven examples from 50 in Periods 5A and 5B).

Although sometimes difficult to differentiate, the sequence of superimposed floor levels built up by gradual accumulation within each building, and their accompanying artefacts, allow the activities within each tenement to be followed with varying degrees of assurance. Evidence for textile production, principally in the form of spindle whorls but also including a range of other items (catalogued and discussed in another fascicule of *AY* 17), was found right across the site; there was also biological evidence for the use of dye-plants, most obviously madder, the dusky red remains of which were found in concentrations in several places *(AY* 14/7, in prep.).

In the later 10th century the remains of the latest phase of post and wattle structures at the street frontage were covered to a depth of up to 1m. This horizon, which was not traced in the yard areas behind the buildings, is interpreted as resulting in part from the upcast in digging out the sunken structures of Period 5B, and partly as a deliberate dump of make-up or levelling material. It thus accumulated very quickly, probably within a period of weeks or months, and contained a mixture of material of c. 975 and before.

The dating of Period 5A is dependent on the dendrochronological analysis of timbers from the immediately succeeding plank-built semi-basement structures of Period 5B. These were erected at the Coppergate end of each tenement, sometimes in two closely- spaced ranks; as in Period 4B, organic rich deposits were concentrated in the vicinity of these buildings, and the organic content of the deposits decreased riverwards. Manufacturing continued at this period, although new trades were practised, and textile working also apparently continued. There is a noticeable concentration of textile remains in and around the two superimposed buildings (Structures 5/5 and 5/6) on Tenement C, but they are

well spread chronologically throughout the period as a whole. A group of carbonised wool tabby and other fragments is associated with the lower building, Structure 5/5, which was destroyed by fire; other textiles, among them linen fragments and a piece of silk, are in adjacent layers pre-dating the rebuilding; another burnt textile comes from the floor levels of its replacement (Structure 5/6*);* and a group, including wool fragments, a wool cord and tufts of goat hair, were found in the dumped infill of this structure, signalling the end of its occupation, and derived from an unknown source. The assemblage as a whole does not necessarily indicate that textile making took place here.

On Tenement D sufficient overlying stratification remained undisturbed to show that the latest of the Period 5B sunken buildings was eventually replaced by structures built at ground level. The chronology of these subsequent buildings is imprecise: they can be assigned only approximately to the mid 11th century. They and their associated stratification are designated as belonging to Period 5Cf. A series of approximately contemporary mid 11th century levels was also identified at the rear of the site, sealing a post-built structure, the latest timber of which has been dated through dendrochronology to 1014–54. These levels, which did not preserve their organic component, are designated Period 5Cr. They were themselves covered by a series of dumps of very dark grey silty clay loam interleaved with evidence for sporadic activity, and dated to the Norman period.

Modem intrusions had destroyed virtually all deposits later than the 11th century right across the street frontage, thus removing virtually all the evidence for the principal post-Conquest buildings on each tenement. Further intrusions also destroyed other parts of the later medieval stratification to varying degrees, but none the less the excavation demonstrated how the areas which had been backyards in the Anglo-Scandinavian era were increasingly built up in the 13th/14th centuries by structures of which some, at least, were roofed with tiles rather than the organic materials that had been used previously. These timber-framed buildings required less refurbishment/repair/replacement than the pre-Conquest ones, and this led to some diminution in the quantity of organic debris deposited alongside them, and a gradual reversion towards the types of sediments which had characterised the Roman occupation on the site. As the medieval period progressed, conditions therefore generally became increasingly inimical to the preservation of organic remains such as textiles, although a number of pits, wells and other cuts provided isolated pockets where organic materials did survive. This goes some way at least towards explaining the very high proportion (36 examples from a total of 47) of textile, cordage and fibre from this period recovered in pits and other cuts. At the time of compiling this report, the Norman and later levels have not been stratigraphically phased in all their detail; the dates offered for particular pieces are approximations based on a more limited appraisal of the evidence for their individual contexts than was undertaken to arrive at dates for the earlier periods. The latest archaeological features investigated in the excavation were broadly dated to the 16th century, later levels having been destroyed by more recent redevelopments.

Throughout the entire Anglo-Scandinavian period the great majority of textiles, cordage and fibre was recovered from the western part of the site, nearer the present Coppergate

frontage, the focus of occupation and activity. In the medieval period, however, after buildings had been erected over large parts of the eastern area which had previously been open land, fragments were deposited here in quantity.

In the catalogue and discussion which follow, each textile fragment is assigned on the basis of its stratigraphic position to one of the periods outlined above. It should be stressed, however, that there is clear evidence from more closely datable artefacts — notably coins and pottery — for the displacement of objects from the context where they were originally deposited and their redeposition in later, often appreciably later, layers. The principal mechanism of this movement was the cutting of pits, wells, etc., which penetrated earlier levels and redistributed the soil removed from them. In the case of the precisely dated coins it can be seen that, in the Anglo-Scandinavian levels, coins sometimes occur in contexts dated 75–100 years later than their striking *(AY* 18/1, 24) although their wear patterns do not suggest circulation for this length of time and there is no evidence that they were hoarded. Less precisely, but none the less clearly, study of the pottery from Anglo- Scandinavian levels *(AY* 16/5, forthcoming) has shown for example that sherds both of Roman wares and also of handmade, middle Saxon type, which are unlikely to have been produced after c. AD 900, are found residually throughout the era, another testimony to the redistribution of earlier material. The period designations therefore indicate a date for the context in which the item was found and not necessarily for the item's manufacture. None the less, any textile item attributed to Periods 3–5 can confidently be assigned to the period from the mid 9th to the mid 11th century, since soil conditions militate against any earlier fragments having survived to be redeposited in Anglo-Scandinavian levels. Furthermore, those textile fragments which themselves were found within pits or other cuts are more than likely to be contemporary with the pit's use, as there is less likelihood of redeposition once they were discarded and sealed well below the contemporary surface. Fortunately, there is overall a reasonably large number of fragments from these sealed contexts; probably many of them ended up in cess pits because they had ultimately been used as toilet paper, for which the only other, presumably commoner, Anglo-Scandinavian equivalent seems to have been moss *(AY* 14/7, in prep.), or had served as a simpler form of sanitary towel.

A final point worthy of comment is the relatively large number of silk textiles and yarns recovered, a total of29. Chronologically, none was found in Period 3 levels, only three in Period 4A, but the great majority, nineteen, came from Period 4B; of the remainder, two are attributed to Period 5A, three to Period 5B and two to Period 6. Significantly, the silks of Period 4B are distributed throughout the front halves of all four tenements, suggesting that the occupants of each had silk in their possession. Since silk was an imported luxury item, this may indicate that the occupants of this part of Coppergate enjoyed a greater degree of affluence than might be expected of artisans, and than is suggested by their food debris *(AY* 15/3).

This is just one of the historical insights given by the textiles from this site; the analysis and catalogue which follow provide a significant step forward in medieval textile studies in general, and contribute a breadth of information to the study of medieval, and particularly Anglo-Scandinavian, York.

Comparative Material

The evolution of the textile industry in Great Britain can now be traced from later prehistoric times to the present day. As yet, little has been recovered from the neolithic period beyond a piece of twine from Etton, Maxey, Cambridgeshire (Pryor, French and Taylor 1985), but several Bronze Age sites have yielded individual fragments of textile, which have been studied by Henshall (1950a; 1964) and Hedges (1972). A scattering of Iron Age finds have also been examined by Henshall (1950a) and by E. Crowfoot (1984a; 1986). E. Crowfoot has further worked on two larger groups from Arras culture cemeteries in Humberside, Wetwang Slack and Burton Fleming, although these are as yet unpublished; another fragment from Skipwith Common, North Yorkshire, is to be reported on by Bender Jørgensen and Walton (in prep.).

Roman textiles, both civil and military, have been published by Wild (1970; 1975; 1977; 1978; 1982); some fragments from York have also been examined by Henshall (1962). A few examples from Scotland which are contemporary with the Roman occupation have been recorded by Henshall (1952) and G .M. Crowfoot (1948). A particularly large number of textiles from early Anglo-Saxon cemeteries has been studied by E. Crowfoot (e.g. 1976b; 1978; 1981; 1983), who has generously supplied the author with a table of finds, based on her published and unpublished work. Study of these finds has also led to the reconstruction of early Anglo-Saxon dress (Vierck 1978; Owen-Crocker 1986).

Middle Saxon textiles are poorly represented, but there are small numbers of finds from Gloucester (Hedges 1979) dated to the 9th century or earlier. From the late Anglo-Saxon period there are several finds dated to the 9th-11th/12th century, from various sites in London (Pritchard 1982; 1984) and also some from 9th-11th century Winchester (E. Crowfoot forthcoming a). Anglo-Scandinavian York has already produced textiles from two sites close to the one currently under discussion, at 5-7 Coppergate and Lloyds Bank, 6-8 Pavement *(AY* 17/3). There is also a scattering of finds from Viking graves of the Scottish islands and the Isle of Man (G. Crowfoot 1949; Henshall1952; Bender Jørgensen 1986).

From post-Conquest Britain there is a small but significant group of textiles from Saxo-Norman Durham(E. Crowfoot 1979) and also a few fragments from Petergate, York, dated to the 11th-13th centuries (L.P. Wenham pers.comm.; Walton in prep. a). Other medieval textiles have been found in considerable quantity at Baynard's Castle, London (E. Crowfoot forthcoming b), Perth (Bennett forthcoming) and in lesser numbers at Aberdeen (Bennett 1982), Southampton (E. Crowfoot 1975) and several other sites. Finally, from Newcastle upon Tyne there are large groups of textile fragments dated to the 15th-16th and 17th centuries (Walton 1981; 1983).

A clearer picture of how the textiles from 16-22 Coppergate fit into the overall pattern of textile production can be obtained by analysis of European reports: in particular, those reports dealing with finds of the Merovingian, Viking and medieval periods will be considered here. Large groups of textiles from these periods have been excavated from sites

in Scandinavia, Germany, The Netherlands, Poland and western USSR. Textiles, mainly of silk or linen, are also found in shrines and treasuries throughout Europe, although it is rare for these to be as securely dated as the excavated specimens.

In Scandinavia textiles have been recorded from the graves at Valsgärde (Arwidsson 1942; 1954; 1977) and Birka (Geijer 1938) in Sweden, Kaupang (Ingstad 1979a) and Oseberg (Rosenqvist 1966; Ingstad 1982) in Norway and Mammen and Lousgard in Denmark (Hald 1980). These, along with town sites such as Lund in Sweden (Lindstrom 1970; 1976; 1982) and Århus (Lorenzen 1979) in Denmark have revealed considerable evidence for textile production and dress in Merovingian/Vendel and Viking Scandinavia. Hedeby (Haithabu), a Viking port close to the Danish border in Schleswig-Holstein, has also produced quantities of finds, to be considered with the Scandinavian material (Hundt 1984; Hägg 1984aand b). More recently Bender Jørgensen(1986) has completed a large survey of textile remains from graves of Scandinavia and has been able to plot developments from the Roman Iron Age to the Viking Age.

In Germany there are textile finds from the settlement sites of 7th–8th century Hessens (Schlabow 1953;Tidow and Schmid 1979), from 8th century Elisenhof (Hundt 1981), and from many row-grave cemeteries (mainly published by Hundt, e.g. 1966; 1972; 1978) as well as from the 8th-9th century cemetery at Dunum (Tidow and Schmid 1979). From The Netherlands there are comparable finds from 6th-10th century Westeremden (Schlabow 1974), 8th-10th century Leens (ibid.) and 8th-9th century Dorestad (Miedema 1980).

Parallels for the medieval finds are many in European excavations. Only the largest groups need be mentioned here: those from Lund (Lindström 1976), Oslo (Kjellberg 1979; 1981), Schleswig (Tidow 1982), Amsterdam and Dordrecht (Vons-Comis 1982) in The Netherlands, and from Gdansk, Poland (Kaminska and Nahlik 1958) and Novgorod, USSR (Nahlik 1963; 1964).

Once the finds from 16–22 Coppergate are placed in the context of textile development within northern Europe, their importance becomes clear on several counts. Leaving aside the prehistoric era, the period which saw most change in textile production was probably that of the 10th–12th centuries. At this time textile tools, the types of fabrics being produced, and more especially the social organisation of weaving, went through considerable change. The Coppergate finds provided an opportunity to investigate how and when this change took place. It was possible, too, to consider the impact of the new settlers on the native population's textile tradition, and, further, to study the difficult problem of Viking Age dress.

Although no complete answers were found to any of the questions posed, the Coppergate textiles provided valuable new evidence in each of these areas.

Preservation of the Finds

The textile finds from 16-22 Coppergate fall naturally into three groups, defined according to their raw material — wool, vegetable fibre and silk. These divisions according to fibre are reflected in different spinning and weaving techniques within each group. The finds of yarn and cordage may be similarly divided into wool, vegetable fibre and silk, with the addition of a single example of metal thread (gold). The raw, unspun fibres which are discussed in this report are all animal coat fibres, predominantly wool; plant fibres which may have been raw material for textile production are discussed elsewhere *(AY* 14/7).

The state of preservation of the finds varies considerably, largely according to the nature of the raw material. The textiles made from the animal fibres, wool and silk, have on the whole survived remarkably well. They feel strong and supple to the touch and examination under a high-powered microscope shows their physical structure clearly, making identification easy. In contrast, the remains of fabrics which could be identified by microscopy as being made from vegetable fibres are small, fragile and ill preserved.

This differing survival of animal and vegetable fibres is regularly encountered in excavations of low-lying sites in temperate climates and may be explained in the following way: during the early stages of burial, while conditions are moist but the textile is still exposed to the air, the fibres are subject to fungal attack, which is particularly damaging to the cellulose of plant fibres (Jakes and Sibley 1983,36-7). As earth builds up above the textile, and air is excluded, the fungi, requiring oxygen to survive, cease their depredation. In some conditions they may be replaced by bacterial attack, which is harmful to the proteinaceous animal fibres (Lewis 1981, 103ff.); however, it is likely that where tannins and humic acids are present such microbes will be discouraged (Jakes and Sibley 1983, 36).

As a rule this leads to a biased view of the surviving textiles. Although it is possible to build up a picture of the range and variety of wool and silk fabrics, the volume of linen textile production usually has to be estimated from mineralised remains on grave goods and a small number of waterlogged finds. At 16-22 Coppergate, however, as well as the textiles mentioned above, whose fibres could be identified from their physical structure, there was also a large group of textile remains whose fibres had been altered by charring. Although these carbonised remains were black and fragile and the fibres beyond recognition by straightforward light microscopy, new analytical techniques were able to show that some, if not all, were originally flax (see below, p.312). These charred remains, despite their fragility, were larger in area and greater in number than the other fragments of linen and it seems probable that the very fact that they were carbonised before burial, and thus less attractive to fungal attack, improved their chances of survival.

Two other groups of textile remains have also survived, although not in their original form. There are four examples of mineralised remains, where the fibres have been replaced by minerals from the surrounding soil (predominantly calcium in the case of 1261, *1380, 1402),* or from nearby metal artefacts (1459). This process leaves a hard 'fossil' of the original object, called a pseudomorph. There is also one imprint of a textile on a piece of lead (1458). Although in these cases the weave and spin of the original textile is clear, in none of them can the original fibre be identified.

Types of Fibre

Wool

The excellent state of preservation of most of the animal fibres made it possible to carry out a study of the types of wool in the textiles, following the work of Dr M.L. Ryder. In order to establish the 'fleece type', a sample was extracted from the yarn and the diameters of 100 fibres measured at x 400 magnification. A total of 67 samples from textiles and also 25 examples of raw wool were measured in this way. The fleece types identified from these measurements, according to the guidelines set out by Ryder (1969, 517), are given in Table 13 and the original histograms are presented on Fig.173 (Microfiche 1); a summary of the results appears in Table 12.

Dr Ryder's work has shown that examples of almost any of his fleece type categories may appear at any period in British history from Roman times onwards, but that certain of these fleece types predominate at different periods. From Table 14 it can be seen that many of the wools from Roman and 5th-7th century Anglo-Saxon sites are of finer types, with only one example of a true hairy type (from Vindolanda). In comparison, the 10th-11th century wools from 6-8 Pavement, York, and those of the 9th-11th century from 16-22 Copper- gate, show a markedly higher proportion of hairy fleeces and correspondingly fewer of the finer types.

The hairy wools (PI.XVa) from 16-22 Coppergate include kemps (bristly fibres over 100μm wide, each with a broad latticed medulla), and coarse hairs (fibres over 60μm wide with a narrower medulla); in general, pigment is only present on a small proportion of fibres

Table 12 Summary of fleece types from 16–22 Coppergate. For details of measurements see Table 13

	Hairy	Hairy medium	Generalised medium	Medium	Short-wool	Fine	Total
Anglo-Scandinavian							
Raw wool	11	7	3	1	–	1	23
Textile	18	14	6	10	–	–	48
Medieval							
Raw wool	–	1	–	–	1	–	2
Textile	1	3	5	3	5	–	17
Unstratified, prob. post-medieval							
Textile	–	2	–	–			2
	30	27	14	14	6	1	92

Table 13 Fleece types: identifications derived from the measurement of the diameters of 100 fibres per sample. Figures in microns (0·001mm). See also the histograms, Fig. **173**, Microfiche 1

	Period	Range	Mode	Mean	SD	Pearson coeff. of skew and distribution	% Medullated	Pigment
Hairy								
1255	3	14–108	24	41·4	±24·8	+1·52, pos. skewed continuous	30 (4 kemps)	0
1257 Z	3	15–67, 87, 102,107	22	30·0	±16·2	+1·21, pos. skewed	4 (2 kemps)	some in coarser fibres
1257 S	3	17–93	24	30·9	±11·5	+0·79, pos. skewed	3 (1 kemp)	some in coarser fibres
1258 Z	3	12–129	22	32·8	±19·2	+1·04, pos. skewed	6 (4 kemps)	0
1259 Z	3	21–71, 84,102	26	40·6	±14·8	+0·81, pos. skewed	9	heavy in all fibres
1264 S	3	14–122	24	32·8	±19·7	+0·86, pos. skewed	10 (5 kemps)	heavy in 25% of fibres
1270	3	19–120	27	36·9	±16·4	+0·80, pos. skewed	6 (2 kemps)	some in coarser fibres
1285	4B	17–116	27	45·4	±28·0	+1·47, pos. skewed/ continuous	33 (24 kemps)	0
1286	4B	20–120	27	37·8	±19·2	+1·03, pos. skewed	23 (7 kemps)	0
1287	4B	12–61, 75,112	16,19, 20	30·2	±16·8	+0·85, pos. skewed	9 (2 kemps)	slight in 3% of fibres
1288	4B	19–116	24	36·1	±19·0	+0·82, pos. skewed	9 (4 kemps)	slight in 7% of fibres
1291a	4B	15–155	22,24	42·0	±28·7	+0·99, pos. skewed/ continuous	18 (8 kemps)	slight in approx. 40% of fibres
1291b	4B	16–72, 108,125	26,30	32·6	±16·4	+0·67, pos. skewed	6 (2 kemps)	slight
1293a	4B	16–119	30	35·6	±20·0	+0·93, pos. skewed	20 (7 kemps)	2%
1295 Z	4B	15–70, 102,104	24	31·1	±15·3	+0·85, pos. skewed	11 (2 kemps)	7%
1295 S	4B	12–66, 112	17,20	27·0	±14·9	+1·05, pos. skewed	7 (1 kemp)	4%
1295 pile	4B	15–56, 72,114	27	31·0	±12·5	+0·68, pos. skewed	6 (1 kemp)	6%
1300 S	4B	15–80, 102	24	31·4	±15·9	+1·13, pos. skewed	12 (1 kemp)	0
1302 S	4B	14–66,106	32	31·4	±12·7	+0·52, pos. skewed	4	0
1303 Z	4B	14–67,99	22,40	41·2	±15·4	+0·05, symmetrical/ continuous	9 (2 kemps)	heavy in most fibres
1304 Z	4B	19–77, 102,119	36	38·3	±15·7	+0·55, pos. skewed	7 (2 kemps)	?

	Period	Range	Mode	Mean	SD	Pearson coeff. of skew and distribution	% Medullated	Pigment
1361	5A	15–148	22	41·5	±26·6	+1·148, pos. skewed	17 (7 kemps)	0
1373	5B	17–93	20,26	38·7	±18·5	+0·88, pos. skewed	18 (1 kemp)	30%
1374	5B	15–59, 75–102	20	29·1	±15·3	+1·09, pos. skewed	4	0
1382 Z warp	5B	18–72	37	40·4	±13·8	+0·55, pos. skewed	11	5% coarse fibres only
1382 Z weft	5B	14–68,77, 79,154	24,26	37·7	±17·4	+0·58	7	4%
1423	6	16–57,66, 75,98	32	34·3	±11·7	+0·53, pos. skewed	4	0
1460 Z	Anglo-Scand.	15–77,127, 138,147	42,43 46,47	44·6	±21·8	+0·30 symmetrical/ continuous	11 (3 kemps)	5% of fibres
1460 S	Anglo-Scand.	15–80,94, 109,129	21,25 30	36·6	±19·8	+0·99, pos. skewed	15 (2 kemps)	3% of fibres
1460 pile	Anglo-Scand.	16–76,87, 91,130	32	41·8	±17·4	+0·52, pos. skewed	12 (1 kemp)	3% of fibres
Hairy medium								
1259 S	3	12–62	25	33·1	± 9·7	+0·64, pos. skewed	3	heavy in c.75% of fibres
1264 Z	3	15–77	22	34·1	±14·4	+0·88, pos. skewed	13	heavy in 20% of fibres
1274	4A	17–60,76	43	38·8	±11·4	+0·25, symmetrical	5	slight in approx. 90% of fibres
1284	4B	12–70	25	30·8	±12·5	+1·10, pos. skewed	7	slight in all fibres
1289	4B	19–70	24	35·0	±13·3	+1·04, pos. skewed	2	some in coarser fibres
1290	4B	11–65	32	28·9	±11·7	+0·71, pos. skewed	5	0
1292	4B	17–56, 67,82	27	30·9	±10·5	+0·74, pos. skewed	7	slight
1297 S	4B	12–57, 80,112	20	25·2	±13·3	+0·76, pos. skewed	8	0
1303 S	4B	14–65,97	24	28·2	±11·9	+0·76, pos. skewed	2	slight in 10% of fibres
1304 S	4B	14–51,67, 72,77	29	30·1	±10·3	+0·50, pos. skewed	3	0
1305 S	4B	17–45,77	22	28·3	± 8·3	+0·35, symmetrical	1	0
1306 Z	4B	19–58,65	27	34·7	±11·5	+0·71, pos. skewed	4	0
1307 Z	4B	16–65,72	24	28·8	±10·8	+1·18, pos. skewed	6	0
1307 S	4B	14–37, 63–94	20	24·6	±11·6	+0·67, pos. skewed	4 (2 kemps)	0
1308 S	4B	12–89	21	33·1	±15·8	+1·02, pos. skewed	8	0

Table 13 *(contd)*

	Period	Range	Mode	Mean	SD	Pearson coeff. of skew and distribution	% Medullated	Pigment
1312	4B	9–50,66, 80	22,24	26·3	± 9·9	+0·62, pos. skewed	3	0
1313	4B	15–57, 72,77	21	28·9	±10·5	+0·72, pos. skewed	5	3%
1375a	5B	16–89	24	33·8	±15·2	+0·78, pos. skewed	6	10% mainly coarser fibres
1375b	5B	16–76	21	28·8	±14·1	+1·13, pos. skewed	7	10% mainly coarser fibres
1376	5B	14–60,75	24	28·3	±11·9	+1·02, pos. skewed	4	20%
1383	5B	16–61	21	32·2	±11·0	+0·55, pos. skewed	3	all pigmented to varying degrees
1384	5B	16–61	27	35·3	±11·6	+0·69, pos. skewed	3	0
1412	6	17–59,70	32	37·9	±10·1	+0·24, symmetrical	2	0
1415 S	6	16–48,61	24	28·6	± 7·9	+0·64, pos. skewed	3	0
1416 S	6	14–48,56	24	29·0	± 8·6	+0·70, pos. skewed	1	0
1463 Z	u/s	16–55,62	32	32·1	± 9·7	+0·19, symmetrical	2	0
1463 S	u/s	15–46,58, 70,72	20	26·4	± 9·5	+0·69, pos. skewed	3	0
Generalised medium								
1258	3	15–57	24	26·2	± 7·7	+0·83, pos. skewed	2	0
1275	4A	15–57	21	25·3	± 8·1	+0·84, pos. skewed	2	0
1293	4B	19–57	22	26·5	± 8·8	+0·94, pos. skewed	0	slight, mainly in coarser fibres
1294b	4B	14–50	22	24·3	± 6·3	+0·50, pos. skewed	0	0
1300 Z	4B	15–52	22,24, 25	29·6	± 8·3	+0·59, pos. skewed	2	0
1305 Z	4B	15–52	27	30·6	± 8·2	+0·69, pos. skewed	0	0
1315	4B	9–52	24	27·5	± 9·3	+0·87, pos. skewed	0	0
1377	5B	16–45,56	24	26·5	± 6·3	+0·72, pos. skewed	0	0
1414 Z	6	11–41	21	24·2	± 5·9	+0·60, pos. skewed	0	0
1417 Z	6	12–48	20	24·1	± 7·7	+0·93, pos. skewed	5	0
1417 S	6	13–45	20	24·8	± 5·9	+0·54, pos. skewed	1	0
1418 Z	6	16–50	22	25·8	± 6·9	+0·58, pos. skewed	0	1%
1418 S	6	13–40	21	24·1	± 5·5	+0·48, pos. skewed	0	0
1461	Anglo-Scand.	16–47	22	28·5	± 7·4	+0·51, pos. skewed	1	approx. 15% of fibres
Medium								
1260 Z	3	16–51, 61,63	20,22	32·5	± 9·7	+0·07, symmetrical	0	0
1262 Z	3	19–52	26	33·8	± 8·7	+0·30, symmetrical	0	1%
1262 S	3	20–50	32	32·1	± 7·5	+0·29, symmetrical	0	0

	Period	Range	Mode	Mean	SD	Pearson coeff. of skew and distribution	% Medullated	Pigment
1263 Z	3	12–47,59	35	30·2	± 8·7	+0·46, symmetrical	1	0
1263 S	3	15–57,65	20	29·3	± 9·6	+0·04, symmetrical	4	slight in coarser fibres
1276	4A	15–55	22,30	29·7	± 8·6	+0·43, symmetrical	1	c.30%
1283	4B	16–57	25	32·9	± 9·3	0·40, symmetrical	0	3% heavy pigment
1297 Z	4B	13–53	40	33·0	± 9·6	−0·24, symmetrical	3	0
1302 Z	4B	17–57	40	36·6	± 7·6	0·00, symmetrical	0	slight in a few fibres
1306 S	4B	17–66	37,42, 47	41·2	±10·9	−0·20, symmetrical	4	0
1308 Z	4B	14–57	30	34·2	± 9·7	+0·29, symmetrical	4	0
1415 Z	6	11–62	20,22	30·1	±10·5	+0·41, symmetrical	5	0
1416 Z	6	16–55	27	34·0	±12·9	+0·46, symmetrical	9	0
1428 S	6	15–52	32	30·8	± 6·8	−0·16, symmetrical	0	0
Shortwool								
1413	6	14–46	25,32	30·8	± 6·7	0·00, symmetrical	0	0
1414 S	6	14–46	22	25·1	± 6·3	+0·23, symmetrical	0	0
1415 Z	6	16–45	24,37	30·5	± 7·2	+0·31, symmetrical	0	0
1420 Z	6	15–37	22	26·4	± 5·6	+0·27, symmetrical	1	0
1420 S	6	14–40	24	24·2	± 5·5	+0·29, symmetrical	0	0
1427	6	15–39	22,25	24·9	± 4·6	+0·31, symmetrical	0	0
Fine								
1362	5A	12–36	22	23·0	± 4·5	+0·34, symmetrical	0	0

(0-7%). Such white kempy fleeces with occasional black fibres are typical of the modern black-faced horned breeds, such as the Swaledale and the Scottish Blackface. At what date the ancestors of these breeds arrived in Britain is uncertain: black-faced, horned sheep can be traced back through documentary records only to the 16th century (Ryder 1981,67), although in the medieval period wool of the same sort was used occasionally in textiles (see Table 12) while the skins of similarly fleeced sheep were made into parchments (Ryder 1964, 70). Further discussion of this problem should also include the skeletal remains, which are outside the scope of the present work (see instead Ryder 1983, 183-93; for the skeletal remains from 16-22 Coppergate, see *AY* 15/3). From the point of view of textile research it is only necessary to establish when and where the hairy fleece type begins to appear regularly in textiles.

Table 14 Summary of fleece types of wools from British excavations in percentages; numbers of samples in brackets. Data from: Ryder 1981, Tables 2 and 3; Ryder 1982, Table 4, *AY* 17/3; Walton 1981, Table 1; Walton 1982, Table 5, *AY* 17/3; Pritchard 1984, appendix

	Hairy	Hairy' medium	Generalised medium	Fine/ generalised medium	True medium	Shortwool	Fine	Total no. of samples
Roman								
Vindolanda, Northumberland	2%(1)	33%(19)	33%(19)	18%(10)	2%(1)	4%(2)	9%(5)	57
Early Anglo-Saxon								
Various sites	–	23%(10)	23%(10)	30%(13)	5%(2)	–	19%(8)	43
Late Saxon								
London	6%(3)	61%(30)	14%(7)	4%(2)	12%(6)	2%(1)	–	49
Viking Age								
Lloyds Bank, 6–8 Pavement, York	20%(7)	41%(14)	18%(6)	–	21%(7)	–	–	34
16–22 Coppergate, York (textiles and raw wool)	41%(29)	30%(21)	13%(9)	–	15%(11)	–	1%(1)	71
Medieval								
16–22 Coppergate, York, 11th–14th C.	5%(1)	21%(4)	26%(5)	–	16%(3)	32%(6)	–	19
Petergate, York, 11th–13th C.	27%(3)	37%(4)	27%(3)	–	9%(1)	–	–	11
Winchester, 11th C.	14%(1)	57%(4)	29%(2)	–	–	–	–	7
Baynard's Castle, London, c.AD 1200	–	25%(2)	63%(5)	–	–	–	12%(1)	8
Perth, 12th–14th C.	19%(17)	44%(39)	18%(16)	6%(5)	8%(7)	5%(4)	–	88
Aberdeen, 13th–14th C.	12·5%(2)	19%(3)	44%(7)	6%(1)	12·5%(2)	–	6%(1)	16
Southampton, 13th–14th C.	–	11%(2)	58%(11)	–	5%(1)	5%(1)	21%(4)	19
Baynard's Castle, 14th C.	13%(3)	8%(2)	8%(2)	38%(9)	4%(1)	13%(3)	16%(4)	24
Baynard's Castle, 15th C.	7·5%(2)	11%(3)	15%(4)	18%(5)	11%(3)	30%(8)	7·5%(2)	27
Yorkshire, 15th C.	–	33%(2)	66%(4)	–	–	–	–	6
Newcastle, 15th–16th C.	16%(5)	13%(4)	28%(9)	–	9%(3)	31%(10)	3%(1)	32
Total Yorkshire, 11th–15th C.	11%(4)	28%(10)	33%(12)		11%(4)	17%(6)	–	36

Hairy types of wool may not have been entirely new to Britain in the Anglo-Scandinavian period. Among the largely mineralised remains from the early Anglo-Saxon cemetery at Fonaby, Lincolnshire, two of the fifteen identified as wool were described as including 'a wide lattice medulla, as found in British Mountain breeds of sheep' (Appleyard in Crowfoot 1981,96): this indicates that these wools were either hairy or hairy medium types. It should also be remembered that all of the early Anglo-Saxon wools derive from textiles in cemeteries and may not represent the full range of fleece types in use in the period.

Further, the hairy type does not seem to have been strictly limited to the area of Viking influence. Recent work on 10th-11th century textiles from London has shown that 6% of this late Saxon group are also hairy (Pritchard 1984,49). Nevertheless, 'Norse' wools from Scotland examined by Ryder (1964, 65) were predominantly hairy and the York Viking Age wools certainly contain many more hairy fleece types than have been found on any Anglo-Saxon site. This points to a significant difference in raw material between the Viking north and the Anglo-Saxon south.

The remaining pre-Conquest fleece types from 16-22 Coppergate, the hairy medium, the generalised medium, the true medium and the fine, are all to be found in Roman and Anglo-Saxon textiles. However, the true medium, which is thought to have evolved from the generalised medium before developing into the modem longwool type of fleece (Ryder 1969, 506, 511-12; 1983,767-8), is more common in the Viking Age and late Saxon collections. The finer wools which were more usual in the Roman and early Anglo-Saxon textiles are only represented at Coppergate by one true fine: this type continues to be rare in medieval textiles of English origin, although it is occasionally encountered in imported textiles and is the same type as eventually emerged in the Spanish Merino.

Turning to the wools from medieval layers, it is clear that the number of hairy fleeces has decreased in the Norman and later periods, and that most of the wools are in the medium categories (Table 12). Table 14 shows that there were still some hairy types among the 11th-13th century textiles from Petergate, but the overall totals for 11th-15th century Yorkshire are only 11% hairy, as compared with 34% in the Anglo-Scandinavian collection.

Although the sample is a small amount of data from which to draw conclusions, this apparent change in the raw material is probably real. An authority on the history of livestock (Trow-Smith 1957, 111) has indicated that the large flocks of sheep belonging to the monastic foundations of the 12th-15th centuries would have been brought into the north from elsewhere, and may have led to changes in the local sheep. However, he further speculates as to whether it was an ancestor of the Blackface which was introduced at this time (ibid.). The evidence of the York wools, so far as it goes, indicates that a sheep with a fleece of the northern Blackface type was already in the locality in the Anglo-Scandinavian period. If a new strain of sheep arrived in the post-Norman period, it seems unlikely that it would be of this type.

By the 13th century York and Beverley had won a reputation for certain types of high quality cloth such as 'scarlet' (Heaton 1920,3-4), which would require a finer, crimpier wool than the hairy type of fleece (Munro 1983,30-1). This suggests that better wools

were available in the district at this time—even if hairy wools were still in use for poorer textiles. Price schedules of the 13th and 14th centuries show that Yorkshire wools varied considerably in quality (Munro 1978; 1979). Whether the lowest prices represent the hairy type of fleece is a matter for conjecture, but the higher prices certainly suggest the presence of wools of a better quality. Significantly, in the 15th century, as demesne farming began to decline, these better wools disappeared (Munro 1979,218). On the whole the evidence suggests that if there was a change in local wools with the coming of the Cistercians in the 12th century, it was towards better quality fleeces than the hairy types of the Anglo-Scandinavian period.

What are these better quality wools, as represented in the York textiles? Four of the nineteen fleece types from medieval York are hairy medium, a type of fleece which is to be found nowadays in such white-faced hill breeds as the Shetland and the Cheviot. A further five from medieval levels are generalised medium in type: Ryder suggests that the reputation of English wool for fineness at this period was probably based on fleeces of the generalised medium type (1981, 27; 1983,472 ff.). The shortwool type, which from other sites is known to be rare before the medieval period, but is increasingly common towards the Tudor period, is absent in York in pre-Conquest levels but present in the 12th-14th century. These medieval fleece types from 16-22 Coppergate therefore fit the general pattern of medieval wools.

Finally, one third of the raw wool from 16-22 Coppergate has fibre roots present, indicating that it had been plucked from the skins of dead animals. Such 'fell wool' is usually short, as it does not represent a full year's growth, and it has rough fibre ends which prevent smooth spinning: for this reason it is of low value and is unlikely to have been the subject of trade in the Anglo-Scandinavian period. The fell wools are therefore likely to represent local fleeces. Fibre roots were found in three hairy, three hairy medium and one generalised medium wool from the Anglo-Scandinavian period and one hairy medium and one shortwool in the medieval group.

Twenty-five examples of raw wool were examined by **Dr M.L. Ryder**, who has contributed the following:

> Raw wool staples – the natural locks into which a fleece falls – are rare on archaeological sites, and on no other site have so many been found (PI.XVI). They can give additional information on the fleece, notably the length of wool (staple length) together with its appearance, the method of harvesting, and indication of the associ- ated activity in the context in which the wool was found.
>
> Length can be measured against a ruler after the staple has been straightened to remove the crimp (waviness) but with no stretching of the individual fibres. With adult fleeces it is assumed that staple length indicates the annual fleece growth. There are three basic shapes: tapering, 'blocky', and curly. Tapering staples are character- istic of hairy fleeces, the pointed tip usually containing only long, hairy fibres. 'Blocky' staples have a straight end indicating uniformity in fibre diameter as well as length. They are characteristic of shorter and finer fleeces, and are frequently wavy, the more waves or crimps per unit length, the finer are the fibres. Curly staples usually contain only fibres of medium diameter and are characteristic of longwools, although the lustre longwool is thought not to have developed until the post-medieval period. Table 15

Table 15 Staple details by M.L. Ryder: * fell/skin wool (plucked after death); H—hairy; HM—hairy medium; GM—generalised medium; M—medium; Sh—shortwool; F—fine

	Appearance	Staple length(mm)	Fleece type from appearance	Fleece type from measurement
1254	Hairy lamb	25	H	too decayed
1255	Straight and coarse hairy lamb	25	H	H*
1283	Indeterminate, probably not full length. Appears maroon, and analysis indicates dyed with madder	8	–	M
1284	Straightish but not too hairy	50	HM	HM
1285	Tapering, wavy but hairy	55	H	H
1286	Like hairy Soay, less hairy than *1291a*	50	HM	H
1287	As above but less hairy	50	H/HM	H
1288	No clear staple or crimp, lamb	20	H/HM	H
1289	Tapering staple, shallow wave individual fibres hairy	100	HM/M	HM*
1291a	Straight hairy lamb	20	H	H
1291b	Adult, shallow wave	90	M	H
1292	?Lamb, shallow wave	30	GM/M	HM
1293a	Straight hairy lamb	20	H/HM	H
1293b	?Lamb, medium crimp of shortwool (but consistent with GM)	20	Sh	GM
1294	Typical tapering and wavy staple of medium wool	90	M	GM
1361	Straight, hairy lamb	35	H	H
1362	Lamb, curly like short (fine) wool	15	Sh/F	F
1373	Straight and hairy, few fine fibres	90	H	H*
1374	8-week lamb?	90	H/HM	H*
1375	3-month lamb with curl, cf. modern lustre longwool e.g. Wensleydale	130	M	HM*
1376	Tapering staple, shallow wave	70	GM	HM*
1377	2–3-week lamb halo hairs projecting beyond bulk of coat (these probably finer at base making measurement GM)	30	HM	GM*
1378	Adult, shallow wave of medium wool	50	M	decayed
1412	6-week lamb wave length 5 mm, cf. fine Shetland	50	GM	HM*
1413	Lacks striking features	40	GM	Sh*

shows that eye assessment of fleece type can only be a guide, since a small proportion of fibres differing from the remainder can be detected only with the microscope.

The characteristic staple formation is best seen in the second and subsequent fleeces. Lamb staples, as well as being shorter, can differ in appearance, frequently having a curly tip which remains a diagnostic feature until the animal is a year old, i.e., the hogg fleece. Lamb staples can also have hairy fibres projecting beyond the rest of the coat, but giving a straight instead of a 'tippy' end. Fleece type determinations made in lambs can be misleading since after the shedding of the birthcoat hairy fibres

can be replaced by finer fibres. Indeed the aim in modem breeding is a hairy birth coat for protection, followed by a fine adult fleece.

The method of harvesting can be indicated by the appearance of the basal (skin) ends of the fibre under the microscope. A shorn fleece will have only cut ends, while a fleece plucked from a moulting sheep will have the brush ends of naturally shed fibres. Darker, soft root ends of growing fibres indicate the plucking of wool from skins after slaughter, i.e. fellmongering.

Some of the staples of the present collection have already been described (Ryder 1983,191-2). The number correspondence is as follows: 19= 1413,20= 1412, 21 = 1377,22= 1374, 23= 1375.

Results and discussion

The results are shown in Table 15 from which it can be seen that the most accurate eye assessments were made in the hairy group. The questions of age, length and fleece type are bound up together and so cannot be discussed separately. Nearly half of the staples were identified as coming from lambs (as compared with the appearance of modern lamb staples) but *1374*, at 90mm, is probably too long for a Viking Age lamb. This sample was therefore grouped with the adults in order to calculate a mean length for hairy adults, which was 67mm, while the mean length of the hairy lambs with this sample removed was 26mm.

Likewise the first hairy medium lamb length of 130mm was transferred to the adults to give an adult mean of 88mm and a lamb mean of 40mm. The remaining groups are too small to give means, but the single adult generalised medium staple was 90mm long, and the two lambs of this type gave a mean value of 25mm. Previous medieval staples described by Ryder (1983, 474) were one fine wool from London with a length of 40mm, and three hairy medium to generalised medium wools from Winchester which were 60mm long. This was not necessarily the maximum length because there were root ends of growing fibres indicating plucking from the skin after death.

Four unspun wool samples from Perth comprise one hairy medium fleece 25mm long, and three hairy fleeces two of which were 40mm long, and the other 60mm long. These lengths are the same as found among staples from Baynard's Castle, London, but are shorter than the modem woolly Shetland fleece, and only half the length of hairy Shetland wool.

The York staples with root ends were identified by Penelope Walton (designated fell wools) and are indicated on Table 15 by an asterisk. These are distributed at random over the different fleece types. Whereas today most skin wools come from lambs, only half are from lambs.

These staple lengths can be compared with 40mm for the woolly, and 50mm for the hairy, Soay, and about 100mm for the modem Shetland, with a tendency for the rams to have longer staples and the ewes shorter staples.

The fell (skin) wools indicate fellmongering activity, not necessarily at this location; the presence of staples without root ends indicates shorn fleece wool, and the inclusion of a dyed example suggests textile activity or at least a wool store. So all that can be said is that the staples indicate a collection of wools some of which are shorn fleeces,

and some of which were obtained by the plucking of skins removed after death. The inclusion of some cattle and goat hair (see below) supports the interpretation of fellmongering activity.

The purpose of the raw fibre

The dyed raw wool, 1283, was almost certainly meant for use in a textile, but whether the remaining examples of raw wool were so intended is open to question. Some may merely be waste from tanning, while others may have been used as latrine-wipes.

Some of the raw fibre was found in close association with yarn and textile: *1286, 1290-1, 1293* with a loosely woven textile *1297*; *1285* with cord *1313; 1284* and *1299* with small textile fragments *1304, 1307* and cord *1314*; and *1373* and *1377* with cord *1385* and goat hair *1386*. This juxtaposition of finds may be fortuitous, but it is worth noting that similar groups of fibre and yarn, occasionally with scraps of textile, feather and down, were found at Hedeby. These finds had had a secondary use as ship's caulking, but there was evidence that they may originally have been stuffing for garments and cushions (Hägg 1984b, 15, 91-5). Similar shredded cloth, yarn and fibre were still being used in 17th–18th century Newcastle upon Tyne, as 'shoddy' or 'wadding' for upholstery and padded garments (Walton 1987).

Other animal coat fibres

There were no textiles woven from goat hair, or from any other animal coat fibre apart from wool. There were, however, six examples of unspun, non-wool fibre: cattle hair, *1271*,*1278*, goat hair, *1386*, human head hair, *1277*, horse-tail hair, *1316*, and possibly mohair, *1387*.

Bones of cattle, horse and goat were present throughout Anglo-Scandinavian and medieval levels at 16–22 Coppergate *(AY* 15/3): fibres from these animals and the cut locks of human hair therefore require little explanation. However, the tentative identification of mohair deserves further comment.

Mohair is derived from the angora goat. The original home of this animal was Asia, probably central Asia, Tibet and the Himalayas (Wildman 1954, 112). It is thought to have been brought to Anatolia by the Seljuk Turks in the 12th century and Turkey has remained one of the major producers of mohair ever since (ibid.). The example from 16-22 Coppergate is dated to the 10th–11th century; a fine quality textile from 9th century Oseberg in Norway has also been identified, with reservations, as made from mohair (Ingstad 1982, 89). It is possible that, during the Viking Age, mohair fibre and mohair textiles were passing along the same trade routes as some of the silks (discussed below). However, in view of the tentative nature of the identifications, the evidence must be considered inconclusive.

Vegetable fibre

Most of the 52 textile finds grouped under the heading vegetable fibre were not well preserved and could only be identified with difficulty; 45 of them were carbonised. Samples from four small, decayed fragments of off-white textile, 1369, 1388, 1389, 1445, were examined under a high-powered microscope (x 400 magnification) with a polarising analyser. 1369 and 1389 proved to be too deteriorated to be certain of their identification, but 1388 and 1445 (PI.XVb) showed the cross-markings and the narrow lumina of the vegetable bast fibres, flax, *Linum usitatissimum* L., and hemp, *Cannabis sativa* L.; the samples most resembled modern specimens of prepared flax.

Samples of 1388 and 1445 were also stained with Shirlastains 'A' and 'C', supplied by the Shirley Institute, Manchester. The colours obtained were compared with the Shirlastains table of colour-changes and with modern fibres similarly stained. In both cases the reaction of the archaeological specimens was that of bleached linen. Indeed, all four of the decayed textiles have the appearance of having been bleached, although whether during manufacture or during burial is difficult to judge. (These stain tests only give useful results on light-co loured fibres, and the recommended pre-treatment by bleaching has proved unsatisfactory on archaeological specimens.)

Forty-five of the textile remains (Tables 20 and 26) were charred or carbonised and were too dark for the transmitted light of an ordinary microscope to show up their structure, or the colour changes of stain tests. However, samples of *1320, 1327-8, 1332-4, 1336,* which were found in a group together, and a further sample from *1390*, were analysed at the Department of Chemistry, North East London Polytechnic by **J. Evans, T. Hill and M. Card**, who contributed the following:

> Infra Red ATR (Attenuated Total Reflectance) was carried out on a group of samples. All samples gave IR patterns consistent with cellulose, indicating they consisted of vegetable and not animal fibres.
>
> Hexane solvent extractions were made of the samples and then the resulting extracts were used for Thin Layer Chromatography. The only indications observed were of linoleic acid which suggested linseed oil was present.
>
> All samples were then mounted for examination by Scanning Electron Microscopy. Again, all samples were confirmed as vegetable by the appearance of regular growth rings.
>
> The appearance of samples *1320, 1327-8, 1332-3, 1336*, with the A TR and TLC results, made it most probable that they were flax fibres. Sample *1333* indicated signs of dyeing and *1328* had an isolated inclusion of a hair which resembled wool fibre. Sample *1334* had a different appearance from all the other Coppergate fibres and could be nettle *(Urtica* sp.). Sample *1390,* although from a different part of the site, appears to consist of flax fibres like most of the others.

All the carbonised remains, except 1317 (see p.345), have several characteristics in common in terms of yarn structure (see below) and appearance. Since in this they differ from most of the wool and silk finds, it seems reasonable to assume that the eight samples tested are representative of all the carboni sed finds and that all, or almost all, are originally of vegetable fibre, a high proportion being flax. This unusual survival of linen textiles forms an important group with few parallels in this country.

According to continental monastic records, which list dues paid by peasants in raw flax, it would appear that flax was cultivated in France, the Rhineland and the Low Countries by at least the 9th century (Pounds 1974,52,62). A late Anglo-Saxon document on the duties of a manorial reeve suggests that it was also grown in England (Swanton 1975, 26). The archaeological evidence for the use of linen in Britain begins earlier in the Anglo-Saxon period: there are partially mineralised remains from several Anglo-Saxon cemeteries, for example West Heslerton, North Yorkshire (Walton in prep. b) and a single example of a textile woven from vegetable fibre, possibly flax, from 10th century London (Pritchard 1982,207).

Linen textiles dating from at least as early as the Roman Iron Age have been found on the Continent in Germany, The Netherlands and Poland. They are rare, however, in Scandinavia before the 7th century, after which they become increasingly common (Bender Jørgensen 1984a, 131; 1986,355). Definite evidence for linen weaving, in the form of balls of yarn and the cut-off lower edge of a warp, together with a loom weight, has been discovered in 10th century levels at Århus, Denmark (Lorenzen 1979,229-32). Most important of all, stem fragments, seed and capsule fragments of the flax plant *Linum usitatissimum* L. have been recovered from Viking Age levels at 16-22 Coppergate *(AY* 14/7, in prep.), which may well indicate that flax was being processed in the very place where the linen remains were found.

The use of nettle fibre is less well documented, and, as a common wasteland plant, the presence of its seeds on archaeological sites cannot be given any significance. However, nettle was certainly used as a textile fibre in Scandinavia as early as the late Bronze Age (Hald 1980, 127), the plant in question being the common stinging nettle *Urtica dioica* L. Textiles of nettle fibre have also been identified at the 9th century ship burial at Oseberg, Norway (Ingstad 1982, 93), and the use of nettles in Scandinavia continued even into the present century (Hald 1980, 126).

Silk

The silk textiles were readily identifiable by their lustrous appearance, only slightly dulled after ten centuries of burial. Samples of yarn were examined under a high-powered microscope, as whole mount preparations and in cross-section. The fibres all proved to be the long smooth filaments which may be reeled off from the cocoon of the pupating silk moth, *Bombyx mori:* that is, cultivated and not wild silk. *B. mori* was originally native to China but by the 10th century its cultivation, together with silk weaving, had reached as far as the Eastern Arab Emirate, the Byzantine Empire and the Islamic areas of North Africa and Spain (Geijer 1979, 128). The silks must therefore be imports from one of these areas.

Imported silks are not unusual on late Saxon and Viking Age sites, but there is a particularly large number from 16-22 Coppergate. Altogether 22 examples of woven silk were recorded from pre-Conquest levels, as compared with 32 of woven wool. Considering the distance the silks would have travelled to reach York and the value of silk even in its country of origin (Lopez 1945, 1-3), this is a surprisingly high proportion and suggests

a vigorous trade with a silk manufacturing country as well as a certain level of affluence (discussed further below, pp.419-20).

In medieval layers there were only two pieces of silk yarn and no woven silks, but there were fewer textile finds altogether from post-Conquest levels of the site and no conclusions may be drawn about the relative availability of silk in this period.

Gold thread, *1410* (Pl.XVIIb)

Five short pieces of gold thread were recovered from Period 5 levels. These consisted of thin flat strips of pure gold, approximately 0.4mm wide, twisted into a thread 0.20- 0.25mm diameter. Originally the gold strip would have been twisted around a core fibre but this is no longer present. There are small kinks in each thread and every 4.5-5.5mm the thread folds back on itself, so that the overall impression is of a band or fringe of gold, half a centimetre deep. The kinking has probably been caused by threads which would originally have held the gold down on to a woven background, either as couched embroidery or as brocading inserted during weaving of a braid.

Gold brocading has been used since the Roman period to decorate braided belts and borders of garments. Flat strip, however, seems to have been the most commonly used type before the 7th century, being found in many of the wealthier graves of the Anglo-Saxons and of the Germanic peoples of the Continent (E. Crowfoot and Hawkes 1967). One example of twisted gold thread of the kind found at 16-22 Coppergate has been recorded as early as the late 6th century, in the oriental embroideries of Queen Arnegunde at Saint-Denis, Paris (ibid., 55-6), but most examples date from the 7th century or later. This type 1 of thread continued in use into the medieval period, when its manufacture was described by Theophilus (Book 3, 77).

In the 8th-11th centuries twisted gold thread was regularly being used for couched embroidery and for brocading tablet-woven braids. Examples of both uses were found in the vestments of St Cuthbert at Durham (G. Crowfoot 1956b, 443-5) and in the 8th-9th century braids and embroideries of Anglo-Saxon design in the treasury of St Catherine's church at Maaseik, Belgium (Budny and Tweddle 1984; 1985). Other examples of braids brocaded with twisted gold are known from Mammen and Hvilehøj in Denmark (Hald 1980, 105-108), while G. Crowfoot cites two more, one from Gokstad, Norway and the other the girdle of Bishop Witgarius of Augsburg (G. Crowfoot 1956b, 450-1). At Birka, Sweden there were three pieces of tablet weaving brocaded with twisted gold thread (Geijer 1938,68), although these were far outnumbered by the drawn wire brocading in the other braids, thought to be Eastern in origin (Geijer 1980,21). The core fibres at Birka, as at York, had decayed away, but at Mammen, Gokstad and Durham they were silk, while the gold at Maaseik was spun round a single fibre of animal tail hair (Budny and Tweddle 1985,361).

The Coppergate thread was identified as 'relatively pure gold with a very small amount of copper (a few per cent or less)' by Dr P.T. Wilthew of the Ancient Monuments Laboratory, Historic Buildings and Monuments Commission. Most of the Maaseik gold was also pure,

although traces of sulphur were detected in some samples (Budny and Tweddle 1984,76). Most other Anglo-Saxon examples have not been tested, but since they remain untarnished they are probably high carat (E. Crowfoot and Hawkes 1967, 43-4). On the other hand, later threads from the medieval period often prove to be silver gilt (Barker 1980, 5). Gold thread was obviously a luxury item, as can be seen from its regular association with silks in the graves of royalty and of saints.

Fibre Preparation

In order to render the raw material ready for spinning, the fibre must be processed in some way. Different techniques are applied according to the type of fibre and according to the kind of finish required for the textile. Occasionally this processing technique can be identified by examination of the textile.

Wool

The wool yarns of the Anglo-Scandinavian textiles show a considerable range, from smooth and even to soft and irregular, different types sometimes being combined in the same textile. A small number have a smooth, glossy appearance, with fibres lying exactly parallel to each other: such yarns have mainly been plied into sewing thread, but occasionally they have been used singly in weaving, for example for the narrow binding strip of *1460b,* and for the warp of *1303*. The wool chosen for this purpose is predominantly coarse and is likely to come from a fleece with a long staple and little crimp.

The wool of such yarns has almost certainly been combed before spinning, using a pair of iron-toothed combs to smooth and straighten the fibres. Wool-combs of a sort have been in use since Roman times, but a type with long handles at right-angles to the teeth first appears in Merovingian Scandinavia (Hoffmann 1964, 258). Such combs are well known from Viking Norway (ibid.) and one example, still with a wool fibre adhering to the base of one of the teeth, has been recovered from Anglo-Scandinavian levels at 16-22 Coppergate (sf10786, *AY* 17/6 forthcoming). The arrival of these combs appears to coincide with the appearance, mainly in Scandinavia, of hard glossy wool fabrics (Bender Jørgensen 1984a, 131; 1986,355-6).

While the combed yarns can be identified with some degree of certainty, the technique used to prepare the remainder of the wool finds is not so obvious. For example, some of the finest yarns are smooth and even but lack the glossy parallel-fibred appearance of the more obviously combed yarns. Although such yarns may have been combed, it is also possible that they have been produced by a skilled spinster working straight from the wool staple.

The greater number of the yarns, however, are soft and bulky, sometimes with loose fibre-ends curling away from the thread. In the later medieval period these yarns were prepared by brushing the fibres with hand cards, small boards set with many fine teeth, or by gently beating the raw wool with a large bow strung with gut. However, there is no

evidence for hand cards before the late 13th century, or the bow before at least the 12th century—if the latter ever reached England at all (Baines 1977,35; Hoffmann 1964,287). It is only possible to speculate whether some primitive form of hand card, such as thistles set in a frame, was used for the earlier finds, or whether the wool was only teased out by hand before spinning.

In some publications, the terms 'woollen' and 'worsted' are used to differentiate softer fabrics from textiles with smooth, even yarns. These terms first occur in English documents in the early 14th century, at a time when the wool textile industry had split into two branches, one producing smooth, often patterned, 'worsteds' made from combed wool, and the other making soft, fulled and teaselled 'woollens', from carded fibres (Beck 1886, 374). The products of the two halves of the industry can usually be identified with ease from the late medieval period onwards. In the Viking Age, however, there was not such a distinct split between the two and there are many intermediate types, where it is not possible to differentiate between a roughly combed yarn and one which has been carefully spun without combing. The terms 'worsted' and 'woollen' have therefore been avoided when describing the earlier group of textiles, although it is correct to say that all of the later, medieval, wool textiles from Coppergate, except for a combined linen-wool fabric, 1422, are 'woollen' in type.

Vegetable Fibre

Flax is prepared for spinning by soaking the stems until the outer parts rot, then breaking them up by beating with a mallet or wooden chopper (Baines 1977,21-3). The crushed stems are next drawn through iron spikes to separate the long fine fibres, which can then be spun into a smooth firm yarn. A similar process is applied to other stem fibres such as nettle and hemp. Spikes which may be from wool-combs or which may have been used in the preparation of vegetable fibres, have been recovered from Anglo-Scandinavian levels of 16-22 Coppergate *(AY* 17/6 forthcoming).

Stem fibres are only pre-treated in this way when they are required for weaving. Ropes made from whole stems of flax have been found at 16-22 Coppergate, along with heavy plaits, made from another plant stem, the hair moss *Polytrichum commune* Hedw.: this requires no pre-treatment beyond stripping off the outer leaves. The hair moss plaits are discussed below (p.394-7).

Silk

The silk moth, *Bombyx mori,* exudes twin filaments held together by gum, as it spins its cocoon. The cocoons may be dropped into boiling water, to soften the gum and to allow the paired filaments to be reeled off in groups. The reeled thread at this stage has a dull appearance, but further boiling will remove the gum, leaving the yarn with the lustrous appearance typical of silk (Baines 1977,39). This degumming process is not always carried out, but cross-sections of a selected sample of Coppergate silk yarns showed that the filaments were no longer in pairs, proving that they had indeed been degummed.

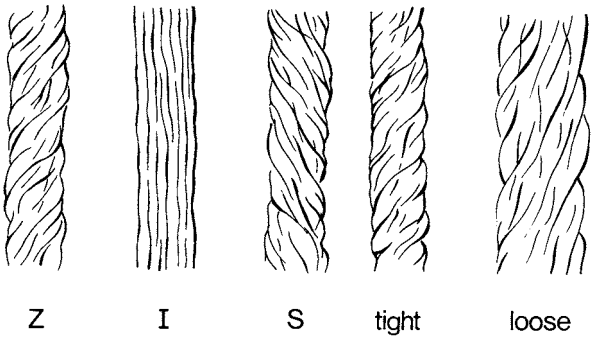


Fig. 124 The lie of fibres in a yarn

Spinning

When spinning, whether a suspended spindle or a spinning wheel is used, the yarn may be twisted either clockwise or anti-clockwise. Clockwise spinning produces a yarn in which the fibres lie in the same alignment as the middle stroke of the letter Z, while anti-clockwise follows the letter S. For this reason the two types of spinning are called Z-spun and S-spun (Fig. 124). The spinner can also regulate the speed at which fibres are drawn out, thus controlling how tightly the yam is spun (Fig. 124).

In the textiles from 16-22 Coppergate, Z-spun yarns with a regular degree of twist, in the region of 40° away from the vertical, appear to be the norm for linen. Both Z and S, with varying degrees of twist (20°–50°), were used for wool. In general, the Z-spun wool

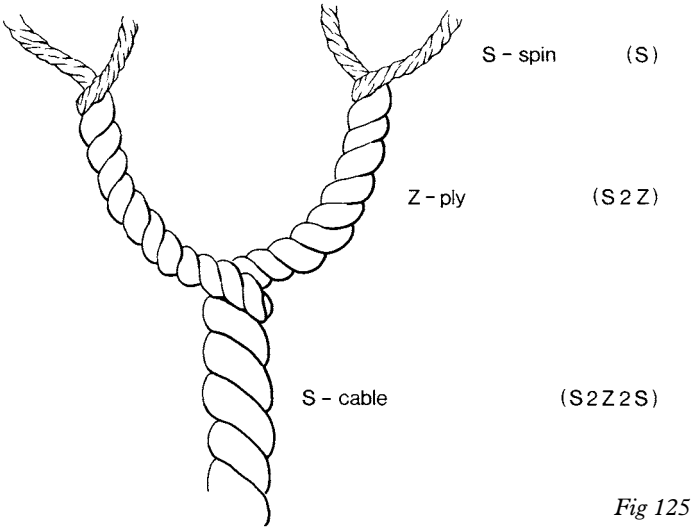


Fig 125 Spinning, plying and cabling

yarns, which usually proved to be the warp, were tighter spun and therefore stronger, but were also sometimes finer than the softer S-spun weft. Silk was also found twisted in S and Z directions, but the long filaments were sometimes used without any twist at all, designated I-twist (Fig.124).

Occasionally, two or more threads were plied together to make a stronger, thicker yarn. Usually the twist of the ply runs in the opposite direction from that of the spin, so that two S-spun yarns will be plied together in the Z direction. This is indicated S2Z (Fig.125). Some thick cords, resembling string, e.g. *1435*, had been given a particularly tight twist, 60°, for added strength. Some plied yarns were further twisted together to give a bulkier cord: a cabled cord twisted in the S direction from two S2Z cords is indicated S2Z2S (Fig.125).

In the tables the direction of spin has been given for warp and weft, alongside the thread count (number of threads per centimetre). In the text, where warp and weft cannot be differentiated, the terms 'system 1' and 'system 2' have been used.

Anglo-Scandinavian Wool Textiles

Description

Tabby weave

Fourteen of the 32 pre-Conquest fragments woven from wool are in the simplest weave, tabby, also known as plain weave (Fig. 126a, Table 16). Twelve of these are worked from combined Z and S yarns and in two cases the Z-spun system was the warp, identified by the presence of the simple selvedge in *1260* (Fig.127a), and the fringe in *1257* (Fig.127e). These tabbies show a much greater variety of fabric-types than any of the other weaves.

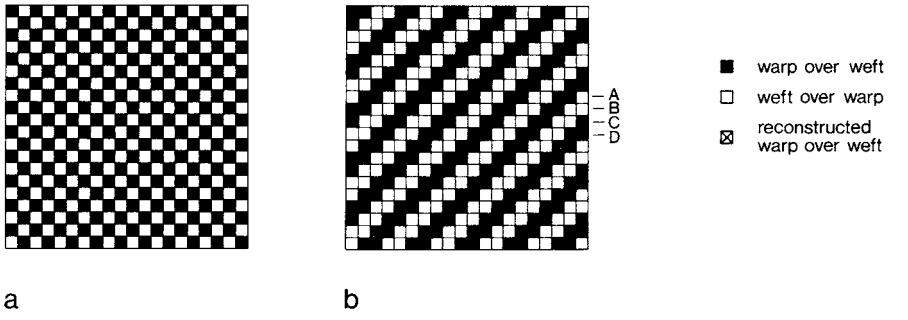


Fig. 126 Weave diagrams: a, tabby; b, 2/2 twill, A, B, C and D correspond to the four different pattern rows in the weft

Table 16 Anglo-Scandinavian wool tabbies: nat. pig.—natural pigment; n.d.d.—no dye detected; H—hairy; GM—generalised medium; M—medium

	Thread-count	Spin	Dye	Fleece type	Comments
1257	4 × 2–3	Z × S	–	H × H	fringe
1258	6 × 5	Z × S	indigotin	H × GM	loosely woven
1259	12 × 8	Z × S	n.d.d. (nat. pig.)	H × HM	
1260	12–16 × 6	Z × S	?madder	M × ?	selvedge
1261	15 × 9–10	Z × S	–	–	probably wool
1262	18–22 × 11	Z × S	n.d.d.	M × M	
1295	5 × 4	Z × S	n.d.d.	H × H × H	pile
1296	3–4 × 3	S × S	n.d.d.	–	
1297	4 × 3–4	Z × S	n.d.d.	M × HM	loosely woven
1298	6 × 4–5	Z × S	–	–	
1299	14 × 8	Z × S	–	–	
1411	12 × 8	Z × S	–	–	partially calcified
1460a	5 × 5	Z × S	madder	H × H × H	pile
b	24 × 16	Z × Z	–	–	combed wool; selvedge

Three of the coarsest, *1258, 1296-7*, have an uneven, net-like appearance, being loosely woven from irregularly spun yarn. It is difficult to imagine that such rough and open textiles could have been used for anything other than sacking, but *1258* has been dyed, which suggests some other function.

Another three textiles, *1259* (PI.XVIIa), *1260, 1262*, have the Z-spun system more closely set than the S-spun (Z 12-22 per centimetre, S 6-8 per centimetre) which gives the fabric an almost ribbed effect and also imparts a certain stiffness to it. Much softer than these are a third group, *1257, 1295, 1297-8, 1460a*, coarse ZS fabrics with more or less equal thread counts in warp and weft. These are woven with the yarns close enough to interlock with each other, but not too tightly packed, giving what must have been a warm, soft fabric which draped easily.

Two of these last have loosely twisted locks of wool darned in after weaving had been finished, giving the effect of a piled weave. The locks of wool wrap round threads of either the warp or the weft, or diagonally round both, and must have been put in with a sewing needle, as in some cases the inserted wool actually splits the yarn of the cloth. 1460a has relatively short tufts worked into it, 25–30mm long, while 1295 has a much deeper pile, approximately 90mm long.

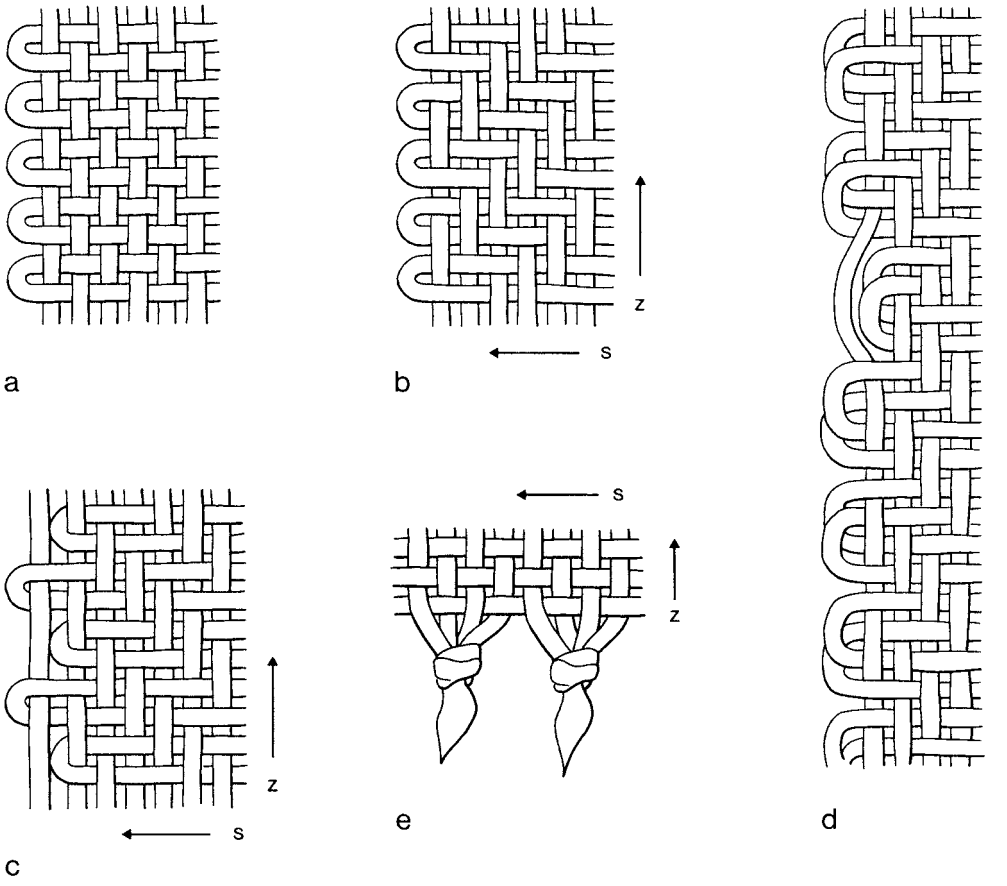


Fig. 127 Selvedges: a, simple, on tabby weave, e.g. 1260*; b, on 2/2 chevron twill,* 1306*; c, on 2/2 chevron twill* 1303*; d, on diamond twill,* 1382*; e, fringe on wool textile in tabby weave,* 1257. *Not to scale.*

The final type to be found within the tabbies is represented by a single example, *1460b.* This is a glossy ZZ strip, fine, hard and evenly woven from combed wool, which has been used to bind the piled fabric, *1460a* (Fig. 128, PI.XVIII). The piled fabric consists of two layers, both pile-uppermost, the lower layers in three segments stitched together. The upper layer has been stitched down to the lower, but does not cover the whole of its extent (at least now). *1460b,* which may be a ribbon or tape, although it is only possible to see one selvedge from the outside, has been folded lengthways over the raw edges of the two layer of the piled fabric. It is held in place with both a running stitch and a small upright hemming stitch. This bound edge has then been turned under and held in place with coarse hemming stitches. This technique is still used today to bind and hem coarse, easily frayed materials.

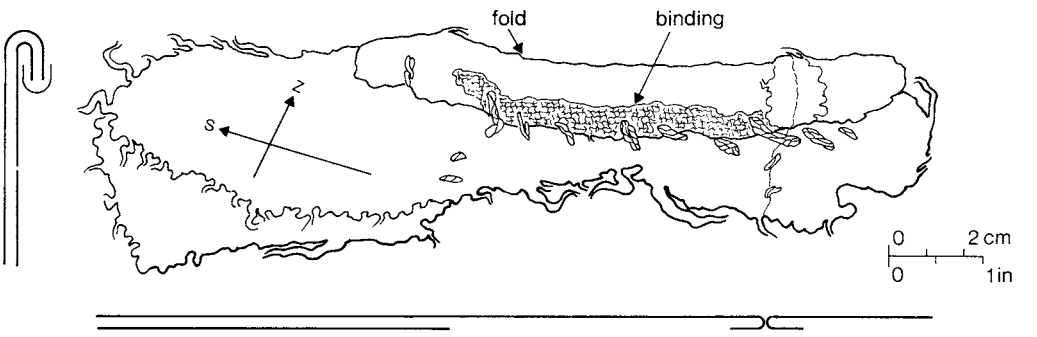


Fig. 128 Piled wool textile, 1460a *(pile face away), and binding,* 1460b. *Scale 1:2*

2/2 twills

The remaining nineteen wool textiles are all based on 2/2 twill, either non-reversed (simple) (Fig. 126b), chevron (Figs. 132-4) or diamond (Figs. 135-7).

Non-reversed twills

The six textiles worked in non-reversed twill (Table 17) are all similar in appearance, being firmly woven from evenly-spun yarns, all in medium qualities, all ZS. Several are in a poor state of preservation and, since these decayed fragments are in general rather small, some may be from chevron or diamond twills. For instance, *1266* is very like diamond twill *1268*, near which it was found, although there are no reverses over 30 x 35mm.

Table 17 Anglo-Scandinavian wool textiles in non-reversed 2/2 twill: n.d.d.—no dye detected; H—hairy; GM—generalised medium; M—medium

	Thread-count	Spin	Dye	Fleece type	Comments
1263	11 × 11	Z × S	n.d.d.	M × M	gore; hems
1265	12 × 10	Z × S	–	–	weave not clear
1266	14 × 12	Z × S	n.d.d.	–	?part of *1268*
1300	14 × 7	Z × S	n.d.d.	GM × H	
1301	14 × 12	Z × S	madder	–	
1379	7 × 5	Z × S	madder	–	

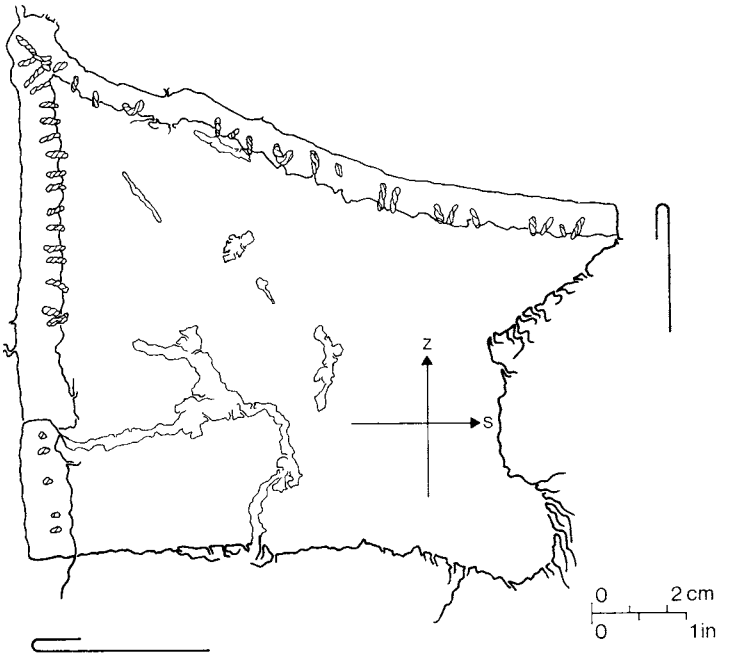


Fig. 129 Hemmed wool 2/2 twill, 1263. *Scale 1:2*

One of the decayed pieces, *1379*, was impregnated with a red material which was visible in the immediately surrounding soil. Analysis showed this to be a strong deposit of madder, a red dye. Roots of the madder plant have also been recovered from the site, together with many other madder-dyed textiles (see below, pp.396-402). The probable interpretation of this particular piece is that it is a fragment of cloth from a dye-vat, for some reason disposed of in a pit.

One of the better-preserved twills, *1263* (Pl.XIXa), has hems on two adjacent edges. If the warp and weft threads are traced, it can be seen that originally these two edges formed a corner which was almost square, but that some sort of strain has pulled it out of shape (Fig.129). Such a distortion might have occurred if the textile had originally been used as a curtain or wall-hanging, a function which the thick and closely woven nature of the fabric would suit. More sumptuous hangings in the homes of the wealthy are frequently described in contemporary accounts and illustrated in documents (Fig.130), but textiles also seem to have been used as curtains and wall-hangings in poorer buildings: in c.1058 Goscelin, for example, describes how, on his arrival in England, he cleaned the poor lodgings he had been given and then furnished them with curtains, hangings and rugs for benches (Dodwell 1982; Barlow 1962,93).1

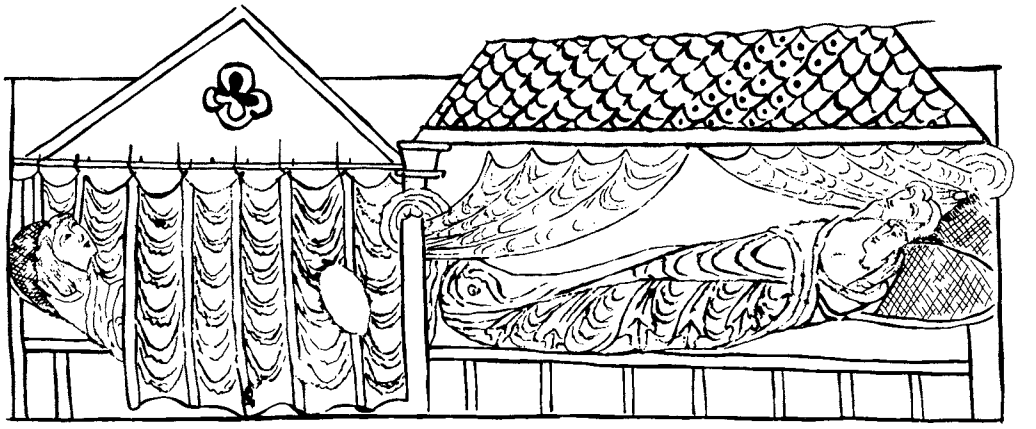


Fig. 130 The use of curtains in the second quarter of the 11th century (after BL MS Cotton Claudius B1V)

One further interesting feature of 1263 is a single S-thread which turns back on itself, forming a wedge-shaped insert or gore (Fig.131). There may be other S-threads, making the wedge even wider, but the area is torn and difficult to decipher. Gores such as this become necessary when the line of the weft has become uneven, requiring the darning in of extra yarn to fill the dips. This most commonly happens with looms where no spacing device is used to keep the warp evenly distributed and regularly occurs with the warp-weighted loom, the instrument most probably used for weaving these textiles. The presence of a gore, which can only occur in the weft, also indicates that here again the Z-spun system is the warp.

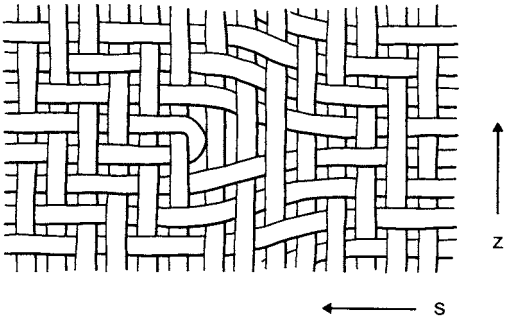


Fig. 131 Gore in 2/2 wool twill, 1263. *Not to scale*

Table 18 Anglo-Scandinavian wool 2/2 chevron twills: n.d.d.—no dye detected; nat. pig.—natural pigment; H—hairy; HM—hairy medium; GM—generalised medium; M—medium

	Thread-count	Spin	Dye	Fleece type	Comments
1264	9 × 7	Z × S	n.d.d. (nat. pig.)	HM × H	
1267	14 × 10	Z × S	–	–	?part of *1268*
1302	8 × 5–6	Z × S	indigotin	M × H	
1303	10–11 × 6–7	Z × S	n.d.d. (nat. pig.)	H × HM	dark warp naturally pigmented; selvedge
1304	10 × 8	Z × S	n.d.d.	H × HM	*Kreuzköper*
1305	16 × 12	Z × S	n.d.d.	GM × HM	
1306	18 × 16	Z × S	lichen purple	HM × M	selvedge

Chevron twill

Seven examples of 2/2 chevron twill (Figs. 132-3a, 134, Pls. XIXb and XXIa, Table 18) occur in medium and medium-fine qualities. They all have Z-spun yarn in one system and S-spun in the other, and in five the break in the diagonal occurs in the Z-system, the one which often proves to be the warp. The two in which the break occurs in the S-system are both small fragments and one at least, *1267*, may be part of a diamond, as it was found on

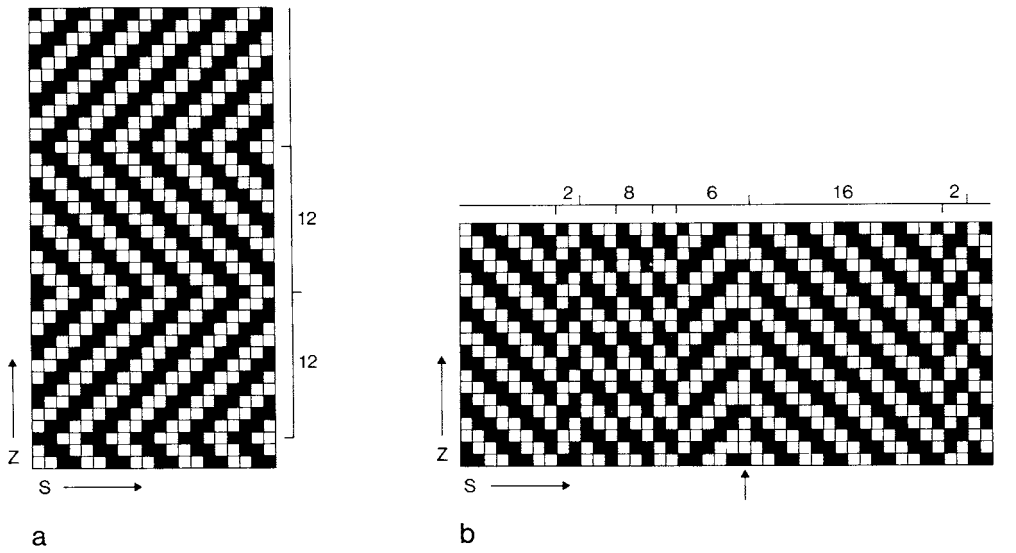


Fig. 132 2/2 chevron twill in wool; a, 1267 *(cf.* 1268, *Fig.135c); b,* 1303 *(weaving fault marked with arrow)*

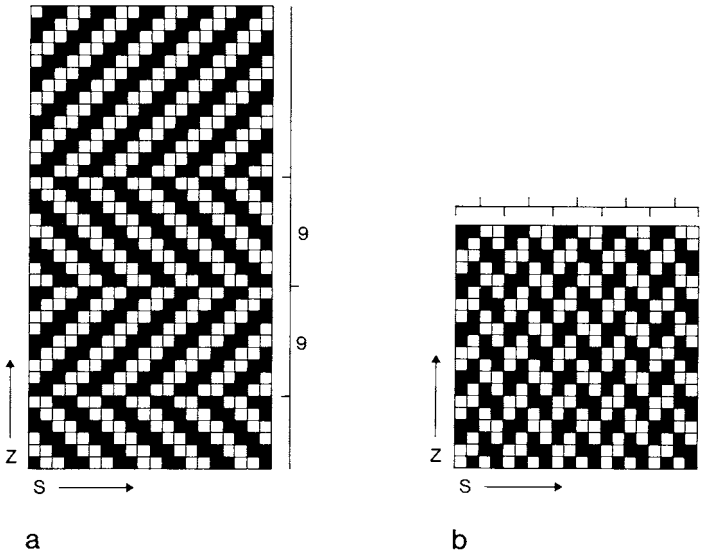
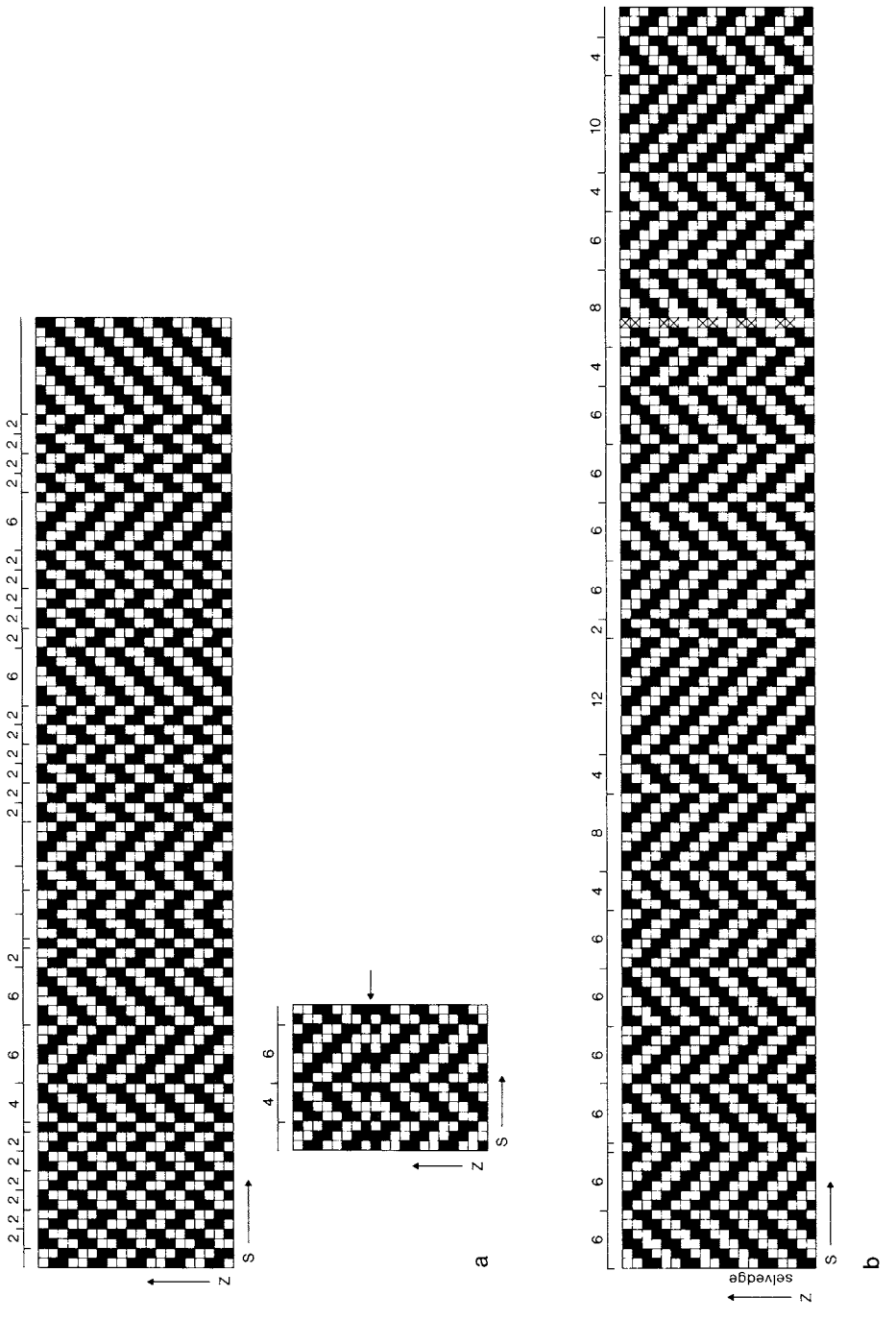


Fig. 133 a, 2/2 chevron twill in wool, 1305*; b,* Kreuzköper, 1304

the same skeleton as diamond twill *1268*: *1267-8* both have reverses after 12S threads (cf. Figs. 132a and 135c), and are similar in thread-count and yarn structure.

It is interesting that most of these pieces would appear to be warp chevrons, since this weave, as compared with the weft chevron, requires more care in the tying of the heddles (the pattern-making equipment of the loom) although less thought in the weaving. It also leaves the weaver with the option of converting to a diamond twill, while weaving is in progress. However, the widely varying numbers of threads between reverses is puzzling. Does this show a lack of skill or care in threading up the warp, or was there some overall pattern across the width of the loom which is not visible in the smaller fragments which have survived? In the pieces where a pattern unit repeats quite regularly, except for a few interruptions (e.g. *1305-6,* Figs.133a, 134b), a weaving error seems the most probable. However the possibility of some overall design should not be ruled out, especially since a slightly later 2/1 twill from Novgorod shows an overall symmetrical pattern, made up of varying numbers of threads between reverses in both warp and weft (Nahlik 1963,261).

Fragments *1305-6* (Pl.XXIa) show a high standard of craftsmanship, apart from the occasionally uneven pattern repeat. They are regularly woven, from smooth, evenly spun yarns, and the quality suggests that they may be traded goods rather than domestic products: it is therefore significant that one of the textiles, *1306,* is dyed with lichen purple, a dye which has not been found in any of the other wool textiles, but which is present in some of the imported silks (see below).


a
b
selvedge
S
Z

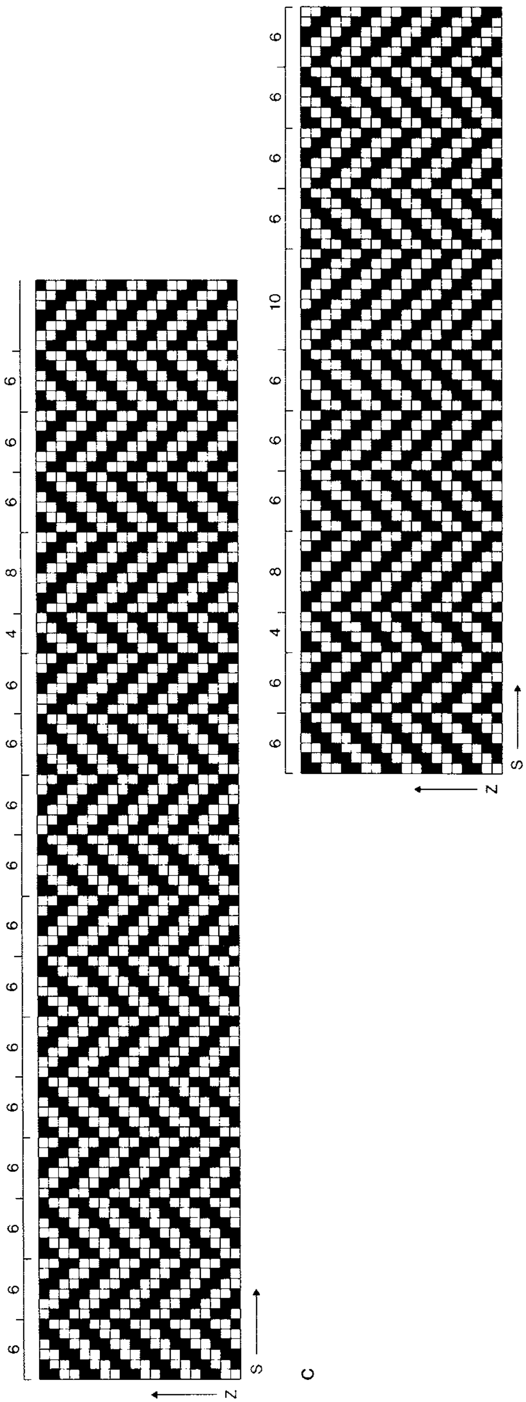


Fig. 134 2/2 chevron twill, wool: a, two pieces of 1302 *(weaving faults marked with arrow); b, piece with selvedge,* 1306 *(see Fig. 127b); c, two pieces of* 1264

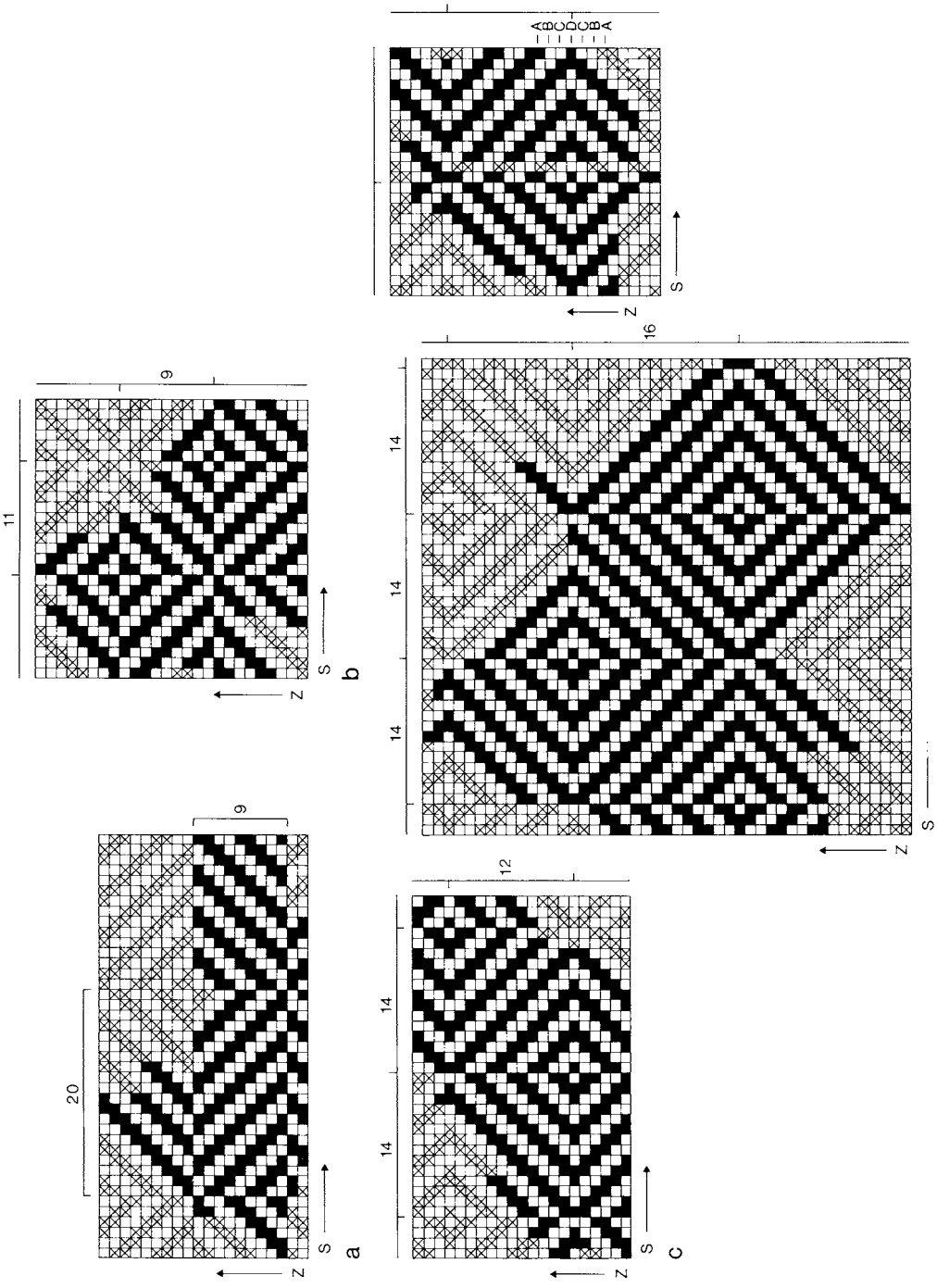


Fig. 135 2/2 diamond twill in wool: a, 1380; *b,* 1381; *c, three pieces of* 1268 *(cf.* 1267, *Fig. 132a*

The coarser chevron twills are still well produced, but lack the appearance of quality cloth. In most of them the chevron pattern does not show up well, being muted by the coarser yarn. However, in one case, *1303* (Fig.132b, PI.XXIVa), a smooth dark glossy warp yarn has been combined with a softer, paler weft, so that the twill lines would have stood out clearly, were it not for heavy matting of the weft which has occurred in places. This textile is an important piece, quite different in overall appearance from any of the other textiles from 16-22 Coppergate (discussed further below).

In another case, *1304* (Fig.133b), the aim seems to have been to produce a fabric with no clear pattern, as here the diagonals reverse regularly after only two threads. This simple weave, called *Kreuzköper* in some publications, is probably a forerunner of the modem crepe weaves, which deliberately avoid any obviously repeating pattern.

Diamond twills

The six diamond twills (Figs. 135-7, Table 19) are of relatively good quality, although only *1382* could be classed as fine. *1307* is the heaviest fabric and closer to the weight of the simple twills and the coarser of the chevron twills.

In the larger fragments it is possible to see that the diamond pattern repeats quite regularly within each textile, although different textiles have different pattern units: *1268*, 28Z x 32S or 24S threads per diamond, (Fig.135c); *1307*, 20Z x 18S (Fig.137a); *1308*, 12Z x 10S (Fig.137b, PI.XXa); *1381*, 22Z x 18S (Fig.135b); *1382*, 20Z x 18S (Fig.136, PI.XXIb); *1380*, (less clear) ?40Z x 18S (Fig.135a). Since the Z-spun system is always closer-set, this use of more Z-threads per diamond makes the pattern, when woven, more symmetrical in shape. Since the weavers seem to have experienced no difficulty in producing regular repeats in these cases, this may be an indication that the irregularity of the chevron patterns was deliberate.

If the Z-system is assumed to be the warp in all cases, it can be seen from the diagrams that in both chevrons and diamonds the reverse in the diagonals across the warp occurs

Table 19 Anglo-Scandinavian wool 2/2 diamond twills: n.d.d.—no dye detected; H—hairy; HM—hairy medium; M—medium

	Thread-count	Spin	Dye	Fleece type	Comments
1268	12–14 × 10–14	Z × S	–	–	?part of *1266–7*
1307	11 × 7	Z × S	n.d.d.	HM × HM	
1308	14–16 × 11–13	Z × S	madder	M × HM	
1380	15 × 11	Z × S	–	–	calcified: ?wool
1381	14 × 11	Z × S	madder	–	
1382	22 × 12	Z × Z	n.d.d.	H × H	selvedge

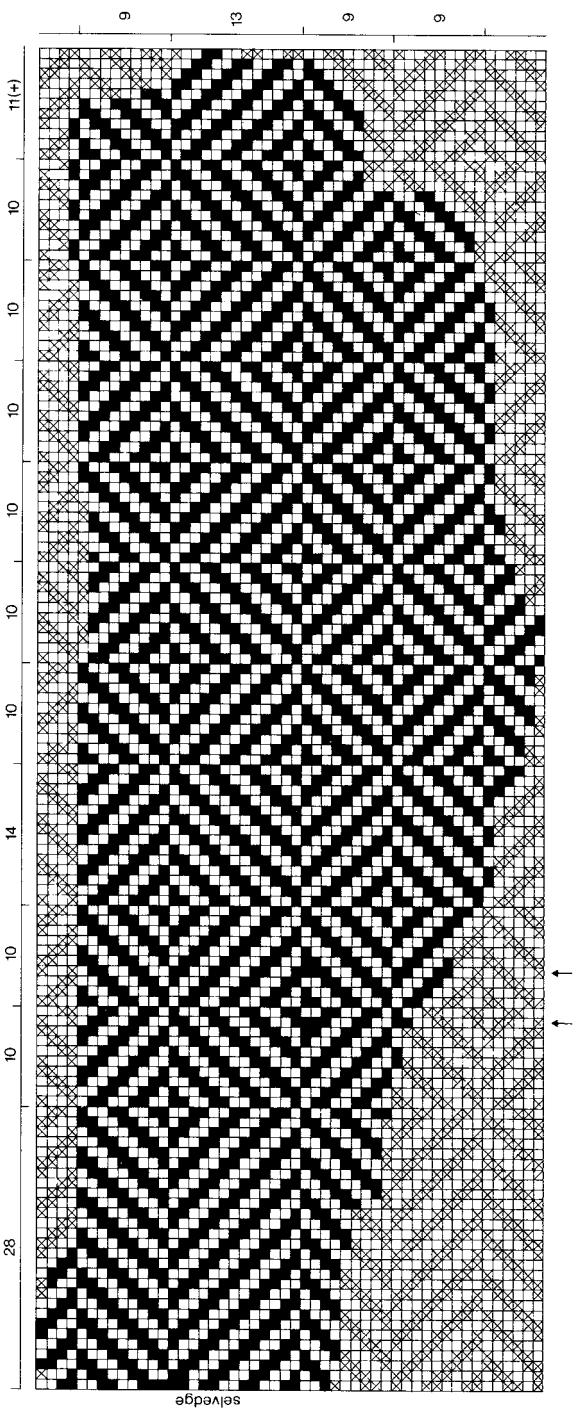


Fig.136 2/2 diamond twill in wool, 1382, *with selvedge (see Fig.127d) (weaving faults marked with arrows)*

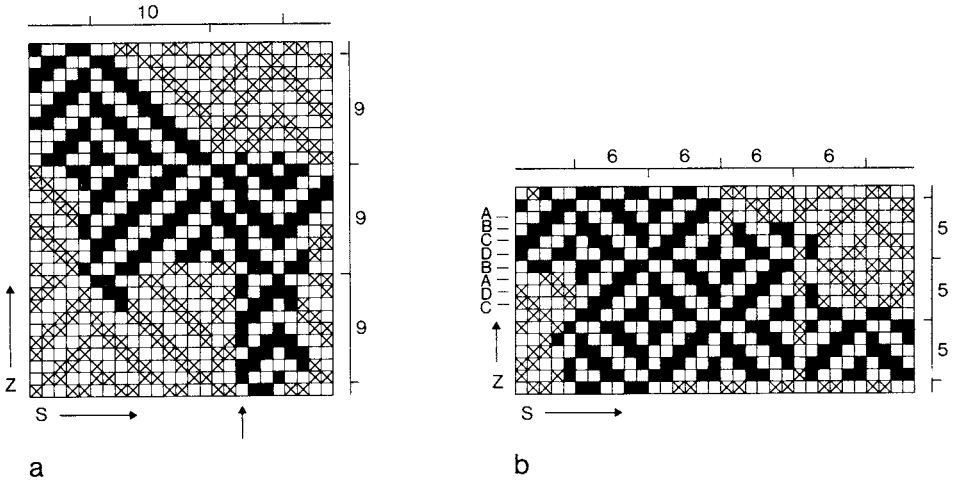


Fig.137 2/2 diamond twill in wool: a, 1307*; b,* 1308

with a complete 'break' in the pattern, so that one pattern unit is mirrored in negative by the next (these weaves are therefore often termed 'broken' or 'asymmetrical'). In the few cases where the warp reverses do not show a break of this sort, it is always in muddled or torn areas of the weave where warp threads may have become displaced or lost. Other authors have already pointed out (Geijer etc.; see p.117, *AY* 17/3) that broken twills are easier to set up and weave on the warp-weighted loom than non-broken ones, as no more than two adjacent warp threads need be lifted together in one heddle loop.

In the weft, on the other hand, the way in which the twill diagonal reverses relies purely on the order in which the weaver lifts the heddles. These are rods which bring forward different sets of warp, opening a space called a 'shed' ready for the passage of the weft. In 2/2 twill weaves, four different sheds, corresponding to four different pattern rows in the weft, are required: A, B, C, D (Fig.126). In most of the diamond twills, the weaver has ordered the opening of the sheds A-B-C-D-B-A-D-C *(1308,* Fig.137b) so that a break similar to that in the warp is produced. However, in diamond twill *1268* and chevron twill *1267* (probably parts of the same textile) the order is A-B-C-D-C-B-A, so that a symmetrical wave pattern is produced (Figs.132a, 135c).

1267-8, with *1266*, were found in several poorly preserved fragments adhering to a skeleton (Fig.138). Another fragment, *1265*, was recovered from the same pitfill. The skeleton was of a male aged 35-45 and was found lying askew in a shallow pit (2.5 x 2m, 0.30m deep) dated to the late 9th century *(AY8/4,* in prep.). The burial appears to have been irregular and unceremonious. The textile remains were found on the upper half of the body, on the back of the spine, shoulder blades and skull, and on the front of the body below the jaw. There were also fragments in the soil to the right of the skull and on both sides of the upper body. The fragments of chevron twill, *1267*, found on the left side of the

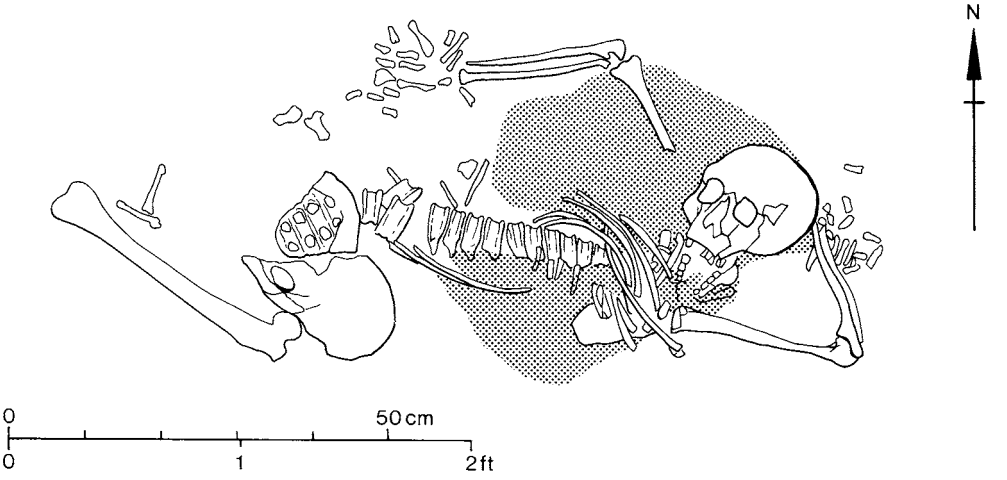


Fig. 138 Skeleton from Period 3; shaded area indicates extent of textile fragments, 1266–8. *Scale 1:5*

body below the shoulder blade, and the fragment of diamond twill, *1268*, on the right side of the skull, included some irregular stitch holes, but there was no other indication of the original shape or structure of the garment. The textile wrapped closely round the bones of the spine, moulding into the gaps in the vertebrae and there were also some pieces present on both the inside and the outside of the ribs. It is difficult to judge whether this would happen in the normal process of burial and decomposition or whether the textile on the inside of the ribs is an indication that the body had been buried here after decay had set in.

Parallels

Coarsest tabbies

The coarser textiles, in particular the rough open-weave tabbies, seem to have more parallels in settlement sites than in burials. In the Viking graves of Scotland, the Northern Isles and the Isle of Man, only two fabrics, both piled, show low thread-counts of 4 x 3 per centimetre (Cronk Moar, Isle of Man) and 8 x 4 per centimetre (Kildonan, Isle of Eigg) (G. Crowfoot 1949). Similarly, among the numerous finds from cemeteries of pagan Anglo-Saxon England, few have counts of less than 8 x 8 per centimetre. Only one example, probably a wrapping for a spear, from West Heslerton, North Yorkshire, shows a loose open weave (a twill, 6Z x 5Z) similar to the finds from 16-22 Coppergate (Walton in prep. b).

In contrast, there are several coarse wool textiles (variously spun SS, ZZ, ZS with counts of3.5 x 3.5 to 6 x 5), some of them loosely woven, of 10th-11th century date at 6-S Pavement, York (p.103, *AY* 17/3). From Milk Street, close to the late Saxon market of Westcheap in London, there are other coarse wool tabbies, some woven from plied yarns, others ZS, with counts of 2 x 2 to 6 x 4 (Pritchard 1982, 204).

This difference between cemetery and settlement textiles can also be seen in Scandinavia, where, among the large numbers of Merovingian and Viking burials surveyed by Bender Jørgensen (1986, 59-106), very few textiles have counts of less than 7 x 7, whereas urban textiles are generally coarser. In 11th century Lund, for example, there were several tabbies (mainly in plied yarns) with as little as two threads per centimetre (Lindstrom 1982, 182, 189), while at Hedeby there was one SS tabby with a count of 4 x 3 and five ZS pieces with counts of 3-6 x 3-5 (Hägg 1984b, nos.9, llg, 55A, 91E; Hundt 1984, 129). Similarly, at the 8th century settlement of Elisenhof, in northern Germany, 24 out of the 162 textiles in tabby weave had counts between 4 x 4 and 6 x 6, of which one example was ZZ and the rest ZS (Hundt 1981,4-8); at least one piece, E93, appears loosely woven (ibid., pl.16), in the manner of 1258.

Paradoxically, in the particularly rich graves at Birka in Sweden there are some coarse tabbies and twills, three of them probably with piles (Geijer 1938, WI-9, 20-2, Dll, 132), alongside the finest most luxurious fabrics. The most probable explanation for this pattern is that most of the coarse fabrics were rough cloths used for everyday tasks and industrial purposes, not for dress, and it is only in the richer graves that they were used as wrappings for grave goods or as an outer cover for the body. The only exceptions are the coarse piled fabrics which are frequently found on burial sites and which may have been used for cloaks or rugs (see below, p.336).

Fine tabbies

At the opposite end of the spectrum are the two fine tabbies, 1262 and *1460b*, the one ZS, the other a strip of combed wool, ZZ. The latter has two interesting parallels at 6-8 Pavement (591-2, p.123, *AY* 17/3). These are combed wool tabbies, 22Z x 12Z and 19Z x 12Z, both of which have been cut into strips of similar size to *1460b*, perhaps ready to serve the same function, as a binding fabric.

Among earlier, Anglo-Saxon, finds there are parallels for the ZS tabby in a mineralised piece from West Heslerton, 20Z x 14S, and a wool fragment from Southampton (Hedges 1980,351). It is not so easy to find comparisons for the ZZ strip, since, although tabbies are much more commonly ZZ rather than ZS in the early Anglo-Saxon period, most of them prove either to have equal counts in warp and weft or to be of a ribbed type with an extremely high count in one system, or to be linen: there do not appear to be any exactly of the Coppergate type.

Bender Jørgensen has pointed out (1986, 356-7) that fine 'worsted' (i.e., combed) ZZ tabby 'reps' of this sort are rare in Germany and Holland, although there are two examples at Elisenhof, one a striped piece, 20Z x 10Z, the other a strip 22Z x 16Z (Hundt 1981,94, 159, E5, E414a). They are, however, much more common in Scandinavia, especially Norway and Sweden, from the 7th century onwards. At Birka, for example, there are eleven, mainly ZZ (occasionally ZS), with counts of 14 x 11 to 24 x 12 (Geijer 1938, W22-32, 34-6), while from graves 6, 7 and 8 at Valsgarde, there are similar, as well as finer, examples (Arwidsson 1942,91-2; 1954, 103; 1977,86). The ZZ tabby binding, *1460b*, is therefore one of the few pieces in the collection which hints at a Scandinavian connection.

These strong but fine fabrics seem mainly to have been used for bindings and linings: at Birka one seems to have lined a diamond twill (W30), and a later example from Leksand church, Sweden, 22Z x l0S, was used as an inside edging for a cloak (Nockert 1982, 150).

Other tabbies and twills

Between the two extremes of the coarse, loose tabbies and the finer textiles, lie the bulk of the tabbies and twills, coarse to medium fabrics with thread counts of 5 x 4 to 15 x 9, all with Z-spun warp and S-spun weft. Some have a closely set warp while others have almost equal thread counts in warp and weft, but all are well intermeshed to give a thick dense fabric.

There is some evidence to suggest that this regular use of ZS spinning for medium quality wool fabrics is a feature which distinguishes textiles of the 8th-11th centuries from earlier ones. In England, textiles from cemeteries of the 5th-7th centuries certainly show, among the tabbies and simple twills, a much higher proportion of ZZ fabrics to ZS. The table of early Anglo-Saxon textiles, supplied by E. Crowfoot, shows that the proportion of ZZ-spun tabbies and simple twills is 83% in northern and eastern counties and 87% in the midlands and south. However, since the fibre is in many cases unidentifiable it must be assumed that some of these ZZ fabrics are linen, as flax is regularly Z-spun. Nevertheless, ZZ spinning can often be seen in medium quality wool textiles, for example in a wool tabby from Bergh Apton, Norfolk (E. Crowfoot 1978,101) and a twill from Mildenhall, Suffolk (G. Crowfoot 1951,27).

In contrast, in the later settlement sites of Gloucester (Hedges 1979), London (Pritchard 1982,204), and 6-8 Pavement and 5-7 Coppergate, York *(AY* 17/3), ZS spinning is more common among medium quality textiles. Since it has already been shown that settlement textiles are not entirely comparable with those from burials, the move from ZZ wool textiles to ZS cannot as yet be verified. In Scandinavian cemeteries, however, medium quality ZS twills similar to those of 16-22 Coppergate begin to appear in the Merovingian period as a new fabric-type (Bender Jørgensen 1984a, 131; 1986,360); Polish researchers have also noted an increase in ZS over ZZ in the Baltic region over the 7th to 13th centuries with ZS predominating in urban centres by the 11th century (Kaminska and Nahlik 1960, 112-14).

Whether the British ZS spinning is a factor of date or not, it is certain that by the Viking Age coarse and medium quality ZS tabbies and twills are to be found throughout north- west Europe. In Scandinavia they have been found at Birka (Geijer 1938, 20-2,27-9), Oseberg (Rosenqvist 1966,297-8) and Lund (Lindström 1982, 182), with many more from Hedeby in Schleswig-Holstein (Hundt 1984, 131-7; Hägg 1984b, 262-70). In Germany and Holland they are particularly common both in settlement sites of the Merovingian period (Tidow and Schmid 1979; Hundt 1981) and contemporary row-grave cemeteries (e.g. Hundt 1966); also in the 8th-9th century graves of Dunum (Tidow and Schmid 1979). Further afield there are similar ZS tabbies and twills from 10th century Novgorod (Nahlik 1963) and 11th century Gdansk and Opole (Kaminska and Nahlik 1960).

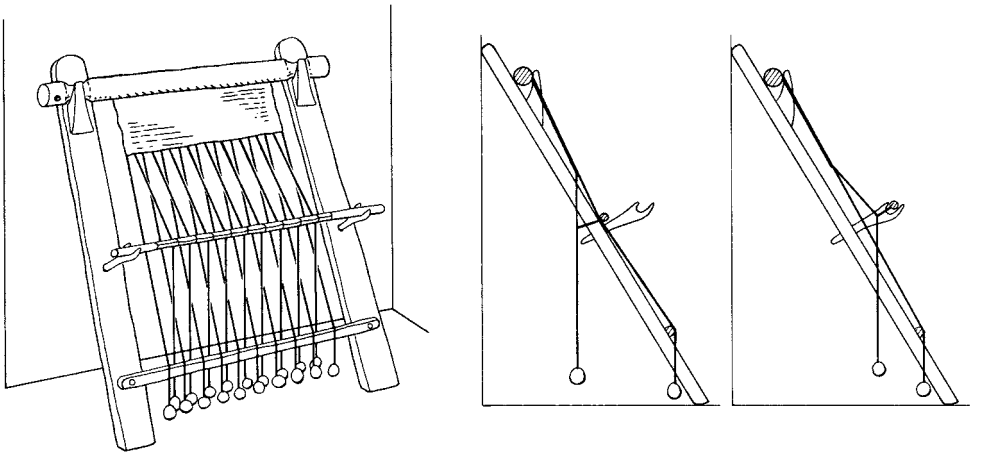


Fig.139 Weaving tabby on the warp-weighted loom

This ubiquitous type of textile is sometimes found with a starting border of a type associated with the warp-weighted loom, together with weaving faults such as missed warps, weft-crossings, gores and other irregularities which suggest non-professional weaving. Such textiles must have been woven by households throughout north-west Europe, using the loom for which there is ample evidence in the form of loom weights (see Fig.139). Although it is possible that the better qualities were traded, it seems more likely that the similarity between the coarser textiles of different sites is the result of the spread of spinning and weaving traditions, rather than organised traffic in the goods themselves.

The softer of these fabrics, with nearly equal counts in warp and weft, were probably used as blankets and rugs and, as in the stitched corner piece, *1263*, possibly for hangings and curtains (see above). Some, particularly those with a pile, may also have been used for cloaks. Hose and tunics also seem to have been made from coarse-to-medium quality wool textiles at this period (Hägg 1984b).

The tougher pieces with closely set warp were probably used for some purpose other than clothing. They may be compared with the wool textile, 9-11 x 4 per centimetre, used for caulking the ship at Oseberg (Ingstad 1982,88) and the l0th century fragments from Ladby boat-grave in Denmark, with counts of 14-22 x 6, which were thought to have been from a tarpaulin, a tent, or perhaps the ship's sails (Bender Jørgensen 1986,225,318). Sailcloth would not be a surprising find at 16-22 Coppergate, which is situated close to the River Foss, with its easy access to the River Ouse and the North Sea.

Piled fabrics

A pile has been added to two of the coarser tabbies,*1295* and *1460a* (Pl.XVIIIa), by darning in lengths of wool after weaving. Two piled textiles from Lloyds Bank, 6-8 Pavement, one a tabby, *581*, the other a diamond twill, *579* (p.114, *AY* 17/3), were

constructed in the same way, but in this the York textiles differ from most of the comparative material.

Piled textiles have been found in several sites in England and Scandinavia. At the late 7th or early 8th century site of Gally Hills, Surrey, a twill weave was found to have even rows of tufts, 25 to 40mm long, which were most probably inserted during weaving (E. Crowfoot 1976a, 69-71). From 7th century Broomfield, Essex, and the early 7th century Sutton Hoo ship burial there are also textiles with regular rows of loops woven into a tabby ground (E. Crowfoot 1983, 443). Other sites such as Bergh Apton, Norfolk (E. Crowfoot 1978, 105) have produced possible examples, but their mineralised state makes it difficult to identify their construction. The Viking piled tabbies from the Isle of Eigg and the Isle of Man most probably had the pile worked in during weaving (G. Crowfoot 1949,25-7), and this was certainly the case with two fine twills with pile from Vendel period Valsgärde (Arwidsson 1942,92; 1977,82-3), an 11th century piece from Lund (Lindström 1982, 182, 190) and the 10th-12th century fragments from Heynes, Iceland (Guðjónsson 1962, 20-1; 1980,41-5). Only at Birka were the remains too fragile to decipher the method of inserting the pile (Geijer 1938, 132, Dll, 22,W8,W9).

The York pieces are therefore without exact parallels. In general appearance the fragment, *1460a,* and the two pieces from 6-8 Pavement are similar to the Scandinavian examples in having an overall fleecy character, while the long spun threads of 1295 are more like the Anglo-Saxon ones, with their 'decorative lines of soft silky locks' (E. Crowfoot 1983,443). However, since the York examples differ from the others in having a pile applied after weaving, a technique which is only paralleled in the Danish Bronze Age (Broholm and Hald 1940), it is possible that they represent a local idiosyncrasy.

Piled fabrics seem to have been used for cloaks, coverlets and rugs; in Old Norse the terms for a shaggy cloak of this sort is 'rǫgvarfeldr' (piled fabric = rǫgg(f.), rǫggr (m.)) (Foote and Wilson 1980, 172-4). They were also articles of trade: both Ireland and Iceland exported piled mantles, and in the 8th century Frisians were dealing in something called *villosa,* which may have been the same type of cloak (Guðjónsson 1962,70). In the Bayeux tapestry, the body of Edward the Confessor lies on a piled rug and there are several other illustrations of piled cloaks from the medieval period (ibid.). Although the design of these cloaks may derive originally from animal fleeces or pelts, it is clear that they were not meant to mimic them entirely, since occasionally they were dyed. One, and possibly both, of the pieces from 16-22 Coppergate had been dyed red with madder, while one of the Birka examples had been worked in blue and red yarns (Geijer 1938, 132). The early Icelandic literature also mentions that some of their cloaks were coloured (ibid.).

Broken twills. chevron, diamond and Kreuzköper

Among the broken twills, one piece, *1303,* stands out as different from the others, with its smooth dark warp and soft pale weft (discussed below). The remainder are medium or medium-fine textiles, of uniform colour; warp and weft yarn are generally spun in opposite directions, although 1382 (Pl.XXIb)is Z-spun throughout. Two of the chevrons, *1305-6* (Pl.XXIa), and at least one of the diamonds (1382) are of such smooth even yarn and

woven with such obvious skill that they must surely be professionally woven goods, most probably traded. As such, a study of the distribution of comparable finds may indicate a place of origin.

Broken diamond twill is first recorded in England in the later Iron Age (Bender Jørgensen and Walton in prep.) and continued in use into the Roman period, when broken chevron twill also appeared (Wild 1970; 1977). These broken twills were produced in a range of qualities, with yarn spun both ZZ and ZS. Such textiles are believed to be native British products (Wild 1977, 30).

In early Anglo-Saxon cemeteries the same weave is regularly found as a standard, medium quality, ZS type, with thread-counts similar to those of the group from 16-22 Coppergate. Examples are recorded from Coombe (E. Crowfoot 1967, 21, 38) and Fordcroft (E. Crowfoot 1969, 50-2) in Kent; from Charlton Plantation in Wiltshire (E. Crowfoot 1984b, 141); Bergh Apton (E. Crowfoot 1978, 99, 104) and Swaffham (1976b, 29) in Norfolk; Sewerby (E. Crowfoot 1985a, 49-50) and West Heslerton (Walton in prep. b) in Yorkshire; and Fonaby in Lincolnshire (E. Crowfoot 1981,94,97); with a late 7th or early 8th century example from Orsett in Essex (E. Crowfoot 1985b, 15). These have thread counts of 9-16Z x 8-14S, but at the richer sites of Sutton Hoo and Broomfield Barrow, Essex, there are finer examples, 17-38Z x 13-24S (E. Crowfoot 1983, 457, 459, 468). Pattern repeats vary, but 20Z x 18S seems to be a recurring unit. Several more broken twills are known from other sites (Fig.171), but full details of these have not as yet been published.

ZZ diamond twills are also known in the early Anglo-Saxon period but, where the fibre has been identifiable, it has always proved to have been flax (e.g. E. Crowfoot 1978). The repeated use of ZS spinning in the wool broken twills is of interest, as we have already seen that the tabbies and simple twills of this period are mainly ZZ. This might suggest that the broken twills were imported from an area with a different spinning tradition, or it may be merely a design feature.

ZS broken twills in wool continue to be relatively common on later sites such as 6-8 Pavement and 5-7 Coppergate in York *(AY* 17/3), and Milk Street and Watling Court in London (Pritchard 1982, 1984). The York chevron and diamond twills have counts of 8-18 x 6-14, of which eight are ZS and three have alternating Z and S yarn in the weft; only one 2/2 diamond twill (669, *AY* 17/3) has Z-spinning throughout, a finer piece, 30 x 22 per centimetre. The 13 diamond and chevron twills from London are all ZS with counts of 12-15 x 9-14; there is also one example of *Kreuzköper,* 9Z x 8-9S. Pattern units vary considerably, but 20 x 18 occurs in two London diamond twills and, in both York and London, chevrons most commonly reverse after 6 or 10 warps. Finally, there is one example of 2/2 diamond twill from Greenigoe, Orkney, 18Z x 12Z per centimetre (HenshallI952, 17), but as this is from a Viking grave, it should, perhaps, be considered with the Scandinavian evidence.

In summary, 2/2 broken twills appear to have been introduced into Britain in the later Iron Age and to have continued in regular use until the 11th century, when they rapidly disappeared: there are no known post-Conquest examples. Chevron weaves and *Kreuzköper*

most commonly occur in the later Anglo-Saxon period. Wool examples regularly have Z-spun warp and S-spun weft. Pattern units vary, but a unit of 20Z x 18S recurs in the diamond twills and units of 6 or 10 are the most common in the chevrons.

On the Continent the earliest example of broken twill is a single example of a ZS diamond from the cemetery at Dürrnberg, Germany, dated to the Halstatt period (Hundt 1974). In the Roman period the weave occurs in German and Dutch sites, predominantly with ZS spinning (Wild 1970; Bender Jørgensen 1986,331-4). At Roman Mainz, however, there is a collection of irregular twills, which include two examples of diamond twills with reverses in the weft comparable with two of the fragments adhering to the skeleton, 1267-8 (Fig. 138) (Wild 1970,48, 116, 165). This particular form of pattern repeat seems to be rare (Wild 1977,28).

In the Migration and Merovingian Periods ZS broken twills are to be found in the cemeteries of Germany and The Netherlands (for a summary of this evidence see Bender Jørgensen 1986,334-8) and, in their greatest numbers, in the marshland settlements of the North Sea coast. In particular, textiles of striking similarity to the finds from 16-22 Coppergate have been discovered at the 8th century site of Elisenhof, in northern Germany (Hundt 1981). Here there were large numbers of textile fragments, including 125 warp chevrons and 184 broken diamond twills, of which 124 and 176 respectively are ZS. They are in medium and medium-fine qualities, many with similar thread-counts to the 16-22 Coppergate finds and also with similar patterns. The chevrons show both regular and irregular numbers between reverses, ten being the most common number, although six occurs in at least five Elisenhof examples, in pieces with counts of 8-22 x 8-16 (ibid., 18-22). There are also two examples of *Kreuzköper* with counts of 12Z x 10S and 14Z x 10S (ibid., 22-3) and 2/2 diamond twills with warp counts ranging from 6 to 30 per centimetre. The most commonly occurring pattern unit of the diamond twills is 20Z threads and 18S per diamond, although there are several other variations (ibid., 25-32), including one with a pattern-reverse in the weft similar to that of 1267-8 (ibid., Abb.17).

Similar textiles have been found at 7th-8th century Hessens, near Wilhelmshaven (Schlabow 1953, 34-8), 8th-10th century Leens (Schlabow 1974), 6th-10th century Westeremden (ibid.) and 8th-9th century Dorestad (Miedema 1980). In burials, they have been recorded in a Frankish grave in Cologne cathedral (Bender Jørgensen 1984b, 92-3); in the row-grave cemeteries of Germany (e.g. Hundt 1966; 1976); and in the 8th-9th century cemetery at Dunum (Tidow and Schmid 1979).

ZS diamond twill therefore appears to be a typical fabric-type of England, northern Germany and The Netherlands from the Iron Age to the Viking Age. ZS chevron twill and especially *Kreuzköper* are more common towards the end of this period.

In Scandinavia the picture seems to be rather different. Diamond twill first appears as a standard ZS type in the Roman Iron Age, but in circumstances which suggest that it is an import from the Roman Empire (Bender J0rgensen 1986,345-53). A few diamond twills also occur in sites of the Migration Period, but mainly as ZZ types (ibid., 353). It is in the Viking period that these ZZ diamond twills become well established as an important fabric-type.

At Oseberg (Rosenqvist 1966, 299-300; Ingstad 1982), Kaupang (Ingstad 1979a, 158-64), Birka (Geijer 1938,23-6) and Lousgard (Hald 1980,99), ZZ broken diamond twills are to be found, in general in fine qualities, with thread-counts in the more closely-set warp as high as 55 or even 64 per centimetre. Only the *Kreuzköper* is occasionally found in medium quality ZS fabrics (Geijer 1938, 39; Ingstad 1982, 86). The same is true of the Merovingian and Viking graves surveyed by Bender Jergensen (1984a, 131-3; 1986, 360-2), although there are also rare occurrences of ZS diamond twill. Only at Hedeby, close to the Danish border in Schleswig-Holstein, are there any number of ZS diamond twills of the type found at 16-22 Coppergate. There were no broken twills of any sort from Viking levels of Lund or Århus.

There are problems attached to this evidence. Although Hedeby was a Viking port, should its textiles be classed with those of the northern German sites to which it is geographically close? Or does the difference between Hedeby and the other Scandinavian sites lie in the fact that it is a settlement while the others are cemeteries? The finds from the settlements of Lund and Arhus are numerically small and there is no large town site in Norway or Sweden with which to make comparisons.

Nevertheless, Bender Jergensen, in her survey of Scandinavian textiles and their parallels in north-western Europe, has argued convincingly that the fine ZZ diamond twills probably originated in western Norway (1986, 358-60) and that the better qualities of ZS diamond, chevron and non-reversed twill came from the Frisian area of north Germany and The Netherlands-the region in which the largest numbers of these fabric- types have been found (ibid., 360-2).

Bender Jørgensen further suggests that the ZS fabrics, which she dubs the 'Hessens-Elisenhof type', are a candidate for the *pallia fresonica* of the documentary sources-that is cloth either made in Frisia or traded by Frisian merchants (ibid.). Previously, *pallia fresonica* had been tentatively identified with the fine ZZ diamond twills found in Scandinavian graves (Geijer 1938; 1979,213). However, other authors have pointed out that Frisian cloth was not necessarily of the finest quality (e.g., Hoffmann 1964, 228-35) and later work has shown that the fine ZZ diamonds are singularly rare in the Frisian area, where, instead, the slightly coarser ZS diamond, chevron and non-reversed twills predominate.

How do the Coppergate broken twills fit into this survey? It is obvious that their weaves, ZS spinning and general quality are typical of the Anglo-Saxon/continental German weaving tradition: but is it possible to distinguish any imports from local products?

One of the diamond twills, *1308* (PI.XXa), has a particularly small pattern repeat, 12Z x 10S threads per diamond. Two other pieces from York, one from 6-8 Pavement (PI.XXb; Fig.66c, *AY* 17/3) and the other an undated fragment from Parliament Street (p.233, *AY* 17/4,) have the same pattern unit and a similar number of threads per centimetre. This pattern unit is rare elsewhere: for example, not one of the 184 Elisenhof diamond twills was of this type; nor have any as yet been recorded among the many broken 2/2 twills from Viking Dublin (Frances Pritchard, pers. comm.). It is therefore possible that this particular diamond weave is a local product.

In contrast, the fine chevron twill, *1306,* one of the two pieces described as being of good, merchantable quality, has two exact parallels in late Saxon London, in textiles with the same thread-count, pattern unit and the same unusual lichen purple dye (Pritchard 1982, 204; 1984,53, nos.19 and 21).

One of these London pieces is a narrow band with a complete loom-width of 86mm (ibid., 55). Seventeen similar bands, fifteen of them in the same weave (counts 10-24Z x 10-18S, pattern units predominantly 10, but in one case 6), have been identified at Elisenhof, where they are termed *Wickelbänder.* From Hedeby there are another five bands, of which two are chevron twills, although one is much coarser than the English and Elisenhof examples (counts 22-23Z x 12-13S, 11Z x 4-5S) (Hägg 1984b, 24-8). Most of the Elisenhof bands are between 69 and 100mm broad, with one example 43mm; the two Hedeby examples in chevron twill are 85mm and 90mm broad. Only one selvedge is preserved on the York example but, since the greatest width across the warp on the largest fragment is 70mm, it may well be a *Wickelbänd.*

Hundt (1981, 49) has pointed out that these bands were a regular feature of early Germanic men's dress, while Hagg (1984b, 25) illustrates them bound spirally round the calf in the manner of puttees. In Anglo-Saxon England both men and women appear to have wound strips of cloth or leather, called *hose-bendas* or *winingas* over stockings or trousers (Owen-Crocker 1986, 54-5, 76-7). Charlemagne, who wore the national dress of the Franks, is also said to have 'bound his legs with bands', *fasciolis crura. ..constringebat* (Einhard,168).

The lichen purple of all three English examples is not to be found in any of the obviously native textiles, and indeed the lichens can only be collected in Scotland and the more remote parts of England (see below p.403): a source outside England is therefore more likely for these bands. If Frisia was a centre for the production of good quality ZS broken twills, then this region is a likely source for the bands. Unfortunately dye analyses have been carried out on very few textiles from 'Frisian' sites. However, there is some evidence that the Frisian region was noted for its dyeing and that the technique of dyeing with lichen purple was known in Germany well before the Viking Age (see below p.416). The chevron twill, *1306,* may therefore be tentatively identified as a Frisian import.

It is possible that one or two of the diamond twills were also traded goods, perhaps from Frisia. 1382 (Pl.XXIb) and *1380,* for example, are both of good, merchantable quality. 1382 is unusual in being worked throughout in Z-spun yarn, but it lacks the high warp-count of the Scandinavian ZZ diamond twills and has the typical English/Germanic pattern repeat (20 x 18): such ZZ textiles are occasionally found in 'Frisian' sites, such as Elisenhof (Hundt 1981,25).

Another textile may be more confidently identified as an import, in this case from Scandinavia. This is the broken twill, *1303* (Pl.XXIVa), described above as being different in appearance from any of the other textiles from 16-22 Coppergate. The warp of this piece is of combed wool, and dark from natural pigment, while the weft is pale, soft and matted. This use of natural brown wool in the warp is common in medieval textiles from Iceland, Greenland and Norway (Norlund 1924, 90; E. Crowfoot 1977, 375) but rare in

this country. However, a fragment of similar appearance to *1303,* and with the same type of wool in the warp, has been found at medieval King's Lynn (ibid.). This textile has been identified as an example of the Scandinavian fabric *wadmal,* which was a fulled twill used as currency in Iceland as early as the 11th century and exported to England in the medieval period (Hoffmann 1964, 194-200). Other examples of *wadmal* have also been identified at two medieval London sites (Pritchard 1982, 200).

A strikingly similar twill, with a count of 10-13Z x *6-8S,* has been found at the Viking port of Hedeby (Hägg 1984b, 20-3). This textile has been used for hose or leggings, and it is therefore of interest that the fragment,1303, was found in association with a piece of footwear, the *nålebinding* sock, *1309.* The only feature which differentiates the textile, *1303,* from the Hedeby example and the later *wadmal* is that it has reverses in the twill diagonal. However, the breaks in the weave occur close to the selvedge (Fig. 132b), where weaving faults often happen, and it is possible that the main body of the fabric was in fact a simple twill. Whether or not this was the case, the dark combed warp, the matted appear- ance and the association of the object with the *nålebinding* sock (see below), identify the textile as of Scandinavian origin.

To summarise, the wool textiles from 16-22 Coppergate have several features in common with other textiles of the post-Roman period, both from Britain and the rest of north-west Europe. The weaves, tabby, twill, broken chevron and diamond twill, are all structures to be found in the countries bordering on the North Sea throughout this period, while the predominant use of ZS spinning in the coarser tabbies and twills seems to be a feature of the 7th or 8th century onwards.

These textiles were deposited at a time when the Vikings were trading and settling in York, yet only two finds, *1303* and *1309,* indicate a specifically Scandinavian influence. On the contrary, most of the ZS chevron and diamond twills appear to spring from the weaving traditions of the native British and the continental Saxon peoples. Some, such as *1308,* were almost certainly woven locally, but one piece at least, *1306,* is more probably imported from Frisia.

The sock in *nålebinding*, 1309 (Figs. 140-2, Pls.XXII-XXIII)

During excavation of the backyard of one of the 10th century wattle buildings of Period 4B, a find came to light which most clearly indicated a Viking influence in the textiles. This was the wool sock worked in a technique never before recorded in England, *nålebinding.*

The sock is slipper-like in style, that is, it would originally have covered the whole foot, probably stopping short below the ankle. It is badly worn in places, but during conservation by Jean Glover (see pp.430-1) it proved possible to draw together the broken areas of the ankle and the ball of the foot, so that the original shape could be seen. A large hole at the heel and a tear down the vamp throat still remain.

After conservation, the length from toe to heel was 260mm, the circumference of the ankle 32Smm and that of the broadest part of the foot 270mm. At the ball of the foot an outline in wool stitching (plied Z2S) marks what was probably once a large rectangular

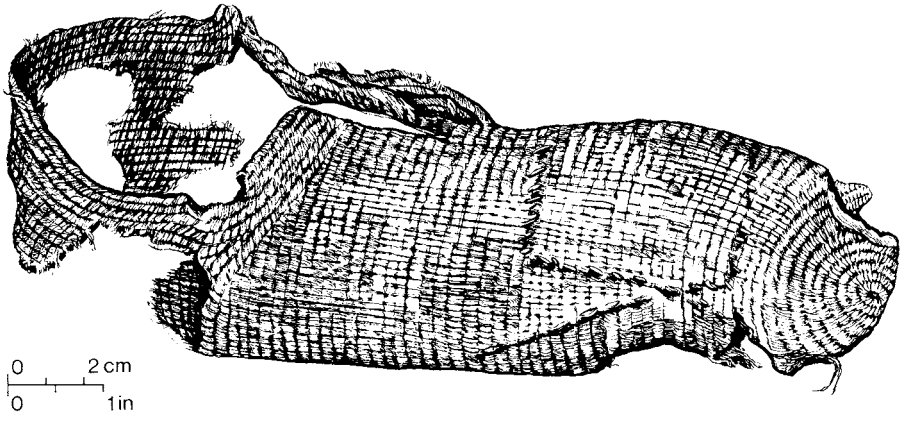


Fig.140 Wool nålebinding *sock,* 1309*, before conservation. Length c. 0.23m. Scale 1:2*

repair patch, covering the hole underneath the foot and the thin felted area around it, wrapping round on to the top of the sock (Pl. XXIIIa). There was no sign of the fabric of this patch, which suggests that it was originally of flax, or some other vegetable fibre, which has decayed away during burial.

Nålebinding, a Danish term which may be translated as 'needle-binding', is a technique worked with a coarse needle and a length of plied yarn. Several different forms are known, but careful analysis of an area towards the upper edge of the sock showed that the particular *nålebinding* stitch which has been used in this case is an interesting and unsophisticated variant of the technique: it is defined as uu/ooo F2 according to the current system of analysing *nålebinding* (Egon Hansen, pers. comm.). The foot part of the sock, however, could not be analysed, owing to heavy wear and felting on the inside, and may be in a different stitch. The yarn is smooth and even, plied S2Z.

The work starts at the toe, where a single loop of yarn is made and then a circular row of loops is worked into it. For the next row the looping is continued, passing the needle through the centre of the first row; after two loops have been completed, the needle starts to be brought back through the next to last loop of the current row (Fig.141). The work is continued in this manner, passing the needle through the row below and back through the next to last loop. The effect of this technique is to produce a heavy, almost double-thickness fabric, of great elasticity.

New lengths of yarn must have been joined in at intervals but, as there are no loose ends visible, they must either have been joined by splicing or stitched into the fabric. As the work continued, round after round (approximately 36 rounds per l00mm), shaping was added by working extra loops into the row below or by missing a lower loop out. At the heel, the line of the work has been turned back on itself several times to form the heel-shaping. At the ankle it circles round a few more times until the last row, which is worked in a smooth dark yarn, dyed with madder (dye tests on the rest of the sock were negative).

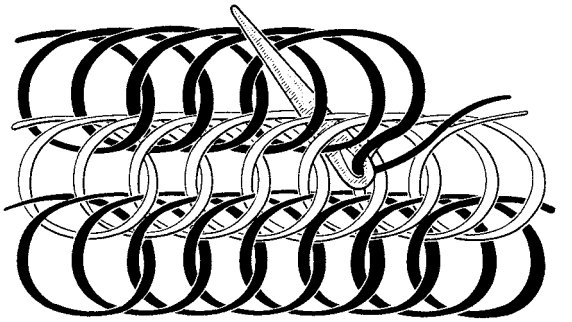


Fig.141 The nålebinding *technique*

Because this technique does not unravel, no special finishing border is needed, and it is therefore uncertain whether this last row was a decorative edge or whether the sock continued into a stocking with a red-coloured leg.

The technique of working a fabric of interlocking loops with a needle and thread may be traced back as far as the neolithic period (Hald 1980, 127, 283). The earliest example of what can strictly be called *nålebinding* is found in a mitten from Asle Mose, Sweden, dated to the 3rd or 4th century AD, but the technique was already quite elaborate by that time (ibid., 293-302). From 4th-6th century Egypt there are also several examples of sandal socks worked in a form of *nålebinding* which resembles true knitting, and for this reason the technique is sometimes called 'single-needle knitting', to distinguish it from knitting on two needles (Burnham 1972, 116-24).

From the Viking period there are two examples of *nålebinding* mittens from Iceland and some fragments from graves in Finland. There is also a panel of gold mesh worked in the technique in a 10th century silk from Mammen, Denmark, and, from further afield, a *nålebinding* cap from 9th-lOth century Antinoë, Egypt (Hald 1980, 302-9). From Novgorod there are nine fragments of *nålebinding* but only one of these is 10th century, the rest being medieval (Nahlik 1963,264-5). Indeed, most examples of the technique date to the medieval period, and come from excavations in Scandinavia, Finland, Poland (Kaminska and Nahlik 1958, 106), Russia and also, in finer qualities, from wealthy royal and ecclesiastical tombs scattered through Europe (Burnham 1972, 122; RaId 1980, 308-9). Margareta Nockert, who is currently working on the Swedish finds, reports (pers. comm.) that they are mostly dated around AD 1200 or 1300. The technique continued through the following centuries and is still in use in several European countries today.

Clearly, *nålebinding* is not a rare find in European, and more particularly Scandinavian, excavations, and yet it has not been recorded before in England. The only evidence that this technique was ever practised in the British Isles is to be found in an 18th century pair of child's bootees in the National Museum of Antiquities of Scotland (RenshaII1952, 27-8). There is also an example of *Osenstitch,* an embroidery stitch related to *nålebinding,* recovered from a cremation in Ingleby, Derbyshire (E. Crowfoot 1956, 52-3), but significantly, this barrow-cemetery has been identified by its excavators as 9th century pagan-Danish (Posnansky 1956,40).

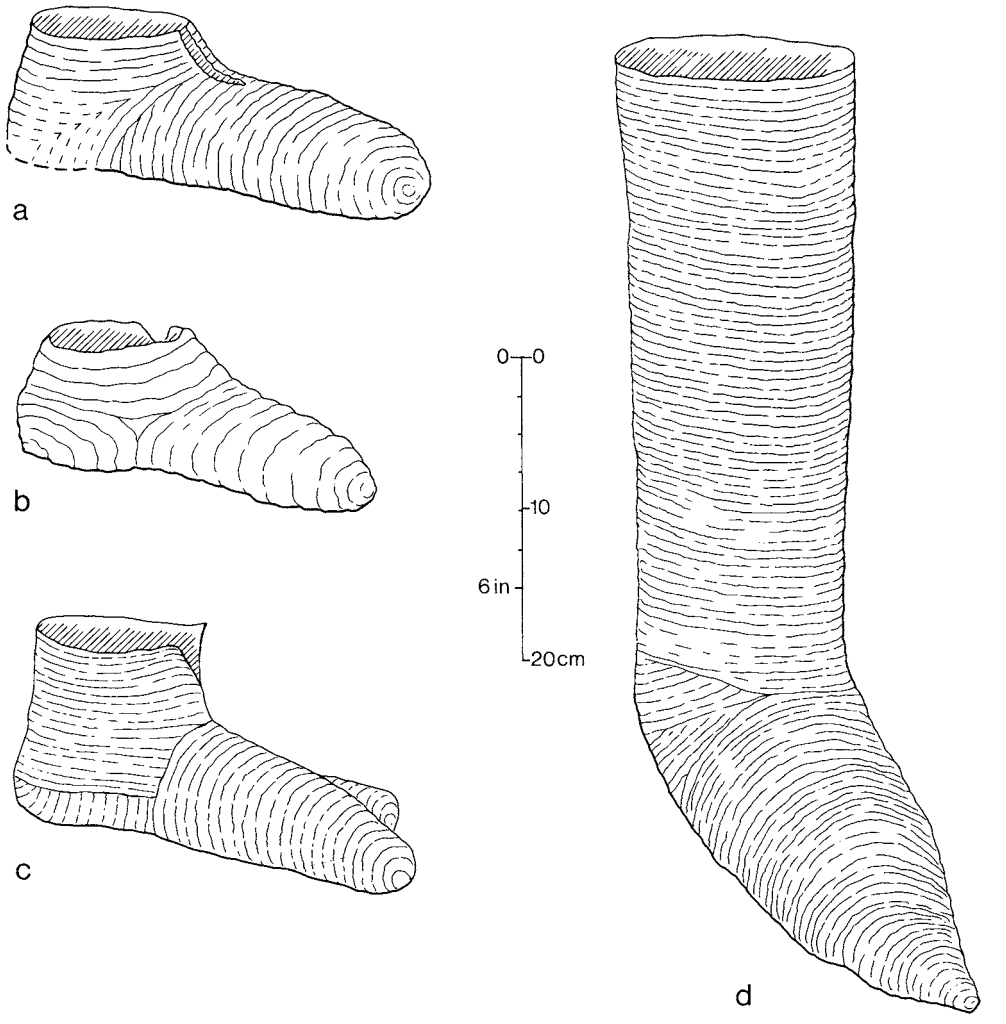


Fig.142 Construction of nålebinding *socks/stockings from a, 16–22 Coppergate,* 1309*; b, medieval Uppsala (from photograph in Franzen 1963); c, 4th–6th century Egypt (adapted from Burnham 1972, 123); d, 12th century Delément, Switzerland (from photograph in Schmedding 1978, 99). Scale 1:5*

The evidence of the foreign material shows that nålebinding has been used for all sorts of garments, but mainly for those which require a hard-wearing and flexible fabric, such as mittens, socks and stockings. As well as the Coptic socks from Egypt, already mentioned, there is another example of a *nålebinding* sock, from late medieval Uppsala, Sweden (Franzen 1963). This is 210mm long, and smaller than *1309,* but is similar in appearance, being ankle height with a border of darker coloured wool yarn at the upper edge. This sock also has a slit from the ankle opening, in this case to one side of the foot,

but this has been deliberately worked; similarly, the Coptic socks also have a deliberately constructed front slit, whereas in *1309* the slit appears to be a tear or cut. Although the socks are similar in some respects, the Egyptian examples have a separately worked toe, to accommodate the sandal thong, and the Egyptian, Swedish and York socks all differ from each other in the method of constructing the heel (Fig.142). Although the heel of *1309* is partly missing, it may be reconstructed as shown in Fig. 142a. A pair of stockings from Delemont, Switzerland, dated to the 12th century, are perhaps closer in construction to *1309,* although they are much finer and worked in linen (Schmedding 1978, 99).

Whether socks, in our meaning of the word, were known at all to the Anglo-Saxons is open to question. Evidence from graves is sparse since the area around the foot is rarely well preserved. In a 7th-8th century burial at Gally Hills, Surrey, a bronze bowl placed at the feet of the body helped to preserve textile and leather in that region, but the textiles, presumably blankets or long garments, proved to be outside the shoe leather (E. Crowfoot 1976a, 68-9). It is possible that a female child in a 7th century burial at Totternhoe, Bedfordshire, may have been wearing stockings or slippers made of textile, but the evidence is based only on an imprint in mud (Owen 1976,455).

The words *meo, socc* and *cæles* are to be found in Anglo-Saxon texts, indicating foot-coverings of some sort, but whether these represent socks, stockings or shoes is uncertain (Owen 1976, 584-6). In Anglo-Saxon manuscript illustrations both sexes either wear ankle-height shoes which would hide socks of the Coppergate style or else they go barefoot. Men are usually depicted wearing what may be loose wrinkled hose, presumably of cloth, or puttee-like leg-bindings (Owen-Crocker 1986, 165-79) – the illustrations are not clear. However, Scandinavian King Cnut (in BL Stowe MS 944, of AD 1020-30) appears to be wearing closer fitting hose or knee-length socks, with a decorative band just below the knee. Finally, mention should be made of a stocking from a burial at Micklegate Bar in York (see below p.359; and Henshall 1950b). This is worked in 'sprang', a technique of similar elasticity to *nålebinding;* unfortunately this find is of uncertain date.

Anglo-Scandinavian Textiles of Vegetable Fibre

Description

One textile, *1388*, was made from well-preserved flax, and two, *1369* and *1389*, were probably the same in poorer condition. The reasons for combining the large group of carbonised remains with these three are discussed above. All except one of the textiles listed in Table 20 are quite different in appearance from the wool finds, being woven from smooth even Z-spun yarns with a regular degree of twist, the same yarn type being used in both warp and weft. The exception is one of the carbonised pieces, *1317*, a ZS tabby with unevenly spun yarn, which from its appearance and spin is perhaps not of vegetable origin but of wool. However, as it is part of the important group of finds, *1319-21,1324-5,1331-6* and *1338-9*, it is considered here alongside the other carbonised remains.

Table 20 Anglo-Scandinavian textiles of vegetable and/or carbonised fibre. Entries are listed in catalogue order, except for textiles from the same find spot which are bracketed together

	Weave	Thread-count	Spin	Comments
1272	tabby	8–9 × 8	Z × Z	carbonised
1273	2/2	9–10 × 7–8	Z × Z	carbonised
1279	2/2 chevron	13–14 × 13–14	Z × Z	carbonised
1317	tabby	5 × 5	Z × S	carbonised
1319	tabby	7 × 6	Z × Z	carbonised
1320	tabby	8–10 × 6–8	Z × Z	carbonised; selvedge
1321	tabby	11 × 7	Z × Z	carbonised; selvedge; hem
1324	tabby	12 × 11	Z × Z	carbonised
1325	tabby	13 × 9	Z × Z	carbonised; selvedge
1327	tabby with diamond mesh	18 × 10 upper 22 × 7 lower	Z × Z	carbonised-flax; hem; seam
1328	tabby	20–28 × 13–18	Z × Z	carbonised-flax; selvedge; seams
1331	2/1 twill	11 × 8	Z × Z	carbonised
1332	2/2 twill	8 × 8	Z × Z	carbonised-flax
1333	2/1 chevron	11–13 × 9–12	Z × Z	carbonised-flax; seam
1334	2/2 chevron	10–11 × 7–8	Z × Z	carbonised-?nettle; seam
1335	2/2 chevron	13–14 × 9–11	Z × Z	carbonised
1336	'honeycomb'	15 × 15	Z × Z	carbonised-flax; seam
1360	tabby	16 × 14	Z × Z	badly decayed; not carbonised; fibre unidentified
1318	tabby	6 × 5	Z × Z	carbonised
1322	tabby	12 × 6	Z × Z	carbonised
1323	tabby	12 × 10–11	Z × Z	carbonised
1326	tabby	14 × 12	Z × Z	carbonised
1329	tabby	24 × 18	Z × Z	carbonised
1330	tabby	20 × 18	Z × Z	mineralised
1363	tabby	5 × 5	Z × Z	carbonised
1364	?tabby	8 × 7	Z × Z	carbonised
1365	tabby	8 × 6	Z × Z	carbonised
1366	tabby	14 × 7	Z × Z	carbonised
1367	tabby	16 × 14	Z × Z	carbonised
1368	tabby	16 × 16	Z × Z	carbonised
1369	tabby	14 × 12	Z × Z	probably flax
1390	tabby	22–26 × 18–20	Z × Z	carbonised-flax; selvedge; seams
1391	tabby	10 × 6	Z × Z	carbonised
1396	tabby	16 × 14	Z × Z	carbonised; selvedge
1401	tabby	22 × 20	Z × Z	carbonised; seams
1392	tabby	10 × 8	Z × Z	carbonised
1399	tabby	20 × 20	Z × Z	carbonised
1400	tabby	10 × 8	Z × Z	carbonised
1393	tabby	17 × 10–16	Z × Z	carbonised

	Weave	Thread-count	Spin	Comments
1394	tabby	14 × 8	Z × Z	carbonised
1395	tabby	20 × 16	Z × Z	carbonised
1388	tabby	24 × 20	Z × Z	flax
1398	tabby	20 × 15	Z × Z	carbonised; seam
1404	2/2 diamond	15–18 × 13	Z × Z	carbonised
1397	tabby	8 × 5	Z × Z	carbonised; selvedge
1403	2/2 twill	8 × 8	Z × Z	carbonised
1389	tabby	13 × 11	Z × Z	vegetable bast ?flax
1402	tabby	13 × 11	Z × Z	calcified
1462	2/2 twill	9 × 7–8	Z × Z	carbonised; stitched pleats

It was difficult to assess exactly how many different examples of each weave were present, as the finds were both numerous and fragmented. A catalogue number was assigned to each group of fragments which came from the same context and which appeared to have the same weave and thread-count. It is therefore possible that two different textiles with similar thread-counts have been grouped together, or more probably that the same textile with a variable thread-count has been listed in separate entries.

Despite these problems, it is clear that the majority are in tabby weave. They vary in quality from coarse to fine, with thread-counts of 5 x 5 to 30 x 28 per centimetre. Some

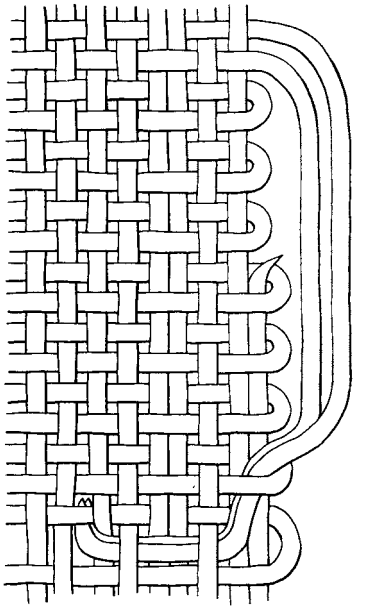


Fig. 143 Selvedge with weft-joining, on carbonised textile 1397. *Not to scale*

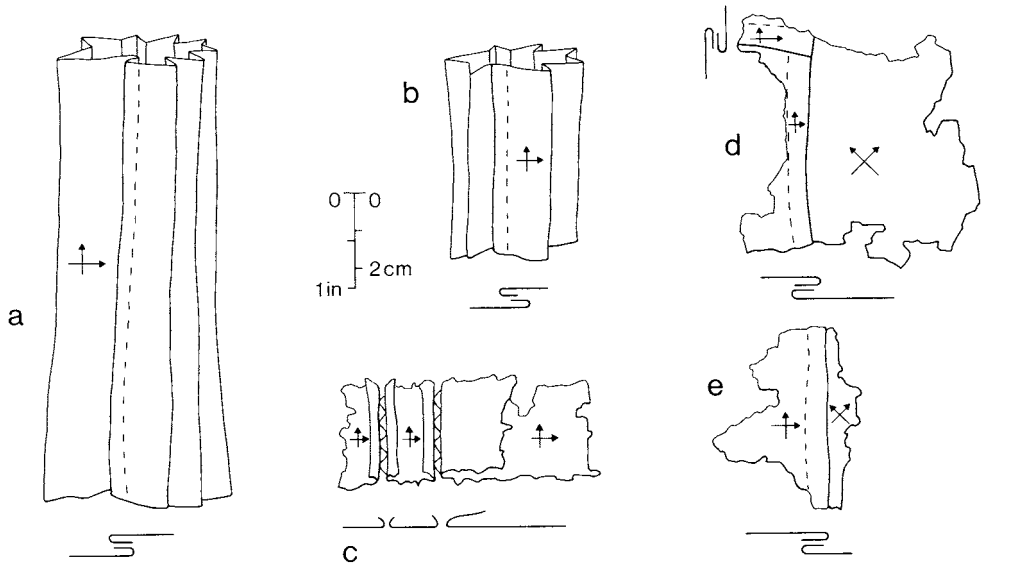


Fig. 144 Fragments of carbonised linen tabby, 1390, *showing seams; a and b, reversible lengthwise seam; c, two parallel seams; d, reversible seam with second at right-angles; e, reversible seam. Scale 1:2*

have equal counts in warp and weft but others have a higher count in one system, and in the four cases where a selvedge was preserved, the higher count proved to be the warp. These selvedges-are all simple in form (cf. Fig.127a). One textile, *1397*, has two adjacent weft threads extending beyond the selvedge and stitched to one side (Fig.143): this may represent the end of one hank of weft yarn and the beginning of the next.

Three of the tabbies, *1390-1* and *1396*, were found crumpled together in many fragments, with fire-ash and cinders adhering. Close examination revealed some seams on the finest tabby, *1390* (PI.XXIVb), but unfortunately the remains were so fragile and in so many pieces that the original shape of the garment could not be reconstructed. However, two pieces were tubular, each worked from a single piece of cloth with one reversible lengthways seam (Fig. 144a and b): both, when flattened, were 80mm wide (i.e., 160mm in circumference) with preserved lengths of 150mm and 90mm; another small piece of the same fine tabby (Fig. 144c) showed two parallel seams, 12mm apart, with their raw edges facing the same side of the textile; on another a folded edge was stitched to a flat piece of fabric; finally, two pieces with similar reversible seams to the tubular pieces were found, 55mm and 65mm long (torn at either end) with, on one of them, a second seam turning at right-angles (Fig. 144d and e). These seams are consistent with a child's shirt or tunic, the tubular pieces being the sleeves and the right-angled seams being from an under-arm gusset. A 9th century linen shirt from Viborg, Denmark (undergoing investigation at Århus University), includes similar seams and two under-arm gussets comparable with the remains

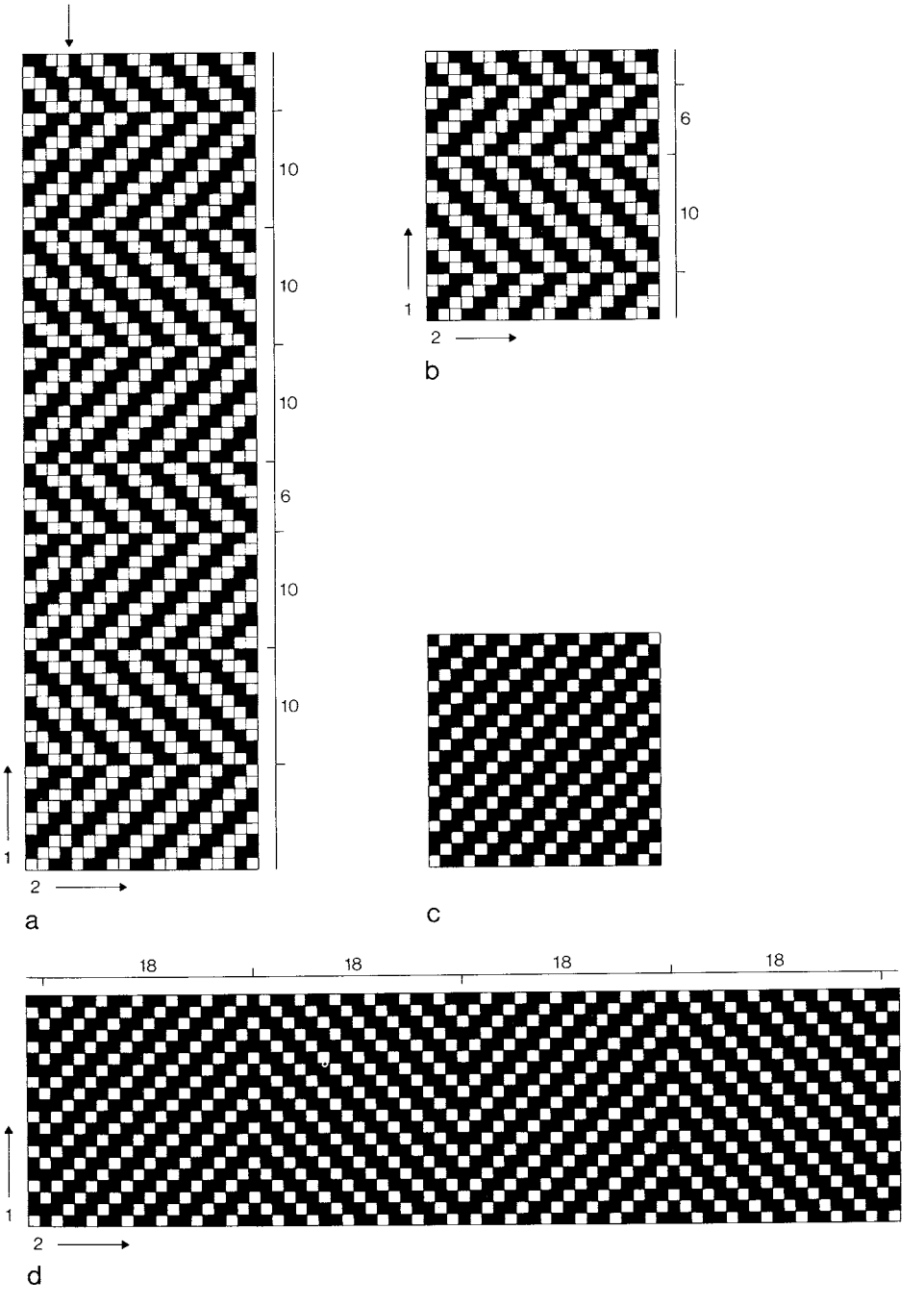


Fig. 145 Carbonised twills: a, 2/2 chevron, 1334 *(weaving fault marked with arrow); b, 2/2 chevron,* 1335; *c, non-reversed 2/1,* 1331*; d, 2/1 chevron,* 1333

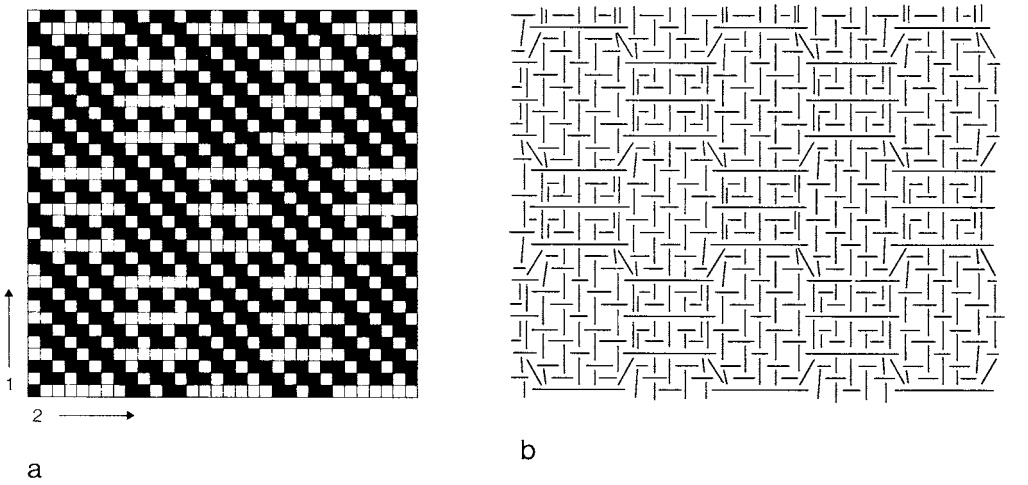


Fig. 146 Carbonised flax textile in honeycomb weave (Wabengewebe), 1336*: a, weave diagram; b, diagram showing overall honeycomb effect*

shown in Fig. 144d and e (Fentz 1986). However, the finds from 16-22 Coppergate are too fragmented to be certain of this identification.

A second carbonised group, including *1317, 1319-21, 1324-5* and *1331-6* (Pl.XXV), recovered from Period 4B levels, was found in a gully outside a building at the rear of the site. Here there was extensive evidence of burning, including a large number of charred fragments of folded and stitched textiles, a curious group, with some unusual weaves and structures. Several of the woven pieces have been stitched to each other in a patchwork fashion, with neat reversible seams. The weaves are 2/2 twill, 2/2 chevron, 2/1 twill, 2/1 chevron, a 'honeycomb' weave based on 2/1 twill, and five or six different tabbies, ranging from coarse to fine and including the ZS fabric. Also in this group is a piece of diamond mesh with tabby borders, *1327*.

The 2/2 simple twill and 2/2 chevron structures have already been encountered in the wool finds, which they resemble in thread-count and structure--although not of course in yarn type. There are four fragments of 2/2 chevron, *1334-5*, possibly all from the same textile; they have reverses after six and ten threads, as is often found in wool chevrons of this date, but unlike most of the wool finds the reverses occur in the system with the lower thread-count, which may be the weft (Fig. 145a and b).

The 2/1 structure, on the other hand, did not occur in the Anglo-Scandinavian wool finds. This weave, which uses only three pattern rows, as opposed to the four of 2/2, is of its nature unbalanced, with the result that the warp dominates on one face, the weft on the other (Fig.145c). When the diagonals are reversed for a chevron pattern, they lack the characteristic 'break' of the 2/2 chevrons. The single example of2/1 chevron, *1333*, has regular reverses after every eighteen threads, but whether warp or weft is not known (Fig.145d).

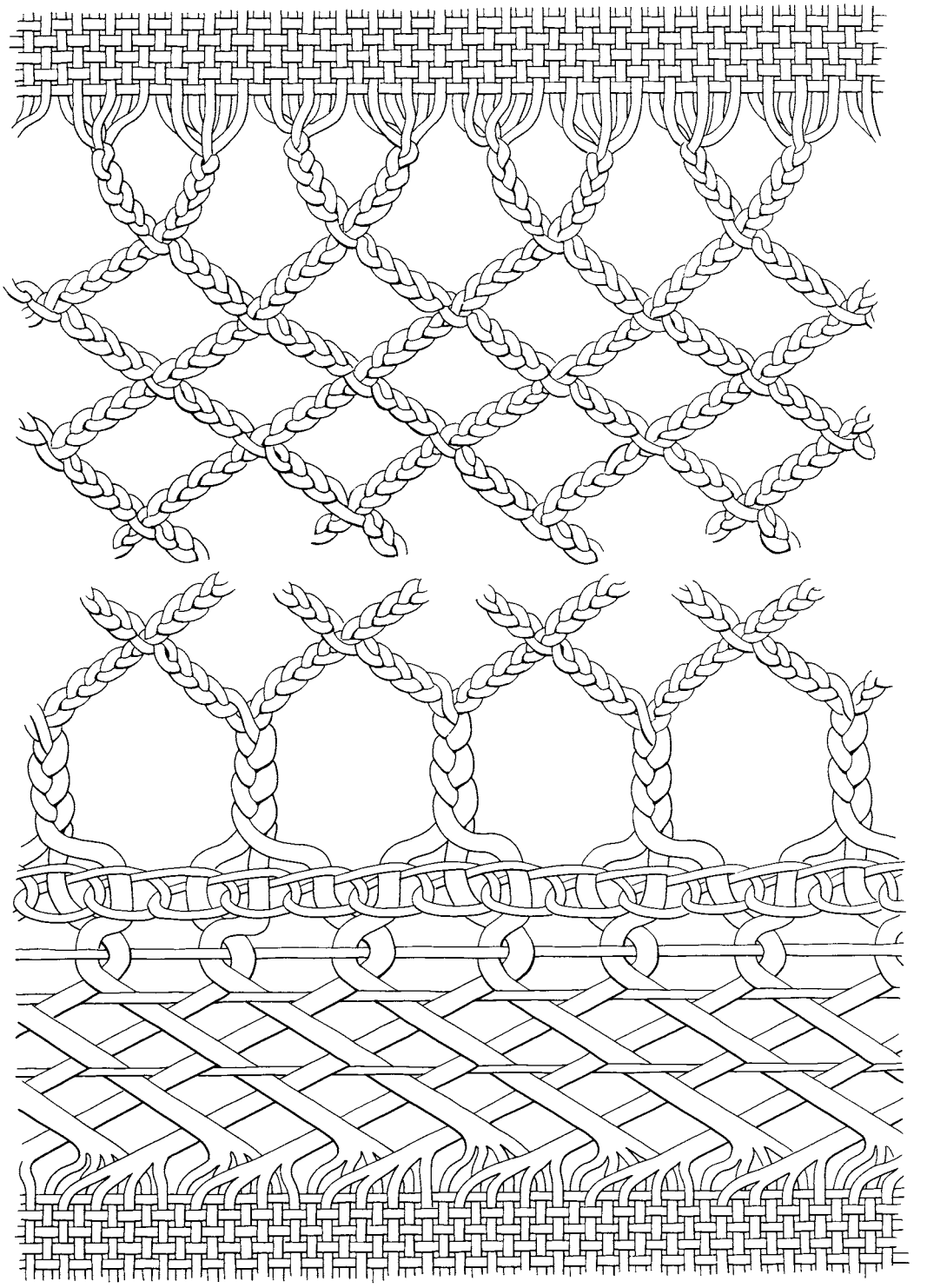


Fig. 147 Diamond mesh with tabby borders, in carbonised flax, 1327. *Not to scale*

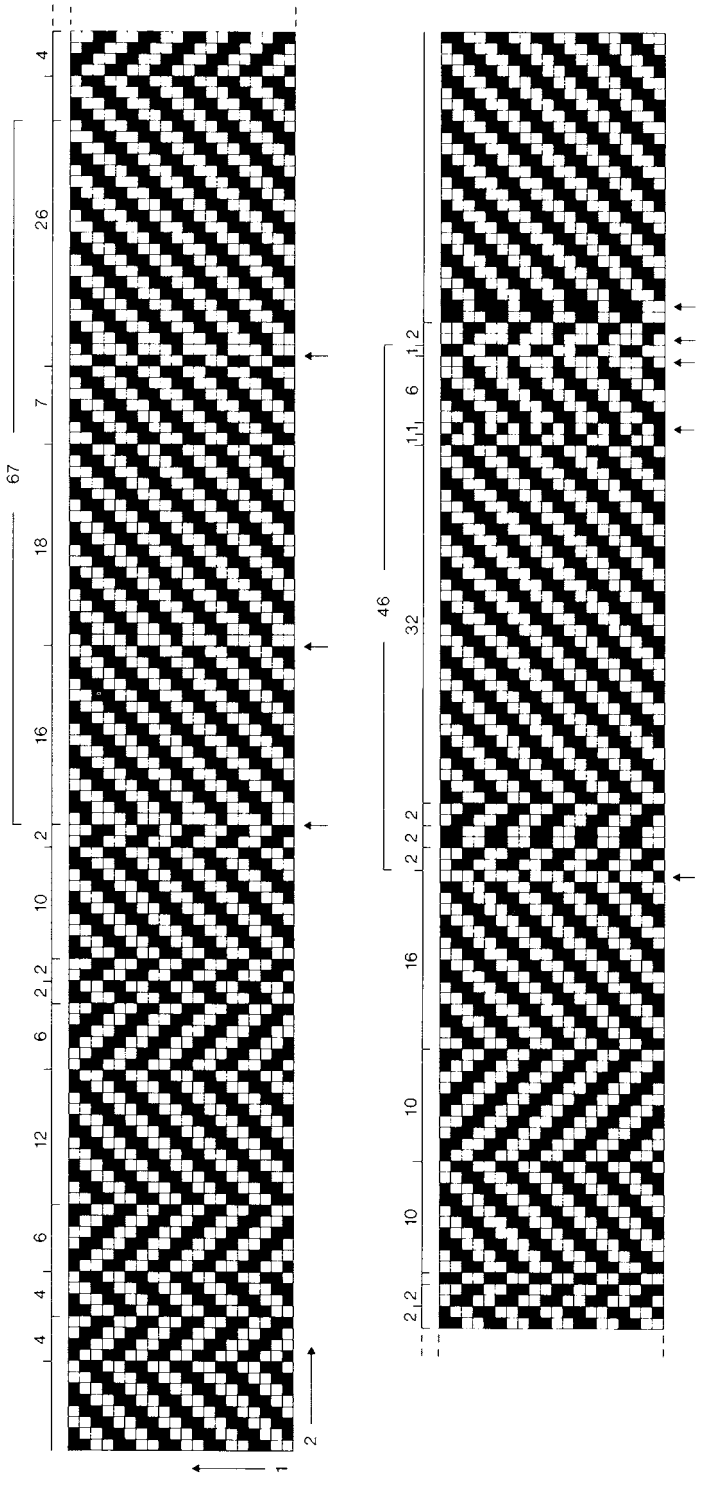


Fig. 148 2/2 chevron twill, in carbonised vegetable fibre, 1279 *(weaving faults marked by arrows)*

The unusual 'honeycomb' pattern weave, *1336* (Pl.XXVIa), is also worked on a 2/1 base, but with a floating weft at every third passage of the weft (pick). These floating wefts occur in two different arrangements, three picks of one and then three picks of the other. The outcome of this, not immediately obvious from the first weave diagram (Fig. 146a), is that the warp threads passing between the floating wefts become distorted by their pull, so that the overall effect is of a honeycomb pattern (Fig.146b). This apparently complex weave is in fact simple in structure but nevertheless presents problems in understanding how it was woven and on what sort of loom. These problems are discussed below (pp.356-8) in the context of finds of similar weaves from Scandinavia and Germany.

Finally in this group, there is an unusual piece of diamond mesh, *1327* (Pl.XXVIb). This is in several fragments, but two different structures can be identified (Fig. 147). In the first, a fine piece of tabby, 18 x 10 per centimetre, has been worked for at least 15mm (the upper edge has been hemmed); the warp threads have then been divided into groups of six and worked into three-strand plaits (two warp threads per strand). These plaits are inter- meshed with each other as the plaiting proceeds, the plaits coming from the right passing through those from the left, so that an open-work diamond pattern is produced. On one fragment the intermeshing starts close to the tabby at one end, while at the other end the plaits are 20mm long before the interlinking begins. The dimensions of the diamonds vary, those close to the tabby being smaller, 5 x 5mm, and those on the other fragments being as much as 20 x 20mm, although most are in the region of 10x 10mm. The depth of the mesh is not known but must be a minimum of 60mm, while the greatest preserved width is 110mm.

In the second series of fragments, the tabby is 22 x 7 per centimetre. Groups of eight warp threads are divided into two and diagonally interwoven, with wefts occasionally being introduced. An extra yam is then worked as a chain over the groups of warp threads, before a row of thick three-strand plaits is worked from bundles of four yarns. These plaits are then divided and diamond mesh continues in the manner of the first group of fragments.

As already mentioned, several of the fabrics from this group (Pl.XXV), are stitched to each other: a piece of one fine tabby, *1328*, is sewn to the 2/1 chevron twill, *1331*; two further pieces of *1328* have been sewn at an angle to the coarse tabby *1320*. This same tabby is elsewhere stitched to the tabby border of the diamond mesh. A second piece of the 2/1 chevron twill, *1331*, is sewn to one of the fragments of 2/2 chevron, *1333*, while another piece of the *2/2* chevron is sewn to the honeycomb weave, *1336*.

The original dimensions of each piece cannot be estimated but the impression is that they were relatively small. The largest surviving pieces of each weave are as follows: simple 2/2 60 x 50mm, *2/2* chevron 125 x 45mm, honeycomb 55 x 45mm; one piece of fine tabby, 1328, is 100 x 50mm and *1321* is 100 x 100mm but the other tabbies are mainly represented by very small fragments less than 30mm square. These finds were discovered crumpled and interfolded one with another, together with some pieces of cord, *1338-9;* these were mainly on the inside of the folds and not therefore used to tie up the bundle. Also in association with the finds were some twisted pieces of woody material, some straw, moss and charcoal.

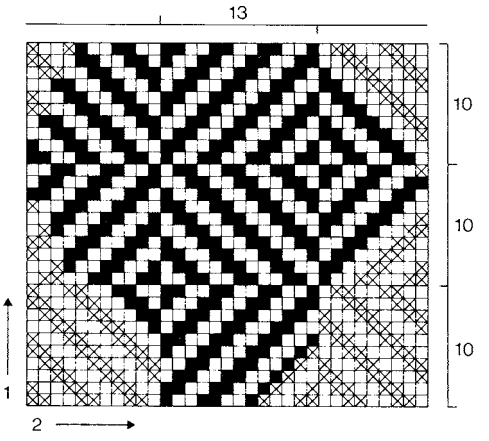


Fig. 149 2/2 diamond twill, in carbonised fibre, 1404

The remaining carbonised textiles are mainly single finds from various parts of the site. Fragments *1363-6* consist of four pieces of tabby layered together, while *1397* and *1403* are a tabby and twill found in close association with each other. Mention should also be made of a particularly large piece of 2/2 chevron twill, *1279*, with reverses after varying numbers of threads, from 2 to 67 (Fig. 148), and another diamond twill, *1404,* (Fig.149). One further object of interest is a fragment of 2/2 twill, *1462*, which has been pleated, with extra threads stitched lengthways along the folds to form a kind of padding (Fig. 150). This piece is small, 50 x 20mm, and the purpose of the padded folds is not clear.

Parallels

The rapid decay of vegetable fibres in damp conditions means that there are few comparisons for the linens from 16-22 Coppergate among contemporary textiles from settlement sites: there is only a single tabby, 20-22Z x 14Z, from 10th century London, which has definitely been identified as of vegetable origin (Pritchard 1982,207).

However, in cemeteries, where textile remains are often found adhering to metal artefacts, linen appears to be preserved to the same extent as wool. In these sites the corrosion products of the metal grave goods provide an environment at least partially inimical to the fungi and bacteria which usually attack textiles (Jakes and Howard 1986, 285). At the same time minerals from the corroding metal impregnate and eventually replace the textile, leaving a rigid facsimile of the original (ibid.). Once this process is complete, the fibre is no longer readily identifiable, although weave and spin are still clear. There are, however, some instances where the fibre has not completely mineralised, or where enough surface detail has survived for the fibre to be identified by scanning electron microscopy (Janaway 1983,48-52).

Where textiles of vegetable fibre have been identified in the Anglo-Saxon and Viking graves of Great Britain, they have proved to be for the most part similar to the finds from 16-22 Coppergate. They are almost without exception worked from Z-spun yarn and the

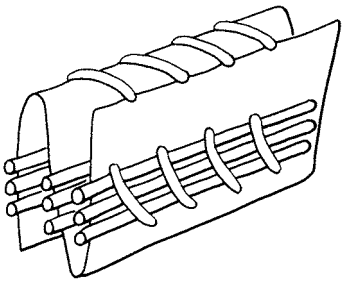


Fig. 150 Padded pleat, 1462*, in carbonised 2/2 twill. Not to scale*

majority are in tabby weave. They have varying thread-counts, most in the region of 14 to 24 per centimetre, some of them equal in warp and weft and some unbalanced. One particularly fine linen tabby from a Viking grave at Balladoole, Isle of Man (G. Crowfoot 1949,27), with a count of 28 x 30-32, provides a parallel for the fine piece, *1400.*

The same Anglo-Saxon and Viking graves also contained a small number of other linen textiles, all of them fine and all in the less common weaves, broken diamond and 2/1 twill. This same arrangement can be seen in the graves of Viking Scandinavia (Bender Jørgensen 1986, 355-6) and the row-graves of Germany (Hundt 1981 etc.), where flax, usually Z- spun, is used for a small number of finer patterned weaves, but on the whole is preferred in tabby weave. Since the evidence from the graves at Birka (Hägg 1983) and the contemporary literature (Owen 1976, 528) is that linen was frequently worn next to the skin as undergarments, it is not surprising that the simplest weave was so common, if it was used for clothing which was usually hidden from view.

Hägg has shown (1974, 30-6) that the pleated linen tabbies found at Birka may have been imported as ready-made garments from Russia. Nevertheless, it seems probable that the greater part of linen goods was made locally. The range of thread-counts and the differing proportions of warp and weft does little to suggest a standard traded type of textile and, moreover, the documentary evidence shows that flax-growing was widespread, at any rate in England, France, Germany and the Low Countries (see above, p.313).

Mention has already been made (p.313) of the discovery of balls of linen yarn and cut-off warp, together with other evidence for weaving, in sunken buildings at Århus, Denmark (Lorenzen 1979). Zimmermann (1982) has pointed out that linen weaving probably took place in these sunken buildings to provide the moist atmosphere necessary to prevent the flax fibre breaking. Such sunken buildings are common structures and clearly were used for other purposes besides weaving, but Zimmermann further describes examples from Germany and Denmark which contained oblong pits with remains of loom weights (ibid., 117-21). In view of the extra humidity supplied by these inner pits, it is possible that the looms associated with them were specifically for linen weaving.

If the linen tabbies may be considered largely domestically produced, the origin of the linen textiles in other weaves is not so clear. Simple 2/2 twill in linen, or probably linen, of which there are four examples at 16-22 Coppergate (*1273, 1332, 1403* and *1462*), is

extremely rare elsewhere, although there may be some examples from Spong Hill in Norfolk (Crowfoot and Jones 1984, 22, 24). Similarly only a small number of 2/2 broken diamond twills in linen are known from Anglo-Saxon sites, from Barrington, Cambridgeshire (G. Crowfoot 1951, 30-32), Finglesham, Kent (E. Crowfoot 1958, 17, 36-7), Sutton Hoo (E. Crowfoot 1983,460) and Spong Hill (Crowfoot and Jones 1984, 24), with counts of 16-18Z x 16-18Z, 22-24Z x 18S, 21-22Z x 15-17Z and 16Z x 16Z respectively, all with varying pattern units.

These linen diamond twills resemble the wool diamond weaves and most probably were woven on the same type of loom and in the same areas as the wool examples; significantly the Finglesham piece is an unusual example of a vegetable fibre, probably flax, being used S-spun for one system in the manner of the wool diamond weaves. Looking beyond Britain, 2/2 twill, whether simple, chevron or diamond, is also rare among the linen finds of Scandinavia and Germany, although some are known, for example at Sievern, Kr. Wesermunde (Hundt 1980, 156-7); one example of 2/2 diamond twill in linen has been recorded as early as the Roman Iron Age at Hemmoor near Hanover (Schlabow 1976,30).

2/1 twill is not common in any fibre before the 11th century. In the Roman period there are examples in wool from Corbridge, Northumberland, and from Germany: Mainz (Wild 1970, 101, 117) and Feddersen Wierde (Ullemeyer and Tidow 1981, 77). From early Anglo-Saxon England there is a fine 2/1, 30Z x 22Z, from Little Eriswell, Suffolk (E. Crowfoot 1966, 29), probably of flax, and another in wool, 21-25Z x 19-20Z from Broomfield, Essex (E. Crowfoot 1983,473); from the Sutton Hoo ship burial there is also a 2/1 chevron, probably of vegetable fibre (ibid., 439). In Germany there are several 2/1-based pattern weaves, discussed below, and two examples each of 2/1 and 2/1 warp chevron from Elisenhof, all in wool (Hundt 1981, 11, 15). In the 11th-13th centuries the 2/1 structure became much more common throughout north-west Europe, being used for fine lozenge twills and coarse simple twills, both of wool (see for example the late Viking Age textiles from 6-8 Pavement in York, *AY* 17/3). However, the 2/1 carbonised weaves from 16-22 Coppergate have a closer resemblance to the earlier linen textiles from Britain and the Continent, in yarn-type and in general appearance, rather than to the later, medieval, wool finds.

Honeycomb weaves (W abengewebe)

From 7th century Valsgärde in Sweden there is a close parallel for the 2/1 honeycomb weave, *1336* (Pl.XXVIa), in a group of fragments, also in linen and in Z-spun yarn, with a thread-count of 24 x 12 per centimetre (Arwidsson 1954, 101-3). The floating wefts of the Valsgärde pieces pass over fewer warp threads than in *1336*, and the wefts which carry the pattern are repeated six or seven times instead of three (giving elongated hexagons), but the weave is technically the same. In the Valsgärde publication the weave diagram is shown at right-angles to that in Fig. 146a, so that the assumed warp and weft are transposed. This may be correct, as by this means the system which distorts is not under tension and ‘ therefore will take up extra yarn more easily. However, it seems to be technically simpler if woven the other way round, with only four different sheds necessary to make up the

pattern. A further piece in the same weave was found at Vendel, grave 12, but this was too poorly preserved to allow full analysis (ibid.).

Two other examples of honeycomb weaves are known, from 8th century Germany, one in linen from Sievern, 20Z x 18Z, the other in wool from Alladorf, Lkr. Kulmback, 20Z x 16Z (Hundt 1980, 153-5, 160). The Alladorf example is the simplest possible variant on the weave, worked on a tabby base, but the Sievern example appears to be similar to the Coppergate weave although with narrower hexagons, as at Valsgärde.

These are the only examples of this weave which have been published in detail. However, Lise Bender Jørgensen (pers. comm. and 1986, 365) mentions two further examples, one at Grave 13 at Valsgärde and another from a Slavonic cemetery at Osmarsleben, Magdeburg, East Germany, dated to the 8th or 9th century. There are also three examples of honeycomb weave on a tabby ground from Egypt, two from Qasr Ibrim and one from Memphis, thought to be Coptic (E. Crowfoot, pers. comm.). These Egyptian examples are all of flax but spun in the S-direction and therefore probably not from the same source as the European examples.

The honeycomb weave of north-west Europe probably belongs with a smaller group of patterned weaves which follow a similar distribution pattern (see Fig.172). These consist of rosette twill *(Rosettenköper),* a tabby weave with a pattern of floating threads *(Wolltuche mit musterkette)*, *Rippenköper* or ribbed twill, and composite twills. These are all more sophisticated weaves than the usual diamond and chevron twills and are comparatively rare. Most examples occur in the German row-grave cemeteries of the 6th-8th centuries (Hundt 1978, 162-3), although six examples of ribbed twill have been found in Denmark, one from the Migration Period and the others from the 7th century (Bender Jørgensen 1986,308,314) and two examples of rosette twill have been found in early Anglo-Saxon cemeteries (E. Crowfoot pers. comm.).

The ribbed weave is of particular interest in relation to the honeycomb weave. This textile type has a ribbed or fluted appearance caused by the alternating of a warp-faced 2/1 twill with a weft-faced 1/2 (Hundt 1966,93,96,100; 1972, 105; 1976,77; 1978, 157; 1980, 154,157-60,162). The appearance of ribbed weave is quite different from that of honeycomb weave, but there are features in their construction which suggest a similarity. First of all, they are both mainly found in medium-fine qualities; secondly they have the same 2/1 foundation; and thirdly, they are all formed by regularly lifting a large number of warp threads to the front of the weave, whichever face is uppermost. This presents certain difficulties if these weaves are to be produced on the warp-weighted loom.

When the shed is opened on the warp-weighted loom, the warp threads being brought to the front of the weave are lifted right out of the main plane of the fabric, leaving enough space for the passage of the weft (see Fig.139). Since on this loom it is usual to tie up each row of the pattern to a single shaft (sometimes with two warp threads to a heddle leash), there is considerable strain on the shaft itself. Indeed, most weaves of the period in which the warp-weighted loom was regularly in use are constructed so that half or less of the warp is lifted forward for each pass of the weft. This does not imply that it is impossible

to produce these weaves on the warp-weighted loom: although extremely cumbersome, two shafts with different tie-ups *may* be lifted forward at once to produce *Rippenköper,* if the warp and shafts are strong enough; and the honeycomb weave could also have been woven by tying up the heddles for 2/1 twill (woven with the face away, so that only one third of the warp is lifted at a time) and then picking out the rows with floating wefts by hand. Although this last appears tedious in the extreme, the technique of picking out the pattern row by hand was used in rural weaving on the warp-weighted loom into the 20th century (Hoffmann 1964,43).

However, these weaves do not come naturally to the warp-weighted loom and would probably be extremely difficult to execute in the fine yarns of the fabrics under consideration here. Other types of weaving equipment need to be considered. Most obviously, the treadle-operated horizontal loom of the medieval period could easily accommodate the honeycomb and *Rippenköper* fabrics, but this loom does not appear to have reached north-west Europe until the early 11th century. On the other hand, a simpler type of horizontal loom may have been in existence before this time.

In their study of some late Roman silks (3/1 twill damasks) from Britain, West Germany and Switzerland, de Jonghe and Tavernier (1978; 1981) have brought forward convincing evidence that these patterned weaves were produced on a horizontal loom without treadles, but with multiple heddle rods. Such a loom with heddles which could be lifted in various combinations to form different sheds could readily be used to manufacture the honeycomb and *Rippenköper* weaves (and other weaves such as rosette twill). De Jonghe and Tavernier suggest, more tentatively, that these silks may have been produced at an imperial weaving establishment attached to the court at Trier, West Germany. Dr J.P. Wild considers (pers. comm.) that any such weavers would probably have left Trier when the court moved first to Arles and then to Milan and Ravenna; and that a continuing tradition in the Trier region is unlikely.

If this loom did continue in use in Italy, it is possible that, as the kingdom of the Franks expanded, products of the loom may have been traded from south to north and by Charlemagne's time the loom itself may have been brought into the linen-weaving areas of the Rhine Valley. However, the dearth of textile finds and loom parts from excavations within the Carolingian Empire, apart from Germany, prevents us from drawing any final conclusion on the origin of these patterned linens.

Diamond mesh

The combined tabby weave with diamond mesh, *1327* (Fig.147, Pl.XXVIb), has at present no known parallels and its method of production is difficult to surmise. It is possible that the surviving fragments represent two deep plaited fringes cut from the ends of tabby-woven cloth. Alternatively, the complete object may have been a diamond mesh with tabby weave borders. If the latter, then it was probably worked in a similar method to sprang.

Sprang is a technique which is worked by setting up a warp on a rigid frame and then twisting adjacent threads into a pattern (Collingwood 1974). The work is built up from

top and bottom simultaneously, the twists being pushed to both ends, so that the finished fabric consists of two halves, mirror images of each other. There is no evidence on 1327 for the second half of the fabric, nor have intermeshed three-strand plaits as yet been recorded among sprang fabrics, but the diagonal plaiting above the lower tabby is a well-known element of the sprang technique (ibid.). The author has found that there is no difficulty in reproducing the diamond mesh with tabby borders on a sprang frame. The combining of woven tabby with the more traditional form of sprang has already been recorded in a narrow hair-band from Windeby in northern Germany (Schlabow 1976, 94, pls.242-4).

Sprang has been known in Denmark from at least the early Bronze Age (Hald 1980,245). From the Viking period there are possible examples from Birka (Geijer 1938, 129) and Clibberswick, Unst, Shetland (HenshaII1952, 16), while from Oseberg there is a small vertical frame which may have been used for sprang (Hald 1980,255). There is already an example of the technique from York in the stocking, possibly of Roman date, excavated from Micklegate Bar in the 19th century (HenshallI950b). Moreover, there is an Anglo-Scandinavian leather scramasax sheath from Parliament Street, York, on which is a design clearly illustrating the simplest form of sprang (753, p.239, Fig.l07, *AY* 17/4).

The function of textiles *1317, 1319-21, 1324, 1327-8* and *1331-6* (PI.XXV)

The more unusual textile structures were found together, as part of the same object, a fact which suggests that they were imported together ready-made into a garment or hanging. However, the appearance of the whole object is impossible to reconstruct. Clothes made almost entirely of patches are known, for example, from Bernuthsfeld in northern Germany (Schlabow 1976,72-3, pl.149) but these are clearly beggar's clothes. The quality of the fabrics from 16-22 Coppergate and the neatness of their reversible seams suggests that they are not repair patches, but were stitched together carefully, perhaps to some overall design.

In the Viking Age and medieval period small pieces of attractive fabric were re-used, for example for reliquaries, and it may be that the Coppergate pieces were put together in the manner of patchwork quilts, as a means of re-using valuable and pretty textiles. The open structure of the diamond mesh, however, would hardly be suitable for this purpose.

If on the other hand the remains are part of a garment deliberately constructed from several different types of textile, it must have been extremely elaborate. It does not seem compatible with the simple lines of Anglo-Saxon dress which can be seen even on royalty in contemporary manuscript illustrations. Similarly, on the Continent Charlemagne seems to have preferred the flowing lines of old Frankish dress (Einhard, 68, para 23). More elaborate costume could be found at the eastern courts such as Byzantium at this date and in the Swedish graves of Birka, where there is a clear Eastern influence, there were several examples of tailored garments with inserts and appliqued decoration (Geijer 1938). However, too little is known of dress at this period to allow any definite identification of these pieces.

Anglo-Scandinavian Silks

Description

It has been noted above that there is an unusually large number of textiles from Anglo-Scandinavian levels at 16-22 Coppergate woven from the luxury fibre, silk. It was probably for the sake of economy that these silk fabrics were mainly used for small items: head-dresses, ribbons, a reliquary and a narrow tablet-woven braid. The silk textiles are predominantly in tabby weave, with one example *(1408a)* and possibly a second (1356) of a more complex weave, compound twill.

ZI tabbies and head-dress

The warp and weft of the tabbies are twisted or non-twisted in various combinations, Z x Z, Z x I, S x S, S x I, I x I, and thread-counts range from 16 x 10 to 40 x 60 per centimetre (Table 21). The counts and twist of the yarns in these tabbies, displayed in diagram form on Fig.157a, show that there is a group of eight similar fabrics, tabbies with a Z-twist warp, 18-28 per centimetre, and non-twisted weft, 14-34 per centimetre. Four of these eight have selvedges which are similar in structure, with the warp worked in pairs: one of them has 26 paired warp threads and the others 39, 39, 41 (or more) paired warp threads (see p.374). In colour, however, they are not alike, some having been dyed with madder or indigotin or, in one case, possibly kermes, while some may have been left undyed (see Table 25).

One of the most exciting discoveries to come from the Coppergate excavation is made from one of these ZI tabbies. It is a silk head-dress (*1372*, Figs.151, 152a, Pls.XXVIII, XXIXa and XXXa-c) which was found twisted and crumpled up in a pit from Period 5A, c. AD 975. This head-dress is a hood-shaped cap, very simple in construction. It is made from a rectangle of fabric approximately 0.59 x 0.18m (for precise measurements before and after conservation, see p.427) with a selvedge along one longitudinal edge. All four edges including the selvedge have a fine rolled hem, of which only the stitch holes and a few tiny pieces of what was once probably linen yarn survive. After hemming, the rectangle has been folded in half widthways and stitched along the edge opposite the selvedge, with S- twist silk thread. This seam does not continue right up to the comer, but curves inwards, to reach the central fold 50mm from the selvedge hem. The sewing thread of this curved dart is no longer present, but stitch holes are still visible. Another row of stitch holes can be seen next to the first, indicating that the fold of the dart had originally been pressed to one side and stitched there.

The excess material in this dart has been cut away, but perhaps not until after the cap had been worn for a time, as there is a circular repair patch in exactly the same fabric covering a hole near the lower part of the hem. This patch appears to have been stitched with a vegetable fibre as, although it was almost in position when discovered, only stitch

FIg. 151 Silk head-dress, 1372*, before conservation. Scale 2:5*

holes remained to indicate that it had once been sewn in place. A front corner has been torn away from the main body of the cap but this too is still present, so that the object may be regarded as complete if not intact.

Some creases run from the back of the cap and focus on two points halfway up the front edges where there are a few stitches in silk yarn. These are only just visible on the outside but are longer on the inside where they can be seen to be stitched over some more remains of Z-spun linen thread, this time part of a woven fabric, although too decayed for identification of the weave. It seems likely that linen ribbons were stitched on here for tying the cap under the chin (Pl. XXXc).

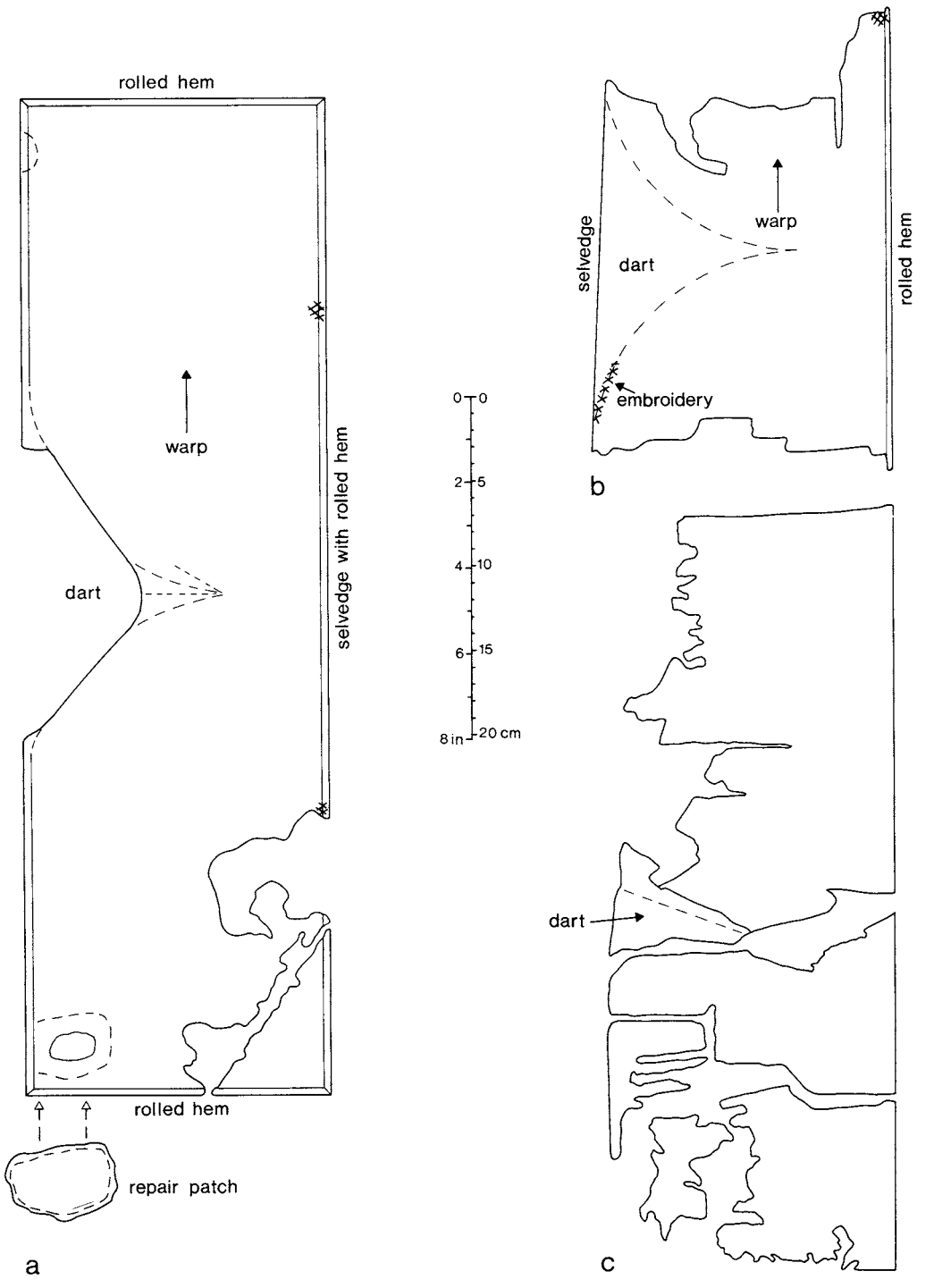


Fig. 152 Construction of silk head-dresses from a, 16–22 Coppergate, 1372*; b, 5–7 Coppergate,* 651*; c, Saltergate, Lincoln. (Redrawn from Fig. 68,* AY *17/3.) Scale 1:4*

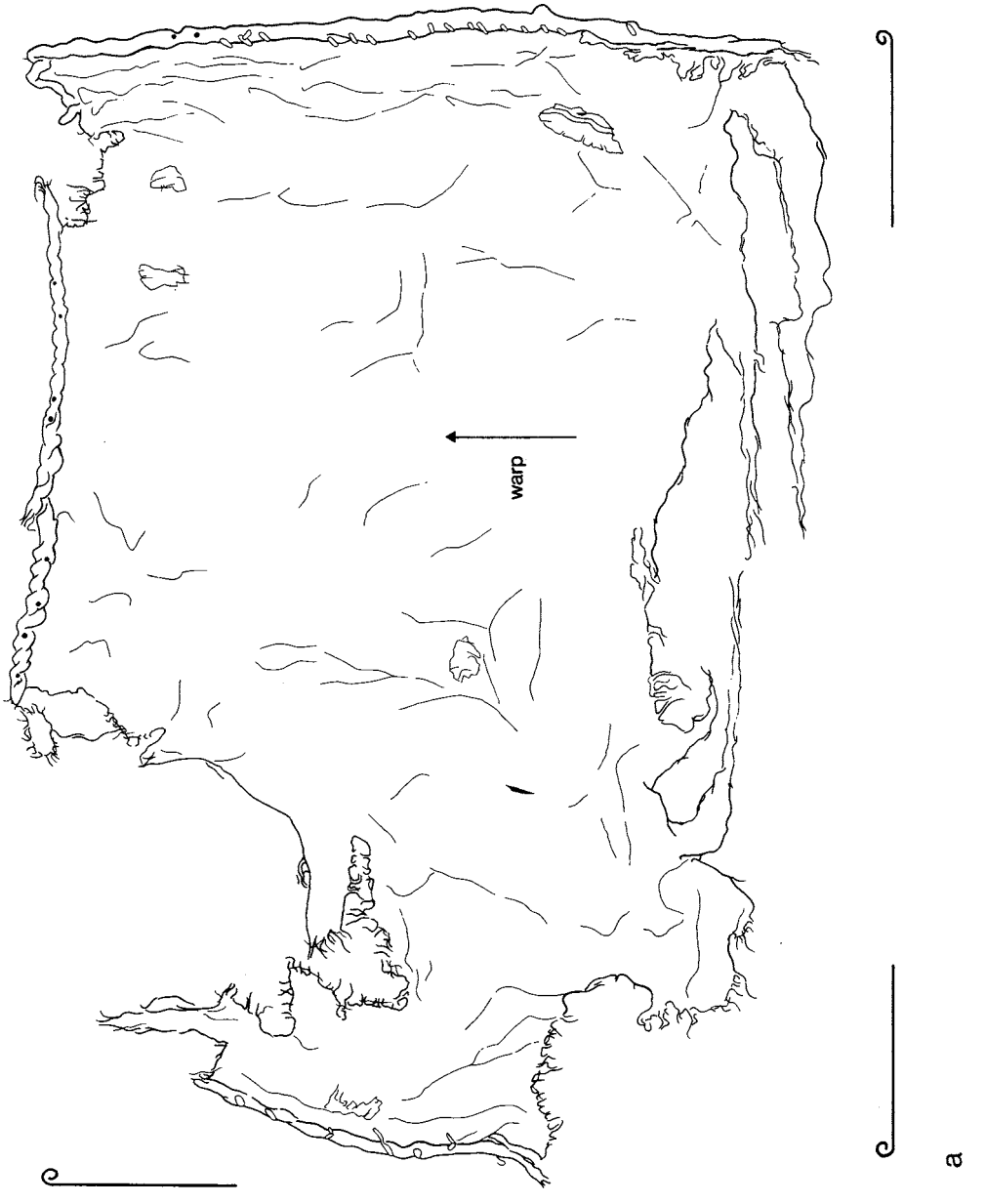
Table 21 Silk tabbies from Anglo-Scandinavian levels: n.d.d.—no dye detected; – = tested for dyes

	Thread-count	Spin	Dye	Comments
1281	20 × 20–40	Z × I	madder	
1282	20–26 × 24–30	Z × I	n.d.d.	selvedge (26 pairs)
1341	18–24 × 20	Z × I	–	
1342	18 × 23	Z × I	?kermes	hems
1343	20–22 × 22	Z × I	indigotin	selvedge (41 pairs)
1344	20 × 24	Z × I	lichen purple	
1345	24 × 20	Z × I	madder	
1346	24–28 × 14	Z × Z	n.d.d.	
1347	24 × 34	Z × I	indigotin	selvedge (17 pairs/ 1 single/21 pairs)
1348	30–40 × 16–20	Z × Z	–	
1349	28 × 20	Z × Z	madder + lichen purple	?child's head-dress; selvedge (39 pairs)
1350	24–32 × 14	Z × I	madder	in association with *1351*
1351a	40–48 × 24	I × I	–	stitched together
b	40–28	Z × Z	–	
1352	60 pairs × 10	Z × Z	madder + lichen purple	selvedge only
1353	56 × 26	S × S	–	ribbon (c. 86 warps)
1354	56 × 20	S × S	–	ribbon (106 warps)
1355	48–52 × 30–36	S × S	kermes	ribbon (c.90 warps)
1371	16 × 34–60	Z × Z	?madder	
1372	24–25 × 19–20	Z × I	–	head-dress; selvedge (?40 pairs)
1407	42–50 × 32	S × S	madder	ribbon (168 warps)
1408b	40 × 60	S × I	–	inner part of
	20 pairs × 52	S × I	–	reliquary pouch

The other ZI tabbies are smaller fragments. One of them, a very worn piece (1343, Fig. 153b), is a rectangle 165 x 25mm with a selvedge on one short side and a rolled hem stitched with silk (single, S-twist) on the other. All four edges have then been folded to the opposite side from the first hem and there are stitch holes all the way round at the edge of the fold. This is probably another repair patch, or perhaps an applied piece of decoration, but in either case it seems to be a re-use of a larger piece of silk which had previously been hemmed for some other purpose.

Fragment 1347, is an interesting piece, a neatly cut rectangle, 120 x 50mm, with no signs of wear or folds or stitch holes. The silk is still in such excellent condition that it seems probable that it was never used and was left over from cutting up silks-an important point, the significance of which is discussed below.

Another fragment, one with almost exactly the same thread-count as the fabric of the cap, measures 95 x 165mm (1345, Fig. 153a). It has two adjacent rolled edges with stitch holes, a third hemmed with silk (two Z-twist yarns used together), the fourth edge being torn. This piece is only slightly narrower than the complete silk cap and is, perhaps, the remains of a second one.


warp
a

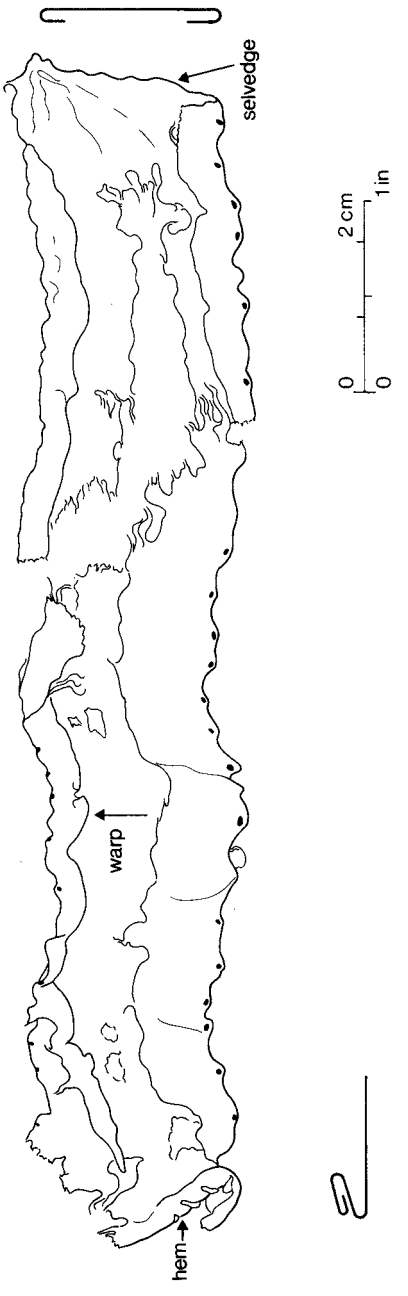
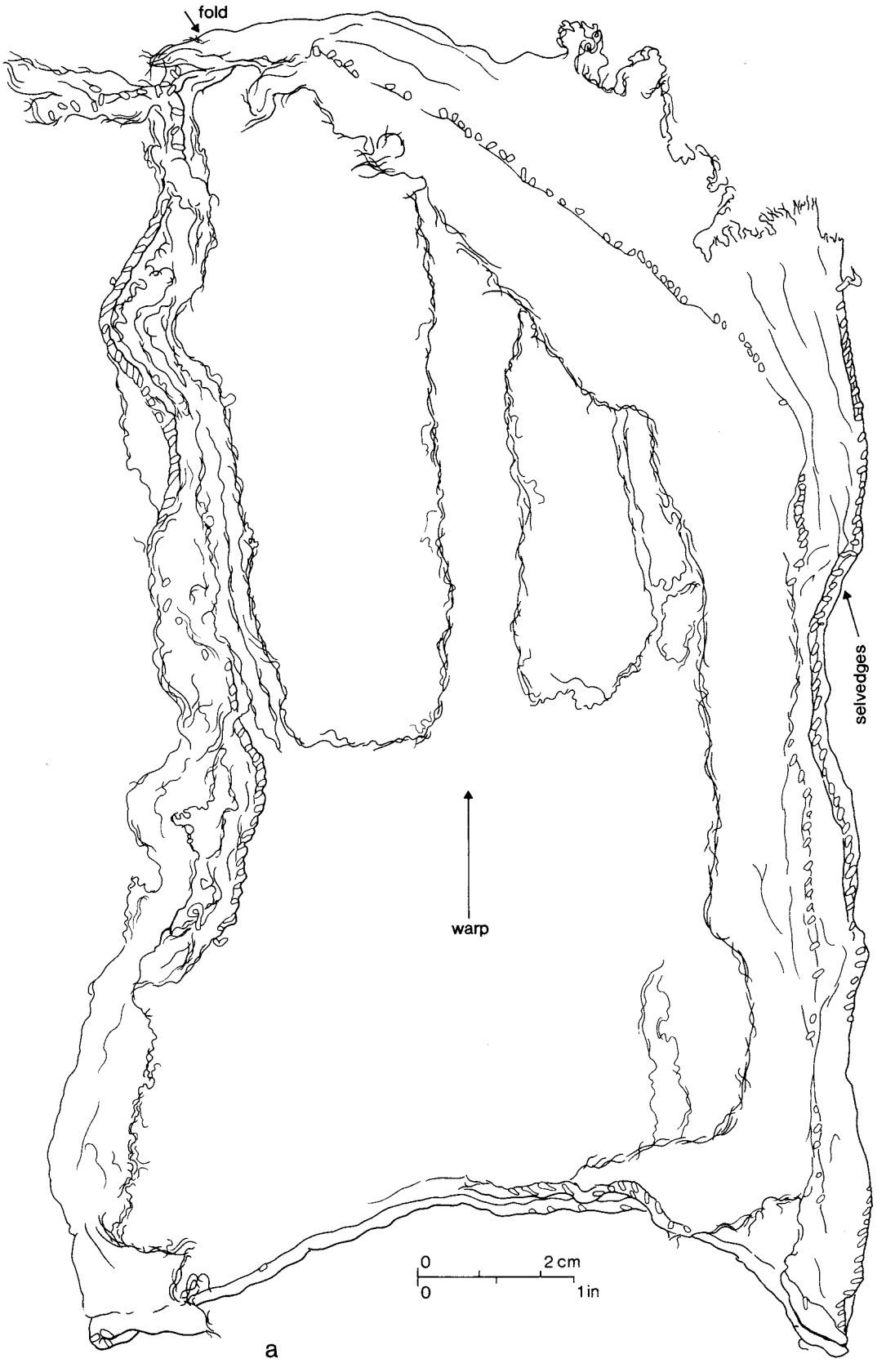


Fig. 153 Silk tabbies: a, 1345; *b*, 1343, *possibly a repair patch. Scale 1:1*



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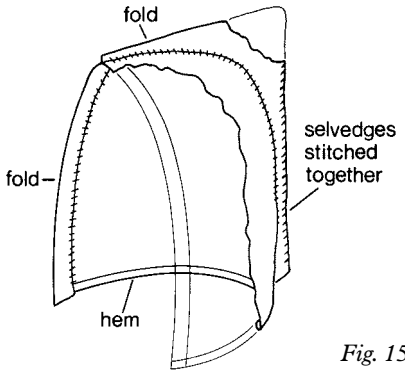


Fig. 154 (facing page) Silk tabby 1349*: a, surviving piece, scale 1:1: b, reconstruction as a child's head-dress, not to scale*

ZZ tabbies

The ZZ silk fabrics (*1371, 1346, 1348, 1349* and *1351b)* are all loosely woven, open fabrics with a 'gauzy' appearance. They are constructed from fine, firmly twisted yarn and have variable thread-counts caused by bunching of threads (counts have been averaged for the graph, Fig.157a). As with the ZI tabbies, there are paired warp threads in the two selvedges which have survived.

Most of these ZZ tabbies are small fragments, on the whole rather worn and torn. One larger piece (*1349*, Fig.154, PI.XXXIa), also badly worn and incomplete, shows some interesting similarities with the silk cap. Originally it appears to have been a rectangle, 0.40 x 0.16m, of reddish purple silk, dyed with madder plus lichen purple with a selvedge on one of the longer sides. This rectangle has been folded in half widthways and the selvedge sewn together at the very edge, with a second row of stitching following the line of the first, until it approaches the fold, when it curves in to form a dart as in the cap, *1372*. The shorter edges (the bottom edge if a cap) have been rolled to the inside, but the opposite edge from the selvedge has been folded 15mm in the other direction and roughly stitched for a few centimetres. Much of one half is missing and the remainder has several holes. All of the sewing is silk but with different types of thread for the different areas of stitching. There is no stitching present to suggest the attachment of ribbons, as in the complete cap. If it is a cap, its size would suggest a child's.

S S tabby ribbons

There are four narrow ribbons of silk, 33mm *(1407)*, 20mm (*1354*), 19mm (*1355*) and 17mm (*1353*) wide (168,106, ?90 and 80 warp threads each). They are firmly woven in tabby from S-twist yarn, with a simple selvedge on either side. Two are very short brownish pieces, but the other two are longer and have been dyed red, one with madder *(1407)*, and the other (*1355*) with the Mediterranean dyestuff, kermes. These two have both been folded longitudinally. *1407* is 225mm long, folded exactly in half lengthways with the short raw

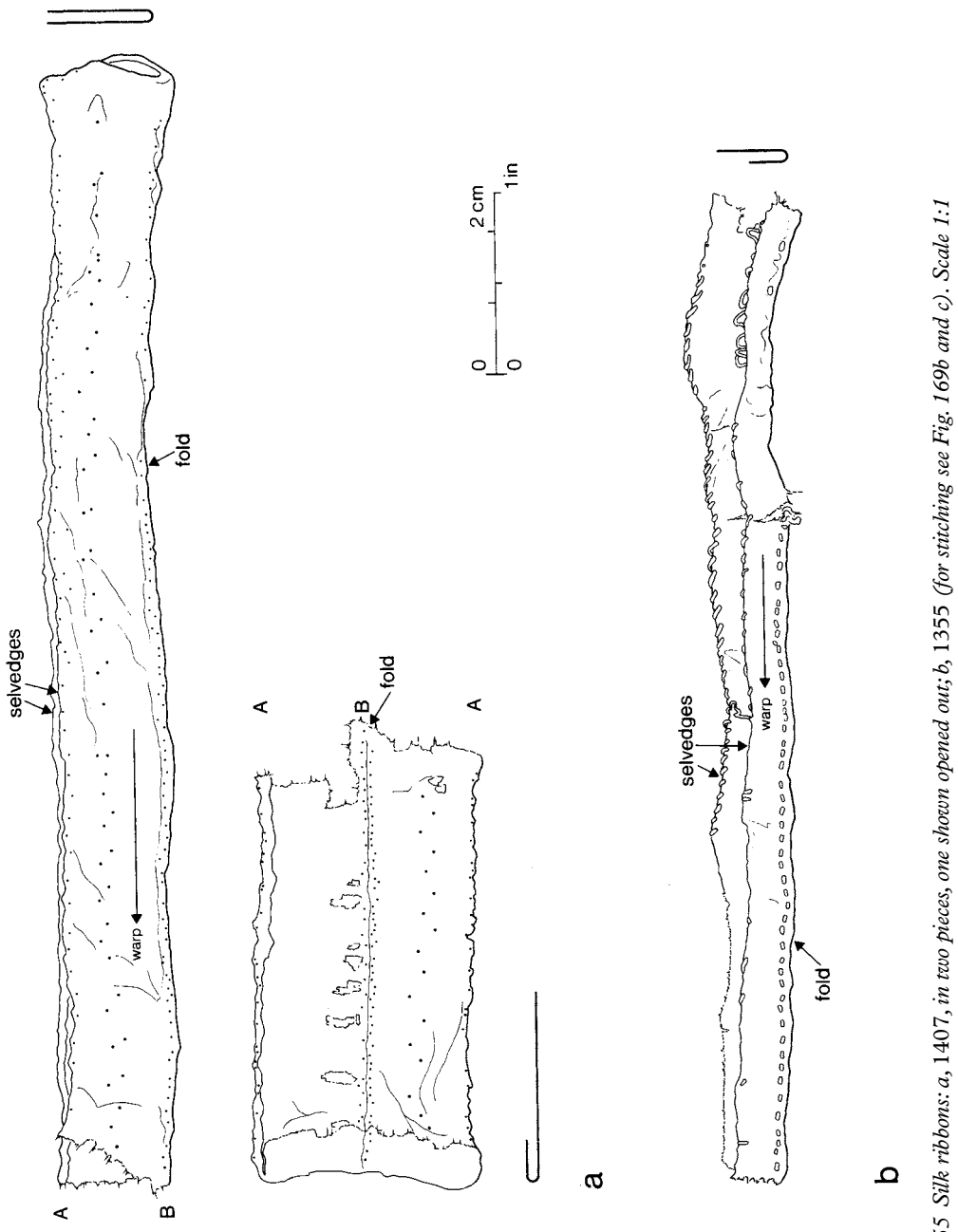


Fig. 155 Silk ribbons: a, 1407, *in two pieces, one shown opened out; b,* 1355 *(for stitching see Fig. 169b and c). Scale 1:1*

edges turned to the inside. Rows of stitch holes run along the fold, the selvedges, the folded raw ends and centrally down the length of the ribbon (Fig.155a, Pls.XXIXb and XXXd). The spacing of the holes along the selvedges suggests that they were originally stitched together. Inside the folded ribbon there were three lengths of silk yarn lying lengthways, with no obvious purpose.

The second red ribbon, *1355*, is in fact two similar pieces stitched together, total length 135mm and torn at either end (Fig. 155b, Pl.XXIXb). It has been folded lengthways but not exactly in half. A row of running stitches in silk holds the fold in place and there are some loose silk overstitches along the selvedges. One stitch crosses from one selvedge over to the other. In some places this stitching is so loose as to suggest that there was once another fabric bound by it; and inside the fold of the ribbon there was a small piece of very decayed fabric (1359). This may have been tabby, approximately 16Z x 14S, the fibre unidentified, although the ZS yarn combination may indicate wool. It is possible that the ribbon once edged a garment of this different fabric.

Silk reliquary pouch in compound twill, 1408 (Fig.156, Pl.XXVIIa)

During excavation to the rear of a building in Tenement A, Period 5B, a small pouch of pink-coloured silk was discovered (Fig.156a). This had been sealed by stitching, but a cross embroidered on one side immediately suggested that it had once been used for holy relics and the find was therefore X-rayed. Unfortunately, whatever was once wrapped in the silk was either no longer present or was not detectable by X-rays. The only hint of the original contents of the pouch was provided when some fibres, possibly vegetable in origin, floated out from inside during conservation. Beyond this, the reliquary's contents are a mystery.

The pouch itself consists of an outer (a) and an inner (b) wrapping. The outer pouch is made from a single fragment of pinkish silk, a six-sided piece which has been folded in half and stitched to form a trapezoid shape, 33mm deep, 25mm wide at the top and 30mm at the bottom fold (Fig.156b). The edges are stitched with a single strand of silk. The cross, which measures 13 x 8mm, has been embroidered in the centre of one side in a rough chain stitch, the silk thread of the stitching now badly abraded.

The outer silk fabric is a weft-faced compound twill (Fig.156c), a complex weave constructed on two sets of warp and two of weft. There is a Z-twisted binding warp which holds all elements of the weave together in a 1/2 twill and there is also a main warp worked in pairs, also of Z-twist yarn, which passes between the two faces of the weft and remains for the most part invisible. The upper and lower wefts are both non-twisted, thus presenting a smooth, lustrous surface to the fabric. In figured fabrics these wefts are differently co loured and interchange as the design requires: this particular piece carries no design, but the fragment is so small that it may well have been cut from a plain area of a larger patterned silk. Dye analysis, by J. H. Hofenk de Graaff of the Central Research Laboratory for Objects of Art and Science, Amsterdam, showed that the upper weft had been dyed with kermes plus an unknown dyestuff and a trace of kermes was also found in the main

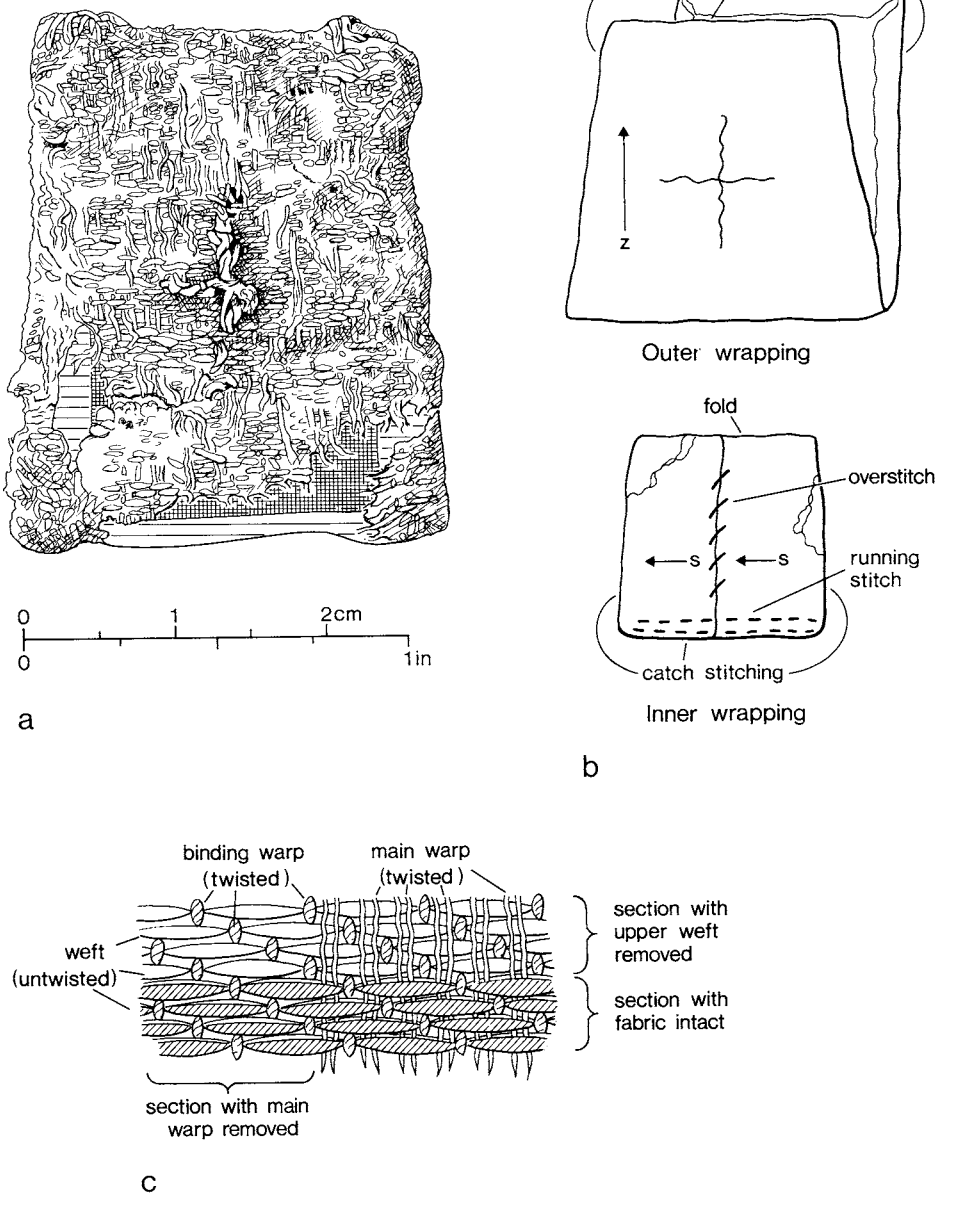


Fig. 156 Silk reliquary pouch, 1408*; a, drawn after conservation, scale 2:1; b, diagrams showing the method of construction, not to scale; c, weft-faced compound twill of outer pouch*

warp, although this may have bled from the weft. The binding warp and the lower weft gave negative results.

Through the torn fold of the outer pouch (a) an inner package (b) could be seen. This consisted of two small pieces of fawn-coloured silk tabby, 40S x 60I, and 20 pairs of S x 52I, which had been stitched together into a rectangular shape, approximately 50 x 22mm, folded in half and the edges turned in and stitched together. Two extra rows of running stitch have been worked along one edge. The central seam which holds the two different fabrics together is roughly overstitched and may not have been finally closed until the relic was placed inside. As in the outer pouch, the stitching is done with a single strand of silk.

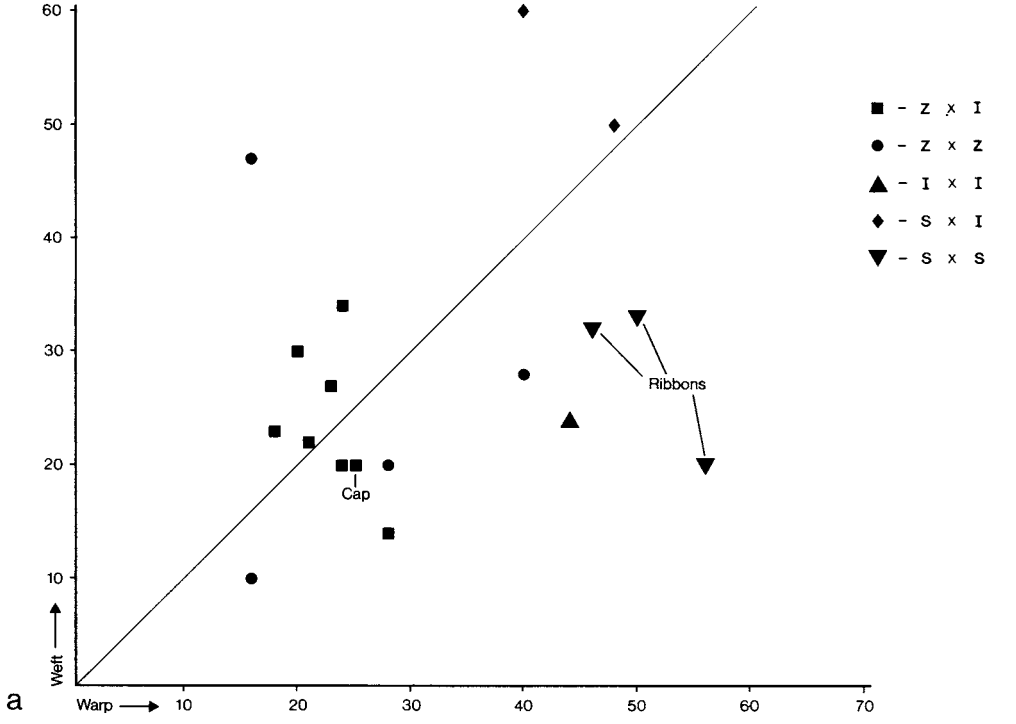
Discussion

Tabbies

Silk textiles of any sort are rare finds in excavations of sites earlier than the 9th century. In Britain there is, from the Roman period, one silk tabby, 451 x 1001, from Colchester (Wild 1983), and a damask, probably of silk, from a grave at Holborough, Kent (Wild 1970, 51-2,101). There is another tabby, 40Z/S x 501, from the Roman sewer in Church Street, York, discussed by Hedges (147, pp.14–15, *AY* 17/1) but there is now some doubt about the date of this piece (Wild 1984, 20). In the early Anglo-Saxon period silk was still reaching England, but the evidence from excavations suggests that it was being used sparingly for braids and trimmings (e.g. Crowfoot and Hawkes 1967). According to Eddius Stephanus (Alexander 1979, 202) silks were being used to adorn churches by the 7th century; on the Continent, they were also being used to prepare Frankish royalty for burial (Werner 1964,212-15). It is not until the 9th century that silks begin to appear more frequently in settlement and cemetery sites, especially in Scandinavia (e.g. Birka and Lund, Sweden) and in areas of Viking influence such as York and Dublin-particularly the latter, where a large number of silks is in the process of investigation (Heckett 1987; Pritchard 1988).

As well as the silks from archaeological excavations, many more are to be found in church tombs and treasuries throughout Europe. The figured silks of these collections, gifts to shrines and vestments of the clergy, may be dated by their design and technique and ascribed to particular silk-weaving centres. Silks from Byzantium, East and West Islam, Italy (at a later date) and even some from China have been identified in this way. In St Cuthbert's tomb at Durham, for example, there were several silks of the 7th–11th centuries, attributed to Persia, Byzantium and western Asia (Battiscombe 1956,483,513, 523).

It seems safe to assume that the silk tabbies in the same treasuries came from the same sources, although evidence for a place of origin in the simpler textiles is rare. One tabby, a ZZ piece (26-29 x 31) in Bamberg Diocesan Museum may be firmly identified as Islamic in origin from a woven Kufic inscription which also dates it to pre-1047 (Muller-Christensen 1960, 54); another resist-dyed fragment, 301 x 301, from Saint Maurice Abbey, Switzerland, has been identified as 8th-10th century and central Asian (Schmedding 1978, 178). Some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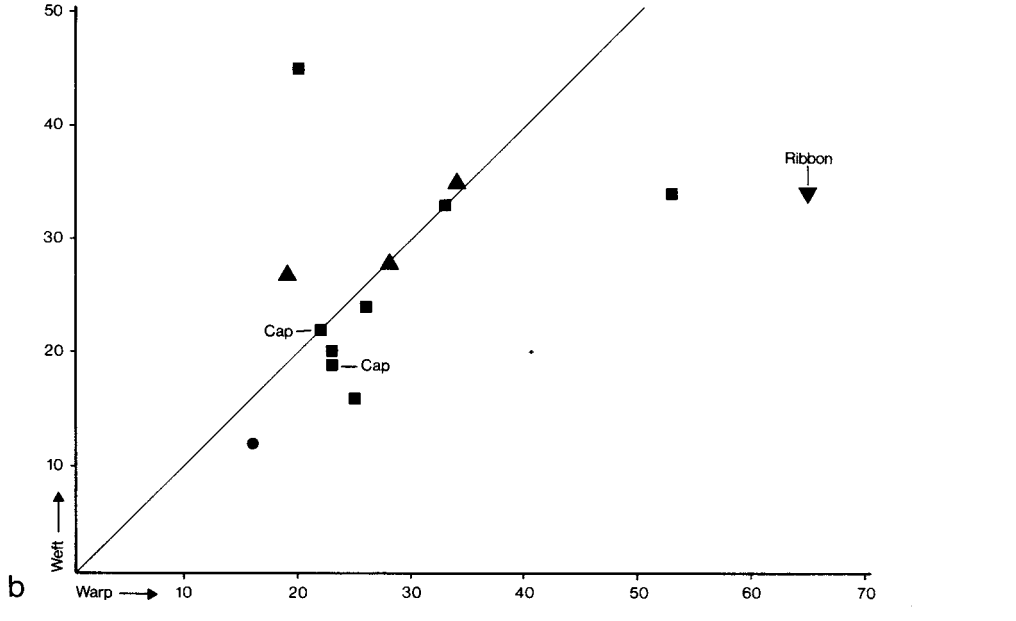
Weft
Warp
10
20
30
40
50
60
70
■ - Z x I
● - Z x Z
▲ - I x I
♦ - S x I
▼ - S x S
Ribbons
Cap

a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Cap

b

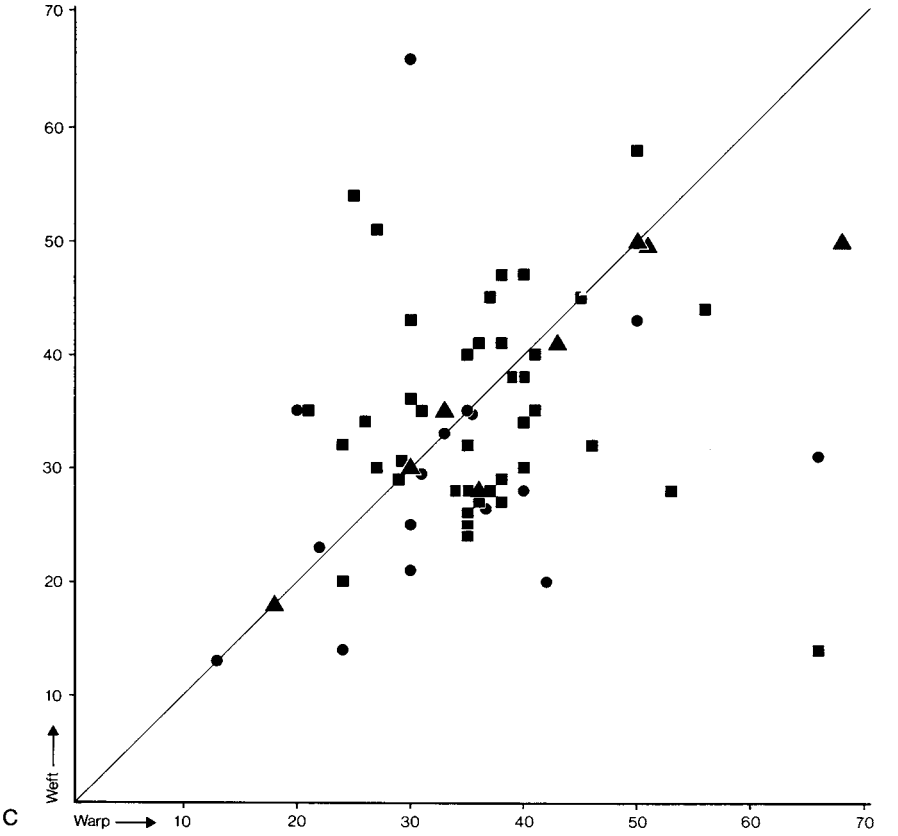


Fig. 157 Graphs showing twists and average thread-counts per centimetre of silk tabbies: a, from 16–22 Coppergate; b, of the 9th to 11th centuries, recovered from European excavations; c, from European treasuries

silk tabbies may also be given a latest possible date by the tomb in which they were sealed or by the design of the embroideries worked on them. The majority, however, cannot be dated more firmly than 'medieval or earlier'.

These loosely dated tabbies from treasuries, together with the smaller number from excavations of the 9th-11 th centuries, have been recorded in graph form (Fig.157b and c). On average the excavated silks are coarser than those from shrines, but there is considerable overlap: for example, fine tabbies have been recorded at excavations in Jelling, Denmark and Lund, Sweden (Hald 1980, 119; Lindstrom, pers. comm.) and a few coarse pieces can be seen in treasuries, for example at Le Puy, France (Pfister 1950, 504). However, the same yarn combinations are to be found in both sources and there is no other obvious difference between the two groups. Preliminary work on the Dublin textiles has shown that the same range of tabbies is also to be found in that city (Pritchard 1988).

Fig.157 shows that ZI tabbies are the most common, with a number of ZZs and some IIs and SSs. Interestingly enough, S-twist silk yarn is almost unknown in cloth, yet its use in ribbons is now well attested at Dublin (ibid.), London (Pritchard 1982, 196, 206), Winchester (E. Crowfoot 1975,338) and York. The SI pieces from the inner pouch of the Coppergate reliquary are very small and may also have originally been from ribbons.

The open weave ZZ tabbies also seem to be a distinct fabric-type with many parallels in treasuries and excavations. This regular use of S-twist yarn for ribbons, Z-twist for open veil-like fabrics and ZI for the more even tabbies raises the question of whether there were different places of origin for the different fabric-types. One group which may be tentatively ascribed to a particular silk-weaving centre comprises fabrics without twist in warp or weft. These have many parallels in Chinese and central Asian textiles (e.g. Sylwan 1949, 97-9) and indeed two of the few II tabbies to be found in Europe come from the cemetery at Birka, where contacts with the Far East are evident in, for example, a Chinese patterned silk (Geijer 1938, 66-7). However, perhaps it is rash to suggest that western workshops did not occasionally produce the same type and it may well be that some centres were producing a whole range of tabbies at once.

On the other hand, there is a group of fabrics among the ZI tabbies from 16-22 Coppergate which almost certainly originated in the same workshop. Comparison of the graphs in Fig. 157a with 157b and c might suggest that they have little to differentiate them from the other tabbies of similar yarn twist, but analysis of the selvedge shows that four of the eight share a feature which is not to be found in most of the comparative material. This is the broad strengthening selvedge with warp threads worked in pairs.

Selvedges have not survived on all the tabbies included in Fig.157b, c, but where they do, if strengthened at all, it is generally with a few bundles of warp threads at the very edge. At Lund there is one example with both edge cords and paired warp threads but this textile is considerably finer than any of the York tabbies (Lindstrom, pers. comm.); another example of much later date is also recorded in London (Pritchard 1982). Only in two silks, one from the nearby site at 5-7 Coppergate (651, PI.XXXIb) and another from Saltergate, Lincoln, are the same selvedges to be found (p.133, *AY* 17/3). These two strikingly similar textiles not only resemble each other in thread-count and selvedge but share several features of their cut and stitching with the silk cap from 16-22 Coppergate (Fig.152). In other words nine Anglo-Scandinavian ZI silk tabbies from York and one from Lincoln have a similar thread-count, six of them with the distinctive paired warp selvedge, and three of them, including the Lincoln one, can be identified as having been made into head-dresses.

Dr Anna Muthesius, comparing the silk from 5-7 Coppergate with that from Lincoln, suggested that these two were so alike that they might even have come from the same bolt of cloth (p.132, *AY* 17/3). Not all of the more recently discovered ZI tabbies can have come from the same roll of fabric since there are at least three different numbers of paired warp threads in the selvedges, representing a minimum of two lengths of fabric. The different , dyes of some of the tabbies may also represent separate lengths of silk, although the fabric i may of course have been dyed after cutting; it was not dyed after stitching as the sewing thread is often a different colour from the fabric.

The presence of one completely unused offcut (*1347*) of the same fabric suggests that these silks were being made up into garments on the site and were not being imported as ready-made caps. A supply of several bolts of silk from one particular workshop therefore seems probable. Since the excavated finds from York and Lincoln can only be a small proportion of the total trade, it may be suggested that a number of silks were being brought into York, made up into head-dresses, and perhaps distributed within the Danelaw. Since York had close connections with Viking Dublin at this time, it will be interesting to discover whether there are further examples from that town. Research already shows that there are similar ZI tabbies with paired warp selvedges, and remains of caps (Heckett 1987, and pers. comm.).

Head-dresses

The identification of the silk tabbies from 5-7 Coppergate and Lincoln as head-dresses was described by Dr Muthesius (in *AY* 17/3). This identification was confirmed by the finding of the complete cap from 16-22 Coppergate (*1372*), which is similar in width (the full length of the other two is not certain) and has the same triangular shape outlined in stitch holes (a dart in the complete cap) (Fig.152). At least one area of stitching for the ribbon ties was also present on the 5-7 Coppergate fragment, 651. There is no definite evidence, however, that the Lincoln head-dress was ever stitched up the back seam, and the conservator of the 5-7 Coppergate silk considered that the stitch holes along the dart in this piece belonged to the embroidery, of which there is a small piece present, rather than to the stitching of the two 'dart' edges together (Glover, pers. comm.). Two similar styles of headwear may therefore be present in the three caps, one with a joined back seam, the other without.

These caps represent a new and important addition to the history of costume, a style of headgear hitherto unknown. In late Anglo-Saxon manuscripts there are several illustrations of women's head-dresses, but these are all wimple-like in appearance, some of them held in place with a headband and occasionally covered with a veil. Anglo-Saxon words for headgear include various names for veils and fillets and also *cœppe*/*cappa* a cap, cape or hood, *hod* a hood, *feax-net* a haimet, *cuffie* or *cuffia* a cap, coif or hood, *hufe* a headcovering (cf. Icelandic *hufa* a hood, cap or bonnet), *scyfel* a woman's headcovering, possibly shading the face, and *wimpel* a wimple (Owen 1976,597-610; 1979,214-19). This last seems to be the one which is usually illustrated, but it is possible that one of the other words may represent a hood-like cap of the Coppergate type.

On the other hand, the presence of the silk caps within the area of Viking influence may point to their being Scandinavian in origin. The few depictions of women in Viking art show them with uncovered heads, their hair tied in a knot. At Birka some kind of headband was worn by both sexes (Geijer 1938, 145-6) while the two women in the Oseberg burial seem to have worn some fine fabric, possibly a veil (Ingstad 1982, 92). Only in the much earlier finds from Denmark is there anything resembling a cap, in the two Iron Age net head-dresses in sprang technique from Arden Mose and Haraldskaer (Hald 1980, 28-32, 58-9,344-7). These are much shorter and more flexible than the cap from 16-22 Coppergate and appear to have been held in place by cords, probably tied at the back of the neck.

Fig. 158 11th century wall-painting in the church of St Sophia, Kiev, of the Princess Elizabeth, wearing a head-dress (drawn from photograph in Lazarev 1966)

However, an 11th century wall-painting in the church of St Sophia at Kiev may hold some clues. This depicts four unmarried daughters of King Yaroslav, none of whom is wearing the usual veil of contemporary illustrations. The eldest daughter's head is poorly preserved but the two youngest appear to be wearing scarfs or kerchiefs which tie at the back, while the second oldest, Elizabeth (Fig.158), seems to have a head-dress which fits closely round the head and possibly ties under the chin. The neck region is poorly preserved, but there may be a lower part to the cap hanging down below ear-level (see also Lazarev 1966, 52, 237).

Yaroslav was king of Novgorod and Kiev, Scandinavian-ruled trading towns on the main route from the Baltic to the silks of Byzantium and the Eastern world (Toynbee 1973,445-6). His daughter Elizabeth was later to marry Harald Hardrada of Norway. If Elizabeth is indeed wearing a cap of the type found at Coppergate, then it would appear to be a Scandinavian fashion, possibly worn only by unmarried women.2

Whatever the origin of this style of cap, it has some parallels in rural Scandinavia in more recent times. Marta Lindstrom has pointed out (pers. comm.) a type of headgear worn by adults and children in the North Dalecarlia region of Sweden, called *hilk* or *hilka*. These are simple rectangles folded in half, most of them short in length with ties attached at the lower edges (Odstedt 1953,267). However, some, sometimes called *flax*, are longer and, most interestingly, the back seams are not closed (Fig.159). Small tucks fit the back part to the shape of the head and the ties hold the back edges together at the nape of the neck (ibid., 501; Lindstrom, pers. comm.). As already noted, two of the Viking Age caps may not have had a closed back seam and maybe this would have been appropriate if the

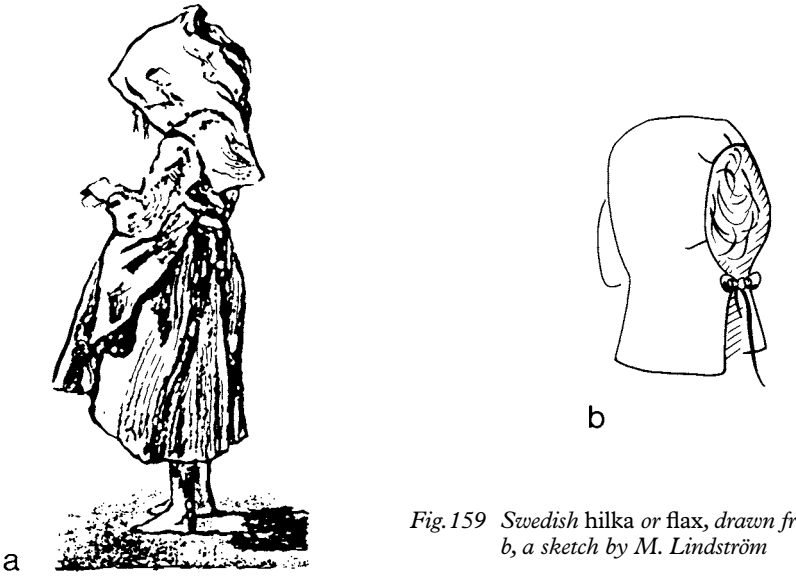


Fig. 159 Swedish hilka *or* flax*, drawn from a, Odstedt 1953; b, a sketch by M. Lindström*

bulky knotted hairstyles had continued in use after the headcovering had been adopted. Yet it should be emphasised that the only complete cap to have survived *was* stitched up the back and the evidence for the other style is not so positive.

The reliquary pouch, 1408 (Fig. 156, Pl.XXVlla)

Despite its complexity, the weave of the outer pouch of the reliquary is not unusual among silk textiles of this date. This weft-faced compound twill, also known as samite or samitum, is the most common figured silk weave of the 7th-12th centuries and was a speciality of the western weaving centres (warp-faced weaves being the usual product of the Orient). Two handsome examples of the weave are to be seen in the Nature Goddess and Peacock silks at Durham (Flanagan 1956, 505-24) and many more are to be found in other European treasuries. The variety of designs among these silks indicates that weft-faced twill was being produced in Byzantium, Persia, Syria, Egypt and Spain by the 10th-11th centuries (ibid.; May 1957,5-12; Schmedding 1978, passim).

The loom on which these fabrics were produced was a drawloom. This appears to have had treadle-operated heddles to work the binder warp, and separate drawcords to operate the main warp. Two differently coloured wefts were used alternately, one being thrown with the main warp raised so that the weft ran along the back of the fabric, the other with main warp down so that the weft appeared on the front: front and back wefts changed places according to the requirements of the design. The use of a paired main warp in order to enlarge a smaller design is known as early as the 7th century (Flanagan 1957, 192) and was commonly being used by the 10th.

Other compound twills with a paired main warp have been recorded at several Viking period sites, for example at Birka (Geijer 1938, 58-63), Dublin (Pritchard 1988), and Winchester (E. Crowfoot 1975,335), with a variant on the same type of twill at late Saxon Milk Street, London (Eastwood and King 1984,61). Twelfth century examples are also recorded at Lund (Lindström, pers. comm.) and from Southampton there is one dated to the late 13th century (E. Crowfoot 1975). Few of these have had their dyes identified, but the Winchester example is described as red and gold, which compares with the pink and ?un-dyed wefts of the York piece. Except for the Milk Street example these are all technically the same, with similar thread-counts and yarn twist. Without evidence of a design of any sort, it is not possible to suggest any particular place of origin among the weaving centres.

Dr Dominic Tweddle comments on the use of the pouch as a reliquary:

> The pouch, *1408,* is identified as a reliquary on the grounds of both its decoration and form. The decoration consists of a simple embroidered Latin cross. This may be purely ornamental, but more plausibly denotes a Christian use or significance for the pouch. Support for this hypothesis derives from both its size and trapezoidal shape. One other early medieval trapezoidal pouch is known, the *bursa* of St Willibrord in Utrecht (Battiscombe 1956,451, pl.XLIII, fig.e). The *bursa* is small in size, 35mm high, like the pouch from 16-22 Coppergate, which is 33mm high. The function of the *bursa* as a reliquary is incontrovertible as it still contains a small fragment of bone from the remains of St Willibrord. The *bursa* is made from part of an unusual and magnificent gold-brocaded tablet-woven braid, probably of Anglo-Saxon manufac- ture and of late 8th or early 9th century date. Unlike the Coppergate pouch the *bursa* is not decorated with an obvious Christian symbol, but is ornamented with a simple vine scroll. This motif occurs widely in Anglo-Saxon art and often on objects of purely ecclesiastical character. It may, therefore, at least in some settings have a Christian connotation. For example, it has been suggested that the vine scroll may represent the tree of life (Cramp 1984, xxiv).
>
> The pouch from 16-22 Coppergate is made from a much less magnificent textile than the *bursa,* but it is a silk dyed with kermes to what was originally a rich purple. Although silks are relatively abundant on the Coppergate site, 22 examples surviving as opposed to 32 woven of wool, they must still have been costly as they had to be imported from Byzantine or Islamic weaving centres. The dyestuff kermes was only used on two other silks from the site, *1342* and *1355*, and its use appears to have been confined to the finest and the most costly of the textiles. The purple colour of the silk may also be significant as Bede equates the colours of scarlet and purple with 'the precious deaths of saints and the fire of charity' (Henderson 1980, 4). Too much should not be made of this, however, as elsewhere Bede identifies purple with 'deceitful government' (ibid., 3). Despite this caveat the comparative richness and colour of the material from which it is made indicate the importance of the pouch and its contents and provides supporting evidence for its use as a reliquary.
>
> In addition to the *bursa* of St Willibrord, there are at least ten surviving early medieval burse or purse reliquaries, all made of metal over a wooden core and presumably skeuomorphs of textile pouch or purse reliquaries. They are from Maastricht, Holland (Jorissen 1976, pl.62); Tongres and Maaseik (Daniels and Sangers 1975, no.2, pl. p.77), Belgium; St Maurice d' Agaune (Bouffard 1974,77-9; Elbern 1962-4, ii, taf.292) and Sion (Lasko 1972, pl.l 0; Hubert et al. 1969, pl.315), Switzerland; Monza, Italy (Lasko 1972, pls.53-c4; Hubert et al. 1970, pl.194); Enger, Germany (Lasko 1972, pls.7-8;

Hubert et al. 1970, pl.193) and Winchester (Hinton et al. 1981). In addition there is an unprovenanced example in the Musee de Cluny, Paris (Hubert et al. 1969, pl.312), and the Stefansbursa in Vienna (Grimme 1973, no.6, pl. p.12). Of them only that from Winchester is of possible Anglo-Saxon manu- facture (Hinton et al. 1981,72-3). All of these reliquaries share the same basic shape, that is they taper towards the top, have a height equal to or slightly greater than their width, and are fairly thin in comparison to their height or width, again usually tapering towards the top. Where the relic chamber is accessible it is reached from the base of the reliquary.

These burse or purse reliquaries, range in date from the 8th to the 12th century. Most are magnificently decorated, both in terms of the material used to cover the wooden core and the elaboration of the decorative schemes used. The reliquaries from Monza and St Maurice d' Agaune, the Enger reliquary and the Stefansbursa all have the front face covered with *en cabuchon* gems and pearls on a gold or silver-gilt base, with, on the Enger reliquary, the addition of *cloisonné* enamels. On the reverse of the Monza reliquary the decoration is in *pointille* and depicts the Crucifixion. On the Enger reliquary the reverse is decorated in repousse with two ranges, each of three figures, beneath arches. In the upper range is Christ between two angels and in the lower range the Virgin with Sts Peter and Paul. The ends of the Stefansbursa and the reverse of the reliquary from St Maurice d'Agaune are also in repousse and are decorated with roundels containing figures and foliage respectively. On the Altheus reliquary from Sion the decoration is simpler with, on the front face, the standing figures of the Virgin and St John above foliate sprays executed in repousse silver-gilt. On the reverse are three *cloisonné* enamels; two are rectangular and depict pairs of apostles, the third is circular and contains the bust of an apostle. The reliquary from the Musee de Cluny is similarly decorated in repousse, this time in gilded copper- alloy, with the figures of the Virgin and child between Sts Peter and Paul. The ends of the reliquary are embellished with *cloisonné* garnets and *en cabuchon* gemstones. The Winchester reliquary is covered in repoussé gilded copper-alloy decorated on the front face with the seated figure of Christ and on the reverse with acanthus ornament. The Maastricht reliquary is much later in date than the other examples and has very different decoration, with, on the front face, a *cloisonne* enamel cross on silver-gilt and, on the ends, *vernis brun* foliate decoration.

The reliquaries from Maaseik and Tongres stand apart from these rich and complex objects by virtue of their small size, the relative poverty of the materials employed, and the simplicity of their decoration (Pl.XXVIIb, c and d). The smallest of the richly-decorated reliquaries, that from the Musée de Cluny, is 90mm high but most are in the range 160-170mm, and two, the Monza reliquary and the Stefansbursa, are very large, at 350mm and 320mm respectively. In contrast the Tongres reliquary is c.50mm high and the Maaseik reliquary only 42mm high. Both the Tongres and Maaseik reliquaries are made of copper-alloy over a wooden core, gilded at Maaseik, but apparently not at Tongres. The Maaseik reliquary is decor- ated only with interlace, the Tongres reliquary with a simple inscription identifying the contents. All this stands in stark contrast to the other reliquaries with their rich materials and elaborate decoration.

These differences might be accounted for by a difference in patronage. The Stefansbursa, for example, was probably produced under imperial patronage, while the Maaseik and Tongres reliquaries appear to have been local products. However, while this might explain the poverty of the materials it does not explain the small size of the Maaseik and Tongres reliquaries, and it may be that they originally performed a different function from the larger and richer reliquaries. The splendour of their decoration suggests

that these larger reliquaries were display pieces, placed on or near altars. As most have suspension loops they may have been displayed suspended or carried in procession slung around the neck. The Maaseik and Tongres reliquaries also have suspension loops, but with such small objects it seems more likely that they were hung around the neck and worn as personal amulets, in much the same way as the Coppergate reliquary pouch and the *bursa* of St Willibrord must have been used. Certainly the Tongres *bursa* or purse reliquary is the one which in shape most closely resembles the pouch from 16-22 Coppergate.

There is sound evidence for the wearing of small reliquaries both in Anglo-Saxon England, and in the early post-Conquest period. In the 7th century the Frankish Queen Iurminburg confiscated a reliquary from St Wilfrid and wore it 'as an orna- ment both in her chamber at home and when riding abroad in her chariot' (Dodwell 1982,196), and when the tomb of Edward the Confessor was opened in 1685 a gold and enamel reliquary cross was removed from his body (ibid.). At the Battle of Hastings William the Conqueror wore round his neck some of the relics on which Harold had sworn his oath (Hinton et al. 1981, 62), and in the reign of King Stephen, Reginald of Durham recounts a story involving a monk of Durham who wore a small book of the life of St Cuthbert round his neck; the book contained a small portion of the saint's winding sheet *(Reg. Dunelm.,* ch.LIV, 111-12). At least three Anglo- Saxon pendant reliquaries survive. One is a hollow, open-work ivory cross, now in the Victoria and Albert Museum, which can be dated to the mid 11th century (Backhouse et al. 1984, no.125, pl.125; Beckwith 1972, no.45, pls.99-102). Another takes the form of a small ivory Crucifixion group with a suspension loop and the reverse hollowed to form a relic cavity (ibid., no.34, pl.71). The gilded copper-alloy Sandford reliquary also has a suspension loop and was probably worn around the neck. It has been dated to the late 11 th century (Hinton 1974, no.30, pls.XV-XVII). Such reliquary pendants continued to be made and used after the Conquest. A rectangular reliquary pendant in the Metropolitan Museum of Art, New York, was made for Bishop Reginald of Bath as a gift to Queen Margaret of Sicily and can, therefore, be dated to the 1170s (Zarnecki et al. 1984, no.303, pl.303). A circular reliquary pendant in the British Museum can be dated to c.1128 and contains settings for the relics of 'Jesus Christ, of Ninian, of Norbert (?), of Fergus (?), of Boniface (?), of St Mary' identified by an inscription. The relics are covered by a domed rock crystal (ibid., no.310, pl.310).

Some of these pendant reliquaries clearly took the form of small bags or pouches. Bede records that in the 5th century St Germanus visited Britain and healed a blind girl, 'he took from his neck the little bag…containing relics of the saints' (Bede, *Ecc. Rist.,* 59). Later he records how a Briton passing the site of St Oswald's death 'took some of the soil with him wrapped up in a cloth', soil which he later describes as 'enclosed in its bag'(ibid., 245). Reginald of Durham, in a story placed in his narrative just after the translation of the relics of St Cuthbert in 1104, tells of an architect who carried with him a bag of silk in which was a book and some relics *(Reg. Dunelm.,* ch.XL VII, 94-8). The implication is that it was hung around his neck. Clearly the pouch from 16-22 Coppergate represents a type of pendant pouch reliquary which was known in the Anglo-Saxon and early post-Conquest periods and which existed alongside other types of pendant reliquary both in metal and ivory.

Little can be said about the original contents of the Coppergate reliquary pouch. It may have contained fragments of a saint's bones, as does the *bursa* of St Willibrord, part of an object associated with a saint, such as the soil from the spot where St Oswald died, or scraps of cloth such as those now contained in the Maaseik reliquary.

These pieces of cloth might be fragments of a saint's clothing, or strips of cloth, known as *brandea,* which had been deliberately placed in contact with the bones of a saint (Thomas 1971, 136-7). In either case this raises the intriguing possibility that the fragments of vegetable matter found inside the pouch were remains of a linen cloth, and thus part of the actual relic. Textile fragments certainly formed a major part of both Anglo-Saxon and medieval relic collections. At Exeter, for example, King .Æthelstan founded the monastery of St Mary and St Peter in about 932 and bestowed upon it lavish gifts of relics including parts of the garments of Christ, the Virgin Mary, St Peter, St Paul, St John the Evangelist, St Caesarius, St Remigius, St Salvinus and St Agatha (Swanton 1975, 15-19). In the period immediately after the Conquest, Peterborough Abbey could boast an even more impressive relic collection, including nine pieces of textile (Mellows 1980, 28-9), and in the mid 13th century York Minster owned parts of the garments of Sts Symeon and Jude, St Ambrose, St Peregrinus, St Agatha, St .Ætheldreda, St Cuthbert, the Virgin Mary, St Agnetis, St Peter and St Paul *(York Minster Fab.* R., 150-3).

Tablet-woven braid, *1340* (Fig. 160, PI.XXXII)

At first sight the find, *1340,* appeared to be a number of loosely plied silk threads, 1.47m long, tied together with two overhand knots at one end. Closer inspection revealed evidence of a yarn of vegetable fibre which had once held the cords together as a narrow flat braid. Such parallel cords joined together by a weft are characteristic of tablet weaving, a technique worked with a pack of small square (or sometimes triangular) tablets with a hole at each corner. Each hole carries a separate warp thread and as the pack of tablets is rotated the cords are formed, one to each tablet. A weft is passed between the warp threads at each turn, to hold them all together.

Only one of the warp cords is 4-ply, but although the others are 3-ply, there is an obvious space for a fourth warp thread, now absent, in each of them, indicating that 4-hole tablets were used (Fig. 160b). The yarn is S-twist, as in the tabby ribbons and some of the sewing yarn, but not as in the full-size silks. Originally the braid must have been 5mm wide, using eight cords across its width (and therefore eight tablets), the cords being twisted ZSZSZZSZ. Most of the cords are now dark brown, but one is a lighter shade, and adjacent to this is the 4-ply cord, consisting of two black and two light brown warp threads. Originally the darker threads were probably red and purple, as dyestuffs madder and ?indigotin plus madder were detected. There may have been some kind of repeating pattern involving these coloured threads and the missing warp thread (presumably of vegetable fibre), but too little of the braid is now present in its original position to identify any design.

Tablet weaving as a technique was well known in both England and Scandinavia long before the Viking invasions: the colourful braids of Snartemo and Evebø in Norway (Hougen 1935; Dedekam 1925) and many fine wool and linen edgings and bands found in early Anglo-Saxon cemeteries (e.g. G. Crowfoot 1952; 1956a) show the skill of the weavers of both cultures. The use of silk for such braids seems to have been rare at this time. The luxurious gold-brocaded silk braids of royal tombs on the Continent have parallels in English graves, but the evidence suggests that wool generally replaced silk for the ground weave in this country (Crowfoot and Hawkes 1967, 57).

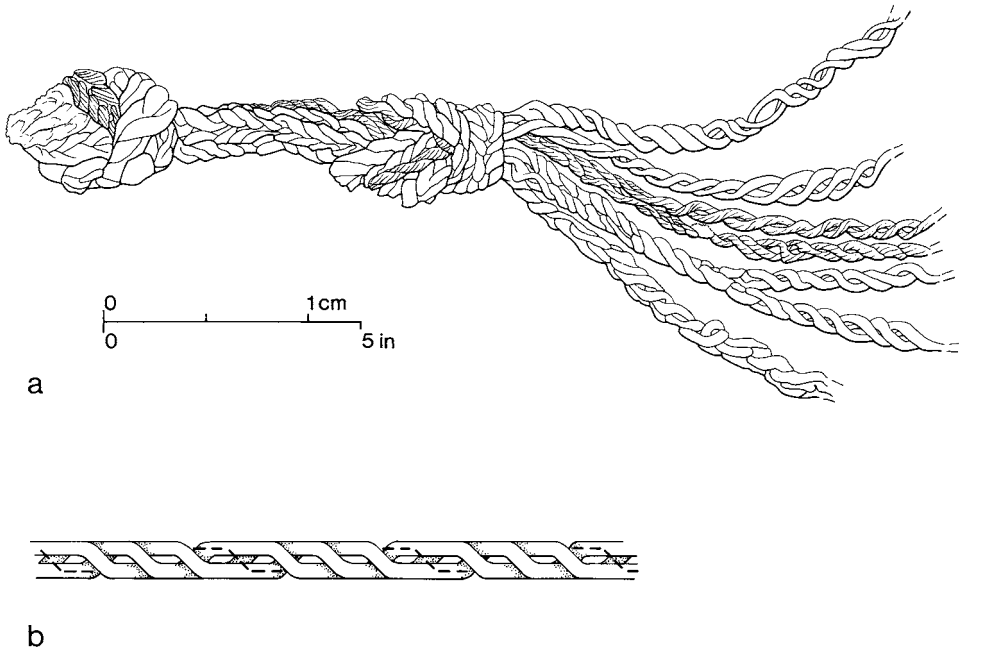


Fig. 160 Silk tablet-woven braid, 1340*: a, knotted end, scale 2:1; b, diagram showing its three warp threads with space for a fourth*

By the late 8th or early 9th century, however, gold-brocaded silk braids accompanied embroideries of Anglo-Saxon design in the so-called *casula* at Maaseik in Belgium (Budny and Tweddle 1984, 72) and later examples are known from the tomb of St Cuthbert at Durham (G. Crowfoot 1956b). Silk and gold tablet-woven braids are also to be found in some numbers from Viking Age sites such as Birka (Geijer 1938, 75-98), and Dublin (Pritchard forthcoming). There has been some discussion as to whether these broad, richly decorated braids are imports or domestically produced (e.g. Hald 1980, 233-7), but in the narrow braid from 16-22 Coppergate, where the silk has been eked out with cheaper linen, there seems little reason to suggest foreign workmanship. Coloured silk yarns were evidently being imported for the sumptuous Anglo-Saxon embroideries of this period (Budny and Tweddle 1984, 84ff.) and a thin bone weaving tablet (s£8476) with small holes for fine yarn *(AY* 17, in prep.) has been recovered from a level at 16-22 Coppergate contemporary with the tablet-woven braid. The production of such a simple trimming would therefore seem well within the range of the local weavers.

Medieval Textiles

Description

The textiles from medieval layers are few in number (see Table 22) and spread over the 12th to 14th centuries. The examples in wool are woven in 2/1 twill, *1414, 1415* (Pl. XXXIIIa), *1416*, 2/2 twill, *1421*, and tabby, *1418*, *1420* (PI.XXXIVb), *1419*, and with a striped weave, *1417* (PI.XXXIVa), and the remains of what was probably once a combined wool and linen textile, *1422*. There is one group of well-preserved linen fragments, 1445, one carbonised, *1443*, and one mineralised piece, *1444*, and one imprint in a lead object, *1456*; the fibre of the last three has not been identified, but *1443* and *1445* resemble the linen tabbies, both medieval and pre-Conquest, in yarn type and thread- count.

Although the linen remains are not distinguishable from those of the Anglo- Scandinavian period, the wool textiles show some changes in technique. A new type has appeared, a 2/1 twill (see Fig.145c) with a close-set Z-spun warp and a thicker softer S- spun weft. To some extent this fabric-type is a successor to the earlier 2/2 twill (see above, p.321), since it is a cloth of similar quality. However, the medieval 2/1s are worked from more unevenly spun yarns than the earlier twills and the use of the particularly soft S-spun yarn has led to a slight matting on one face of the fabric-perhaps from wear rather than deliberate fulling.

The three 13th-14th century tabbies, *1418-20,* are again made from combined Z and S spinning, but in the main from finer, more regularly spun yarn than the 2/1 twills. They are a relatively lightweight fabric and present a very even appearance, since they lack the closer-set warp of the earlier textiles. The slight matting of the fabric is evenly distributed and may therefore be the result of fulling.

Two colour-patterned fabrics have survived. One, *1421*, is a 2/2 twill with indigotin-dyed yarn in one system and undyed wool in the other, so that the twill pattern stands out as diagonal lines of green/blue alternating with off-white. The other, *1417*, is a striped wool tabby of interesting construction (Fig.161, PI.XXXIVa). The main body of the cloth is a thin tabby with warp and weft threads used singly, 9Z x 9S per centimetre. Stripes are added by operating the warp in pairs, introducing a coloured weft yarn and beating this in so tightly that it covers the undyed warp. Narrow red, brown and natural stripes have been worked in this way, 15-18 weft threads per centimetre. The find is in fragments, but the best-preserved piece includes an area of tabby 25mm deep, with extended tabby wefts in the order two red, six natural, six brown, eighteen red, eight natural, four brown.

Another piece, *1422*, a strip 15mm long by 8mm wide, at first sight appears to be a narrow wool braid. However, although the lengthways wool yarn was clearly once woven into tabby (sixteen threads in 0.8cm), some small decayed pieces of a vegetable fibre yarn and indentations in the wool threads are all that indicate where the crossways threads once were. It is not clear whether this was a narrow braid or a fragment from a linen and wool fabric such as linsey-woolsey or tapestry. Similarly, some plied silk threads, *1456*, of

Table 22 Medieval textiles: HM—hairy medium; GM—generalised medium; M—medium; Sh—shortwool

	Fibre	Weave	Thread-count	Spin	Dye	Fleece type	Comments
1414	wool	2/1	14 × 7	Z × S	?orange dye	GM × Sh	
1415	wool	2/1	11 × 6–7	Z × Z + S	–	M × Sh + HM	one face matted
1416	wool	tabby	12 × 7	Z × S	–	M × HM	one face matted
1417	wool	tabby	9 × 9–10	Z × S	madder	GM × GM	stripes in extended tabby
1418	wool	tabby	13 × 9–10	Z × S	madder	GM × GM	matted
1419	wool	tabby	12–14 × 12–14	Z × S	–	–	matted
1420	wool	tabby	13–14 × 13–14	Z × S	?madder	Sh × Sh	matted
1421	wool	2/2	11 × 8–10	Z × S	Z indigotin S natural	–	
1422	vegetable and wool	?weft-faced tabby	4 × 20	? × S	madder + indigotin	–	
1443	carbonised ?vegetable	tabby	20–22 × 14–16	Z × Z	–	–	
1444	mineralised ?vegetable	tabby	22 × 22	Z × Z	–	–	
1445	flax	tabby	20 × 12	Z × Z	bleached	–	

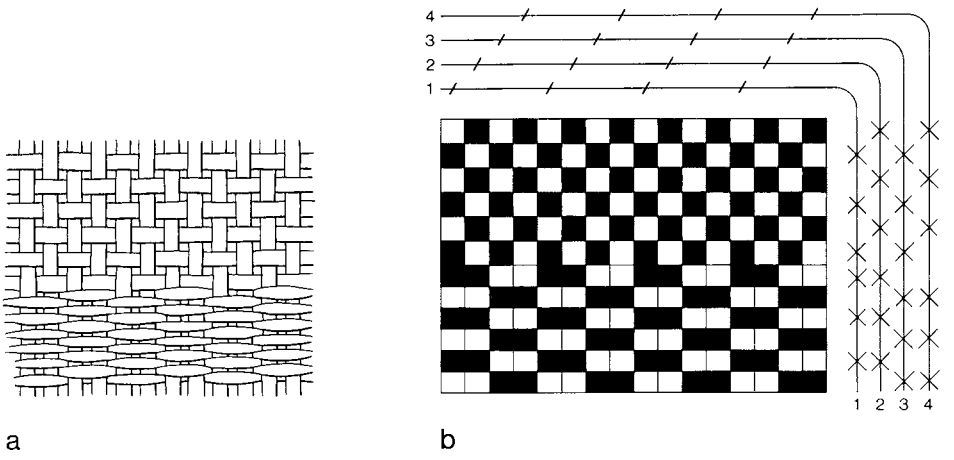


Fig.161 Striped wool tabby, 1417*, showing a, its construction; b, its probable heddle tie-up in weavers' notation*

the 13th-14th century, may also have been woven originally, but as they were found only loosely together, they have been grouped under yarn and cordage, p.393.

Parallels

Although the medieval group is small in number, a survey of the comparative material shows that it represents a neat cross-section of the fabric-types in use in this period. In particular, ZS 2/1 twill and medium and lightweight ZS tabbies are standard types of clothing material used for the dress of both men and women in the 11th-15th centuries. The 2/1 twill is often lightly felted on the weft face which, from the evidence of seams at Baynard's Castle, appears to have been inward facing (E. Crowfoot 1979, 38), while the tabbies are matted to a greater or lesser extent on both faces. The uneven felting of the earlier 2/1 twills may be the effect of wear, but in the later tabbies the more even effect was probably achieved by fulling, either trampling the cloth underfoot in a vat of water or beating it with water-driven hammers in a fulling mill. This later mechanised process seems to have become particularly common from the late 12th century onwards (Carns-Wilson 1954, 194ff.).

Simple 2/1 twill is known from Roman and Anglo-Saxon sites, but only as a comparatively rare find, and examples in linen come from Anglo-Scandinavian levels at 16-22 Coppergate. The earliest examples of the characteristic medieval type of 2/1 twill have been found in the Saxo-Norman tenements at Durham, one from the 10th-11th century, others from the 11th-12th century (E. Crowfoot 1979,36-7). At 12th-14th century Perth, 70% of the 293 wool textile finds were in this weave (Bennett 1982, 197; and forthcoming) and other

groups are known from medieval Aberdeen (Bennett 1982) and Carlisle (E. Crowfoot, pers. comm.). In London another large group, 155 in number (of which 130 are ZS), is recorded from Baynard's Castle, dated to c.1330-40; however, in the late 14th-early 15th century deposit from the same site there were only 22 (of which six are ZS) and in the late 15th-early 16th century levels the number had fallen to four, all of them ZZ (E. Crowfoot, pers. comm.).

ZS tabbies in medium and fine counts are known in small numbers from 13th-14th century Southampton (E. Crowfoot 1975, 338-9), Nottingham, Oxford and King's Lynn (E. Crowfoot 1977,375). There are 138 non-patterned tabbies from early 14th century Baynard's Castle, while in the late 14th-early 15th century collection there were 326 (E. Crowfoot, pers. comm.); other examples are recorded from other 14th-15th century sites in London (Pritchard 1982,205; and pers. comm.). Of the 15th-16th century textiles from Newcastle upon Tyne 68% were in tabby, although by this time SS spinning pre- dominated over ZS (Walton 1981, 194). From this evidence it is clear that 2/1 twill and ZS tabby run parallel to each other through the medieval period but that 2/1 predominates in the 11th-14th centuries, while tabby weave increases through the 14th century, until it outstrips 2/1 in the 15th century.

Outside Britain ZS 2/1 twills in similar thread-counts to the Coppergate examples are known from several sites in Scandinavia, notably 11 th-14th century Nykoping and Lodose (Franzen and Geijer 1968, 131-2), 14th century Svendborg (Bender J0rgensen 1979,3) and late 15th century Oslo (Kjellberg 1979, 95-101); also from 12th-15th century Schleswig (Tidow 1982, 177); from Holland, from several sites of the 13th-15th centuries (Vons-Comis 1982, 162); from Poland from the late 10th-13th centuries (Kaminska and Nahlik 1960, 116); and from late 10th-early 15th century Novgorod in Russia (Nahlik 1963,297-312). The rise of tabby weave over 2/1 can be seen in the foreign material also, most noticeably in the Dutch and German sites (Vons-Comis 1982; Tidow 1982) but also at Oslo and Novgorod.

The loom on which these twills and tabbies were produced is an interesting subject for discussion. It was pointed out by Hoffmann that the use of the warp-weighted loom on the slant, with the warp divided in half on either side of the lower cross-bar (Fig.139; as evidenced by current weaving traditions in Norway and Lapland and written descriptions from Iceland) was not compatible with the 2/1 structure. Since the woven staning border, a distinctive feature of products of the warp-weighted loom, had at that time only been found on tabbies and 2/2s, not on 2/1 s, she concluded that if this loom had ever been used for the 2/1 weave, it could only have been by some warping and weaving procedure other than the one for which there is evidence (Hoffmann 1964,202-3).

On this evidence it seemed reasonable to suppose that the increase in 2/1 fabrics in the 11th century was connected with the arrival of the horizontal treadle-operated loom, which reached Europe in the 10th or 11th century. An 11th century Mishnah commentary written in France or Germany refers to men weaving with their feet, a clear indication of treadles (ibid., 260) and from about this time loom weights for the warp-weighted loom cease to be a common find in urban excavations in England.[3] Eleventh-twelfth century

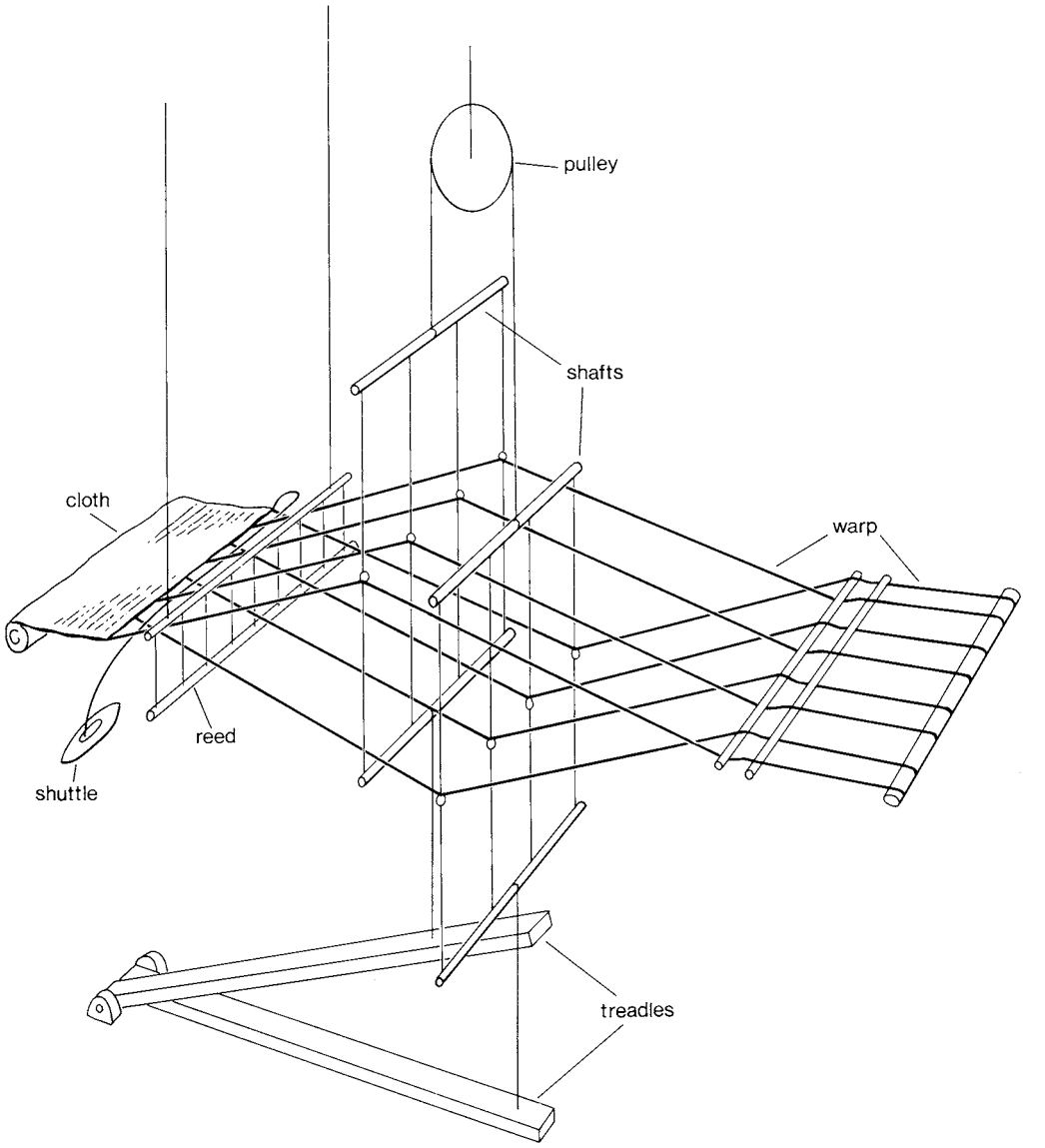


Fig. 162 The horizontal loom

pulleys and other horizontal loom parts have been recovered from excavations in Poland (Kaminska and Nahlik 1960,89-97) and by the 13th and 14th centuries illustrations of the loom appear in English, Flemish and German manuscripts. The earliest illustration of an English loom, so far known, is in a manuscript dated to the 13th century (Trinity College, Cambridge, MS 0.9.34, see Hartley and Elliott 1931, pl.22b).

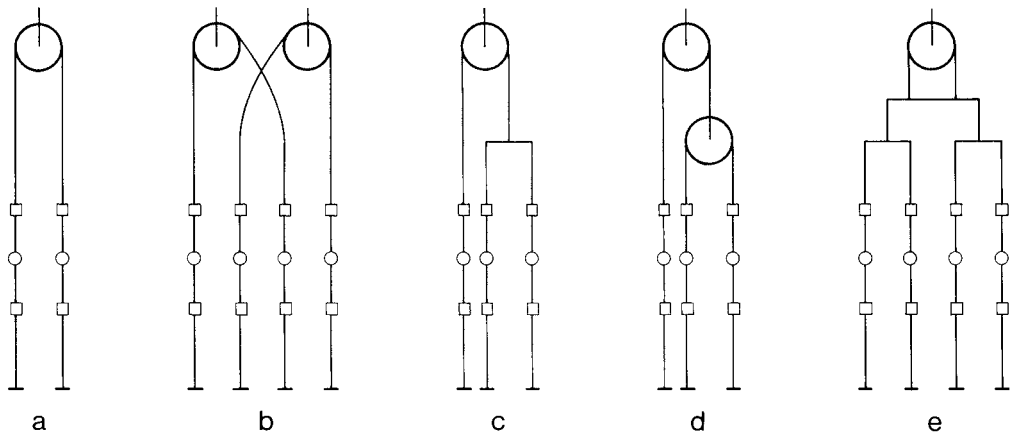


Fig. 163 Possible treadle-heddle-pulley tie-ups for the horizontal loom. Tabby may be woven with the tie-up shown in a; 2/2 twill with b; 2/1 twill with c and d; striped tabby, 1417, with e (and see Fig. 161)

In its simplest form this loom is operated by pressing a treadle which in turn depresses one of two shafts on which heddles are mounted (Figs. 162, 163a). As one shaft goes down, the other, connected to the first via a pulley, rises and a shed is made between the two groups of warp. By pressing the treadles alternately and passing a weft, tabby is woven. 2/2 twill is produced by four shafts, four treadles and two pulleys (Fig.163b): for each shed two shafts go down as two go up. A non-balanced weave is perhaps not the most natural product of a loom which operates on a system of pulleys and balances, but 2/1 twill may be produced , with either of the arrangements in Fig.163c and d. In Fig.163c it would be woven by pressing one treadle at a time, the resulting fabric having its warp face uppermost, although care would have to be taken in pressing the right-hand treadle so that the other two rose simultaneously. Alternatively, if the arrangement in Fig.163d were used and the treadles pressed two at a time, 2/1 twill with the warp face downwards would be produced. The use of three treadles on a loom is mentioned in documents concerning French weaving centres in the 13th century (de Poerck 1951, 75ff.). One document from Chalons-sur- Marne (cited by Hoffmann 1964,263-4, and brought to the author's attention by E. Crowfoot), implies that weaving with three treadles was becoming outdated in 1369. This confirms the archaeological evidence that 2/1 twill is popular from the 11th to the early 14th centuries and is found much less frequently after that.

If the 2/1 structure could be woven on the horizontal loom and was incompatible with the weaving techniques of the warp-weighted loom, then the loom and weave must have arrived simultaneously. The case for tying 2/1 twill so closely to the horizontal loom is not, however, as clear-cut as it seemed. Recent excavations in Scandinavia have recovered several finds of 2/1 twill with a woven starting border, thereby firmly connecting them with the warp-weighted loom. These finds are dated to the 11 th-15th centuries (Kjellberg 1982, 142-3; Lindstrom 1976,282,288-92), but a much earlier example has also been found at Feddersen Wierde, Germany (Ullemeyer and Tidow 1981,82). Hedges has pointed out that the warp-weighted loom may be set up vertically rather than on the slant and thus

readily make three-shed weaves possible (pp.116-18, *AY* 17/3); and the present author has woven a 2/1 twill with tablet-woven starting border on such a loom. It should also be mentioned that Geijer considered it impossible that the fine 2/1 diamond twills of Birka, with their tightly packed warps, could have been woven on a loom with a reed (a grill-like beater used on a horizontal loom) and thought the warp-weighted loom the more likely implement (Geijer 1938,29-34).

This evidence admits of two possible conclusions. Either the weavers of rural Scandinavia, where the textile industry was slower to develop than in England or Flanders, were adapting their old looms to produce a new type of twill, which the horizontal loom had brought with it; or there was simply a change in fashion, towards the new type of fabric, independent of the looms available. Whichever was the case, the arrival of the horizontal loom must have speeded up cloth production considerably – Nahlik (1965,100) estimates it to be six times as fast as the upright loom – and contributed to the move of textile production away from the housewife's domain and into the professional weaver's workshop.

There can be no doubt of the type of loom used to produce the striped tabby, 1417 (Pl. XXXIVa). This is of necessity a product of the horizontal loom and shows that the weavers were discovering a new versatility in the implement. Fig.161 illustrates in weaver's notation the draft for the weave with, above, the threading of the warp threads through the heddles, every fourth thread attached to one of the four shafts. Vertically on the right-hand side is the order in which the shafts have to be depressed in order to produce the weave: shafts 1 and 3 alternate with 2 and 4 for the simple tabby, while shafts 1 and 2 exchange with 3 and 4 for the stripes. The change to extended tabby naturally allows the weft to be beaten in more tightly, but the weaver must also have applied extra pressure in order to completely cover the warp with the weft stripes. The most probable tie-up of the loom apparatus for this weave is shown in Fig. 163e.

Several examples of this striped fabric are known from other excavations. From Trig Lane, London, there are two tabbies, 10Z x 11S per centimetre, with stripes of extended tabby, one undated, the other c.1.440 (Pritchard 1982, 205). From Baynard's Castle, London, there are much finer examples, 54 from the early 14th century and 31 late 14th-early 15th century (E. Crowfoot, pers. comm.). Some of these last also have narrow stripes of silk and sometimes a band of2/2 twill, while from 13th century levels of the same site there is an example of a 2/2 twill with narrow red and brown stripes in extended tabby (E. Crowfoot 1980, 112-13). The change from extended tabby to twill presents no difficulty on the 100m tie-up illustrated in Figs.161 and 163e, since the shafts may be depressed in the order 1 and 2, 2 and 3, 3 and 4, 4 and 1, etc. for 2/2 twill.

From 13th-14th century Holland there are nine examples similar in thread-count and spin to the York piece: the stripes in these were 7-20mm wide and the areas of simple tabby 55-90mm, with the occasional use of silk for a stripe (Vons-Comis 1982, 156). Finally, from 13th-14th century Novgorod are five examples, again with similar counts to the fragment *1417*, with yellow or green for the ground colour and red and brown wool, or in one case linen, for the stripes (Nahlik 1963, 252-4); Nahlik also mentions some Polish parallels (ibid.).

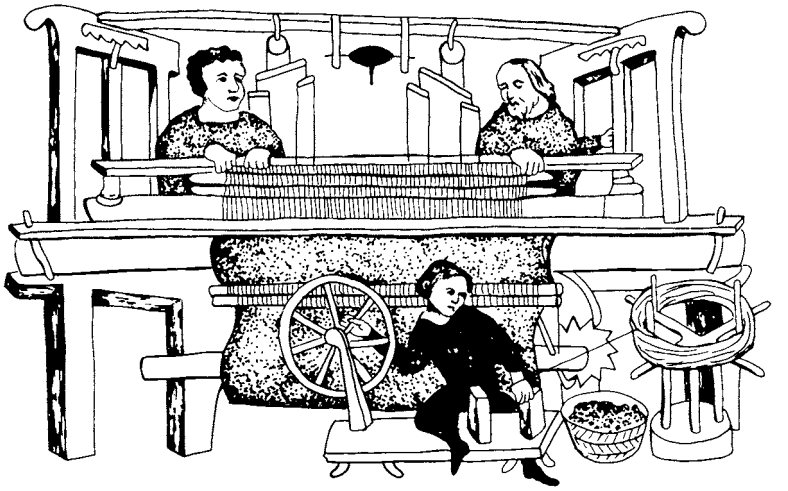


Fig. 164 A 14th-century loom from Ypres (drawn from a 19th century copy of Kuerboek*)*

Nahlik considers the Russian and Polish textile finds to be Flemish in origin. In this connection, it is interesting to note that the upper loom apparatus illustrated in Fig. 163e can be seen in a drawing of a loom from Ypres (Fig. 164). If the shafts were tied directly to the treadles (these are not visible in the drawing), then here in 14th century Flanders is the very loom which could have accommodated these striped weaves.

On the other hand, 'dyed and rayed [i.e. striped]' fabrics were being woven in York and other East Riding towns by at least the mid 12th century (Sellers 1974,407). However, there is no evidence to suggest these were anything other than simple stripes of colour with no change in the weave, such as can be seen in other medieval textiles (see below). Moreover, a political poem concerning the reign of Edward II (1307-27) describes how 'now in every town,/The ray is turned overthwart that should stand adown' (Wright 1968,336): this suggests that the crossways stripes of the Coppergate textile were not common in England before the early 14th century, the stripes previously having been mainly in the warp. A record of 1337 shows that two Durham wool merchants returning from Flanders travelled with a large consignment of cloth, including '25 bolts of striped cloth' (Fraser 1969, 53) – perhaps fabrics similar to 1417.

The twill with blue-green warp and undyed weft, 1421, is an example of a simpler type of colour-patterning. 2/2 twills with a differently coloured warp from weft (generally using naturally pigmented wool) are known in Scandinavia, Iceland and Greenland (E. Crowfoot 1977, 375; Nørlund 1924, 115, 119) but are rare in this country. However,

striped and checked twills, mainly 2/1, are known from 11th-12th century Durham (E. Crowfoot 1979,38-9), 11th century Winchester (ibid.), and from London—early 14th century Baynard's Castle (E. Crowfoot,pers. comm.) and mid 14th century Custom House (Pritchard 1982,200). Since the fragment *1421* is so small, it may well be from a stripe within a larger patterned textile.

The wool and vegetable fibre piece, *1422*, from the 14th-15th century is also difficult to place, since it is only a narrow strip. It is possible that it was originally a wool warp-faced braid with a linen weft, but since linen makes a stronger, less elastic yarn than wool, it is perhaps more likely to be the warp. Tabby weave with linen warp and coloured wool weft is used in tapestry, the weft being beaten in to cover the warp, as in the piece under discussion. The yarn and thread-count are also similar to a later medieval tapestry examined by the author, and although only one colour was found in the woven fragment, a darker yarn of similar type was found lying next to it.

In the medieval period many towns had their own tapiters, making rugs and hangings to cover walls, beds and floors. In York in 1381 there were at least thirteen engaged in the profession, one of whom lived in the parish of All Saints, Ousegate (Pavement), the church directly opposite the excavation at 16-22 Coppergate, and others in the parishes of St Crux and St Mary Senior (Bishophill) (Bartlett 1953, 15).

Unstratified textile fragment, *1463*

After the excavation, when building work had begun, some finds of unknown provenance were recovered from the contractors' spoil heaps. One of these, *1463*, was a fragment of a thick heavy fabric with a smooth nap, a dense springy layer of fibres which obscures the weave on both faces. Only at the neatly cut edges was it possible to see that this was not a felt, but woven. Careful dissection of a small area showed it to be tabby weave, 8Z x 8S per centimetre.

This type of finish was applied to textiles by raising the nap with teasels and then shearing the surface back with long cropping-shears, the process being repeated several times for a smooth even surface. It is a technique which was known to the Romans, although shorn textiles are not discovered in any numbers before the medieval period. Even then the high quality of finish displayed by this fragment is rare until the 15th–16th centuries. At this date a dense nap was usually given to the finer, more lightweight fabrics (Walton 1981, 197) and it was only in the 17th century that these finishing techniques began to be regularly applied to heavy coat and cloak material (Walton 1983,225). Studies of 830 fragments from 15th–17th century Newcastle upon Tyne also showed that ZS spinning was more common in the later textiles (ibid., 219). It can therefore be suggested with some degree of confidence that the fragment *1463* is a tailor's offcut from the 17th century or later.

Table 23 Anglo-Scandinavian and medieval wool and silk yarns and cords not associated with textiles: n.d.d.—no dye detected

	Fibre	Spin/Ply	Diameter in mm	Comments
1269	wool	Z2S	0·8	combed wool
1270	wool	SZZ	1·2	dyed with madder
1274	wool	Z14(=6Z+8Z)S	3·0–4·0	n.d.d.; natural pigment
1275	wool	Z4S	average 4·0	n.d.d.
1276	wool	Z2S	3·0	
1310	wool	S	2·0	
1311	wool	Z	2·0	
1312	wool	S2Z8S	5·0	dyed with madder
1313	wool	S2Z	0·4–0·6	?yellow dye
1314	wool	Z2S	1·0	?combed wool
1315	wool	S2Z	1·5	?combed wool; dyed with madder
1383	wool	Z6S2Z	4·0	natural pigment
1384	wool	Z2S12Z	4·0	?combed wool
1385	wool	Z2S	0·9	combed wool
1423	wool	Z	0·4	
1424	wool	Z	0·9	bundle of yarns
1425	wool	S	1·0	
1426	wool	Z	0·7	bundle of yarns knotted together; wrapped with *1425* and *1433*
1427	wool	Z	0·8	
1428	wool	Z	0·4–1·0	tied together
	wool	S	1·0–1·5	
1429	wool	Z	0·8	dyed with indigotin
1430	wool	Z	0·6	
1431	wool	S	1·5	
1432	wool	Z	0·4	
1433	wool	Z	0·3	n.d.d.
1434	wool	Z2S	2·0	
1435	wool	Z2S	2·5	poorly preserved
1436	wool	Z2S	2·5	poorly preserved
1437	wool	Z2S	2·0	
1438	wool	Z3S2S	3·0	
1439	wool	Z2S	2·0	
1440	wool	Z2S	1·2	
1441	wool	Z2S	1·0	dyed with indigotin
1442	wool	Z2S	2·0	poorly preserved
1461	wool	S11Z	7·5	
1280	silk	S	2·0	
1357	silk	S3Z	0·3–0·4	
1358	silk	Z	0·1	
1409	silk	Z	0·2	yellow dye
1456	silk	12S	not recorded	
1457	silk	12S	0·4	

Yarn and Cordage, Anglo-Scandinavian and Medieval

Table 23 shows the wool and silk yarns and cords found unattached to woven textiles. Some were found as individual threads and others in groups, in the cases of 1424 and 1428, tied together in a bundle (Fig. 165, PI.XXXIIIb). Most of the finer threads readily compare with the single weaving yarns of the textiles and their plied sewing thread (see below, p.409, and Table 26). It seems likely that they are weaver's, spinner's and seamster's

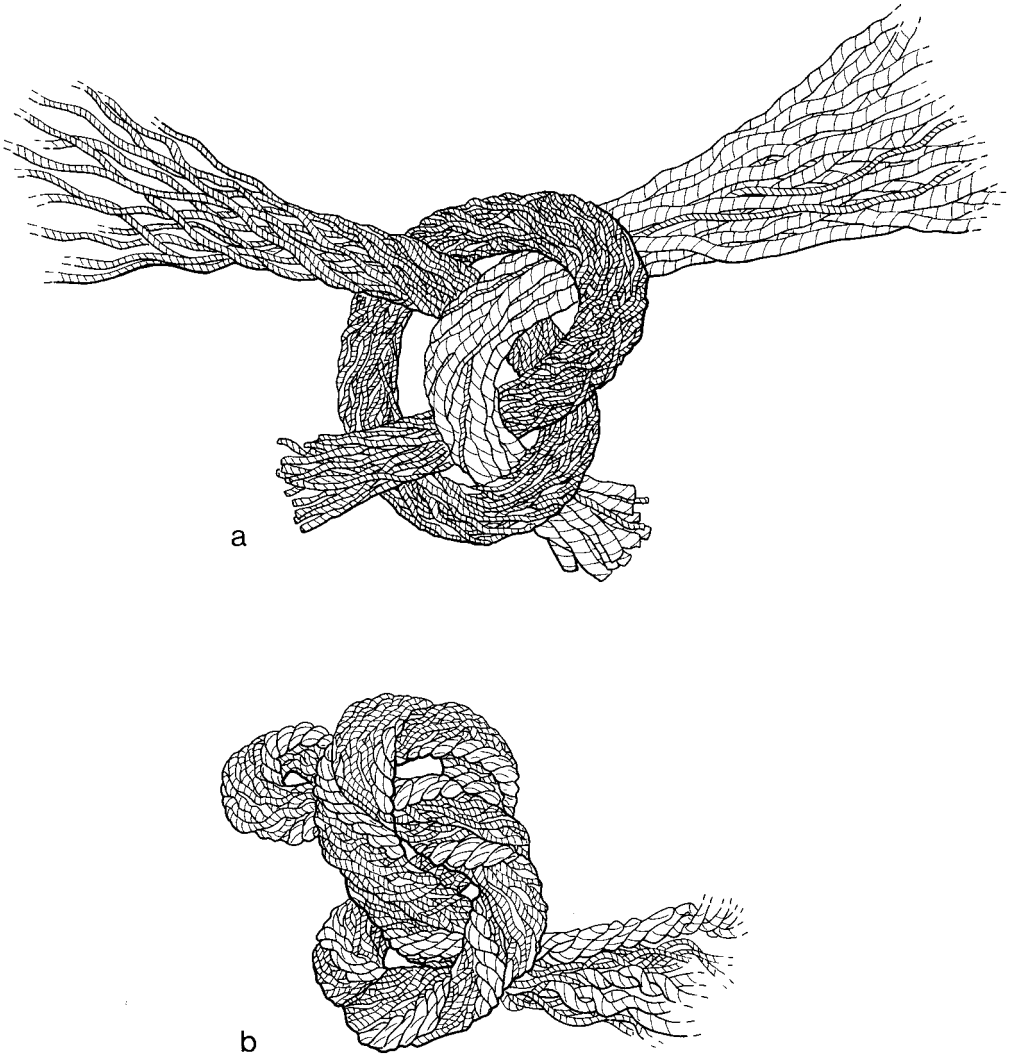


Fig. 165 Knotted wool yarns: a, 1428*; b,* 1424. *Not to scale*

wastage. The coarser cords, such as *1274-6, 1438* and *1461*, must have had some other function. Some of the plied and cabled Anglo-Scandinavian cords have been dyed, suggesting that they have been used for some decorative purpose such as lacing garments or binding hair. Such uses were demonstrated in the dress of a woman in a 12th-13th century grave at Leksand church, Sweden, where yellow and red wool threads had been used to tie her hair and cords used to fasten her cloak (Nockert 1983, 102).

The cords, *1274* and *1379*, which would have been a natural shade of grey or brown may have been used for the same purpose or perhaps for industrial tasks. Four examples, *1435-7* and *1442*, of very tightly plied cords, 2.0-3.0mm in diameter, from 13th–14th century levels, closely resemble modem wrapping string, although the fibre has proved to be badly decayed wool. The poor state of preservation is curious since some of them come from the same context as raw wool and wool cloth preserved in near-perfect condition. It can only be assumed that they decayed while in use, before burial.

It was stated above, p.300, that vegetable textile fibres rarely survive on archaeological sites except under unusual conditions. However, the more woody parts of plant material are often much better preserved and from 16-22 Coppergate there are several examples of hair moss, untreated flax stems and other bast fibres being twisted, plied and plaited (Table 24). These were identified by Allan Hall and Philippa Tomlinson of the Environmental Archaeology Unit, University of York.

Table 24 Anglo-Scandinavian and medieval twisted and plaited vegetable fibre

	Fibre	Structure	Diameter in mm
1406	bast	S	5
1338	?bast	?I5S	5
1339	?bast	S?Z	9
1405	?bast	S2Z	5
1446	flax stems	?-ply	10
1454	flax stems	3-ply	10
1447	hair moss	3-strand plait	25
1448	hair moss	3-strand plait	40
1449	hair moss	3-strand plait	30
1450	hair moss	3-strand plait	?
1451	hair moss	3-strand plait	25
1452	hair moss	3-strand plait	30
1453	hair moss	3-strand plait	40
1455	hair moss	loose bundle	15
1337	?	?S2Z	8
1370	?	S2Z	6

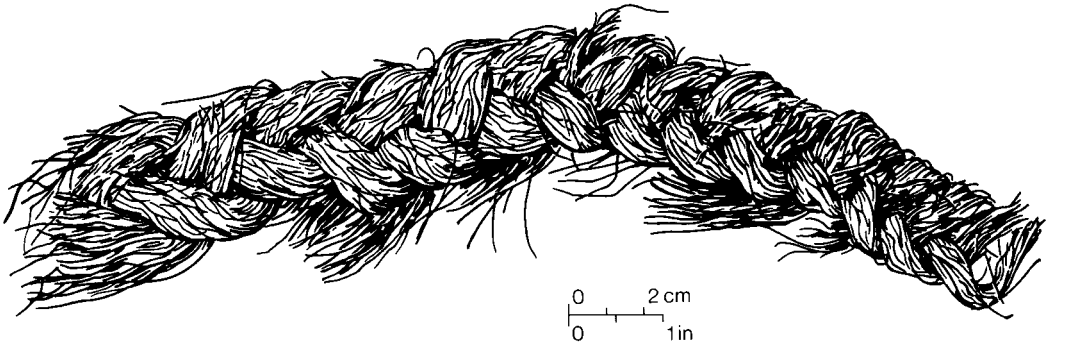


Fig.166 Plaited hair moss, 1448. *Scale 1:2*

Dr Allan Hall has provided the following report on the history and uses of hair moss.

All the moss plaits recovered from the excavation at 16-22 Coppergate are formed of the stems of one species, the common hair moss, Polytrichum commune Hedw. Indeed, in many cases where remains were still attached to the stems, the apical cells on the leaf lamellae were seen to be grooved, indicating var. commune (Smith 1978, 93), the largest and the most common of the varieties.

P. commune is the tallest British moss, reaching about 0.40m, and occurring in 'dark green tufts or turfs, sometimes of considerable size, in bogs, by streams, and on wet heath, moorland, etc.' (ibid.). It is recorded today from all vice-counties of England, Wales and Scotland and is likely to have been much more abundant in the past in areas, like the Vale of York, that had poorly drained, mainly acidic soils. *P. commune* grows as close to the city now as Heslington Common, 3 miles (4.5km) from the centre of York. There is no reason to suppose, therefore, that the moss was not collected locally by the Anglo-Scandinavian inhabitants of York.

Isolated leaves of *P. commune* are regularly found in archaeological deposits of all dates from York and it may be that many of them are waste from stripping the stems for plaits of the kind described here.

Although no other artefacts of *P. commune* were recovered from the excavations, it may be worth remarking that the moss has been used for a variety of purposes in the past. Gilbert White, in a letter to the Hon. Daines Barrington in 1775, recorded 'little neat besoms, which our foresters make from the stalks of the Polytrichum commune, or great golden maiden-hair, which they call silk-wood, and find plenty in the bogs. When this moss is well-combed and dressed, and divested ,of its outer skin, it becomes a beautiful bright chestnut colour; and being soft and pliant, is very proper for the dusting of beds, curtains, carpets, hangings, etc.' (White 1775, letter 26).

Nearer to York, Banks (1886) describes besoms of 'brush moss' or 'moor silk' from Horton Moor, near Horton in Ribblesdale (now North Yorkshire). The local inhabitants, apparently, used no other kind of broom except one of bristles. Høeg (1976), writing of the traditional use of plants in Norway, similarly describes P. commune used for brushes, for example, for cleaning baking ovens. None of these

Table 25 Dyes and natural pigment from 16–22 Coppergate and Lloyds Bank, 6–8 Pavement (see *AY* 17/3). Brackets indicate uncertain results; arrows indicate textiles with two dyes

	Madder	Indigotin	Lichen purple	Kermes	Natural pigment
16–22 Coppergate 9th–11th centuries	*1256* raw wool *1283* raw wool (*1260* wool tabby) (*1301* wool twill) *1379* wool twill *1308* wool diamond twill *1381* wool diamond twill *1309 nålebinding* sock *1270* wool cord *1312* wool cord *1315* wool yarn *1281* silk tabby *1345* silk tabby *1349* silk tabby ⟷ silk tabby *1350* silk tabby *1352* silk tabby ⟷ silk tabby (*1371* silk tabby) *1407* silk ribbon *1340* silk tablet-weaving ⟷ silk tablet-weaving	*1258* wool tabby *1302* wool chevron twill *1343* silk tabby *1347* silk tabby	*1306* fine wool chevron twill *1407* silk thread	(*1342* silk tabby) *1355* silk ribbon *1408a* silk reliquary, outer pouch	*1259* wool tabby *1264* wool chevron twill *1303* wool chevron twill, warp *1274* wool cord *1383* wool cord
Lloyds Bank, 6–8 Pavement 10th–11th centuries	(*584* coarse wool tabby) *591* fine wool tabby *592* fine wool tabby *589* wool twill (*593* wool twill) *576* wool diamond twill (*566* fine wool diamond twill) *567* fine wool diamond twill ⟷ fine wool diamond twill				*666* wool tabby, warp *663* wool chevron twill
16–22 Coppergate Medieval	*1417* wool striped tabby red + brown *1418* wool tabby (*1420* wool tabby) *1460* wool tabby *1461* wool cord *1422* wool/veg. tabby	*1421* wool twill, ?warp *1429* wool yarn *1441* wool cord *1422* single thread			

authors, however, mentions the making of plaits, and the only other examples of this kind of artefact are plaits from prehistoric Scotland (Henshall 1950a, 154) and from excavations of medieval deposits in Shrewsbury (Barker 1961) and in London, for example a piece of plait, 2o98m, from Trig Lane (Rhodes 1982,90). More recently, a massive 10m length of P. commune plait-rope has been described from a 13th century latrine pit in Aachen, West Germany (Kn6rzer 1984), and several large fragments of plait have been recorded from 13th-14th century deposits in Aberdeen (Grampian), Scotland (Hall in prep.). There are no doubt other finds of similar material buried in the artefactualliterature.

The function of the hair moss plaits is difficult to judge. They may have been used as ropes, which seems most likely in the Aachen case, or as bindings for casks etc. Alternatively, the Trig Lane example was tentatively identified as a coiled mat (Rhodes 1982,90): indeed, a coiled basket which may have been of plaited fibre can be seen in the illustration from Ypres (Fig. 164).

The York examples appear to have been constructed by working in a new bundle of fibres at regular intervals, the end of the fibre showing at the back of the plait (*1447–53* and *1455*, and Fig.166). On one example, *1448*, the bundle-ends protrude as much as 70mm, which is surprisingly long if this is only wastage. It should be pointed out that precisely this method of working a three-strand plait, by bringing in new fibres at each turn of the plait, is used in basketry for working the uprights into a plaited edge. Hair moss would seem far too flexible if it is compared with modern basketry cane, yet there is an example of a basket made from *P. commune* from the 1st century Roman camp at Newstead (Borders), Scotland (Henshall1950a, 152): unfortunately this basket is unfinished and has no upper border.

Colour

Most of the textiles have been stained by the soil to such an extent that it is not possible to see any trace of the original colour with the naked eye. Despite this, it was possible in many cases to extract and identify remains of dyestuff. Dr G.W. Taylor, working at the York Archaeological Trust conservation laboratory, undertook the immense task of testing almost all the textiles, cords and raw wool, using techniques described below. Only the mineralised and carbonised remains and a few fragments, too small to allow a sample of yarn to be ifemoved, were not tested in this way. Since this is a comparatively new field and there has been little work on dyes in textiles of this date, Dr Taylor has also examined as many of the textiles from 6-8 Pavement, York (published without a dye report in *AY* 17/3), as were available for study. Results obtained from both are given in Table 25.

Detection and identification of dyes

By **Dr G.W. Taylor**

An outline procedure was kindly supplied by Professor M.C. Whiting of Bristol University. In this, indigotin (the colorant from woad and indigo) and some lichen purple dyes are extracted with a mixture of pyridine and water, and then mordant dyes are extracted with a mixture of alcohol and dilute sulphuric acid. These initial extracts are worked up to further separate any dye from non-dye staining material. The cleaned-up solutions are scanned spectroscopically in the visible region, that is 390–670nm, and, where appropriate, specific further tests are used to strengthen the identification of dye.

The procedure used for these analyses was as follows. The textile sample (preferably at least 10mg) was heated in a water bath at about 90°C with about 3ml of pyridine/water (1/1 by volume) in an open test tube for about one hour. The mixture was cooled; this is the initial extract. Generally speaking, this extract was heavily contaminated with non-dye stain and unsuitable for spectroscopy. Occasionally, however, it was sufficiently clean to be scanned in the spectrophotometer, and sometimes a purplish tinge might suggest the presence of a purple dye. In such cases, the spectrum of the initial extract was scanned; absorption at about 570-590nm indicated the presence of lichen purple. If the presence of lichen purple was suspected, a drop of the extract was placed on a piece of filter paper and this was treated with dilute sulphuric acid; a colour change from purple to pink was a strong indication of the presence of lichen purple, which behaves as an acid/base indicator.

In any event, the initial extract was diluted with two volumes of de-ionised water, and then shaken with a little diethyl ether. The ether extracted any indigotin present, and a proportion of the lichen purple (the degree to which the lichen purple is extracted depends on the particular lichen used to prepare the dye, and also, probably, on the fraction of the dye originally put on the textile still remaining on excavation). The ether extract was either scanned directly or, more usually, the ether was evaporated and the residue takep up in methanol for spectroscopy. A characteristic peak at 605nm indicated the presence of indigotin.

The spectroscopy was carried out using a Perkin-Elmer model 402 spectrophotometer, adapted to take glass microcells.

The residual textile was rinsed with de-ionised water in preparation for the test for mordant dyes (or a new sample was taken if supplies warranted it). The textile was heated at up to 90°C in the water bath with about 3ml of Industrial Methylated Spirit/ l0% aqueous sulphuric acid mixture (2/1 by volume), again in an open test tube, for about one hour. The acid hydrolysed the link between the mordant and the dye, and the alcohol then extracted the dye itself. The latter part of the heating time served to evaporate the alcohol, leaving an acidic residue. This was cooled and extracted with ether. The ether extracts colorants of the madder type, kermes, weld and most other mordant yellow dyes. It does not extract to an appreciable extent cochineal, brazilwood, and logwood; however, the chance of any of these dyes being available in Europe, and probably the Middle East as well, in the 10th and 11th centuries, is small.

The ether was evaporated from the extract and the residue taken up in a little methanol. The methanol solution was sometimes scanned directly in the spectrophotometer but, as a routine, a few crystals of magnesium acetate tetrahydrate were added first.

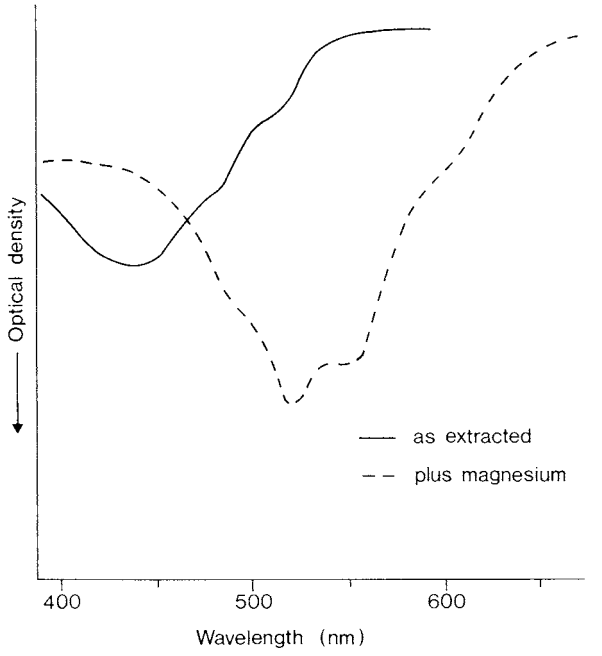


Fig. 167 Spectrum of madder dye, extracted from wool

The magnesium salt was added to enhance the sensitivity of the dye detection. The test was based on a finding by Shibata et al. (1950) who developed their paper chromatograms of hydroxyanthraquinones by spraying with a dilute methanolic magnesium acetate solution. Many of the natural dyes, particularly the reds, contain compounds which should react with the magnesium salt; for example, the colorant in madder is made up of at least nineteen hydroxyanthraquinones, of which the main ones are reported to be alizarin, purpurin, and pseudopurpurin (Burnett and Thomson 1968). In the YAT laboratory, a solution in methanol of the colorant stripped from wool dyed with madder was yellow; addition of magnesium acetate resulted in a red colour. The absorption spectrum of the dye was both shifted to longer wavelengths and increased in intensity; both these effects enhance the detecta- bility of madder in a dye extract contaminated with non-dye stain. Most of the mordant dyes expected to react with magnesium did so; however, the spectrum shift with yellow dyes was not, in general, sufficient to separate dye absorption from that of dirt, and in archaeological samples these dyes will probably not be detected by the methods used in this investigation-but in any event, the chances of survival of such dyes are small.

The absorption spectrum of the colorant from madder in the presence and absence of magnesium acetate is shown in Fig. 167 . The colorants from dyes such as wild madder and lady's bedstraw produce similar spectra; however, in the presence of the magnesium salt, the shoulder in the spectrum of madder at about 600nm (which is due to alizarin) is absent.

Many of the Anglo-Scandinavian textiles seem to have been dyed with madder-type dyes and, in several cases, sufficient dye survived to determine whether madder itself (*Rubia tinctorum* L.) had been used. In all cases, spectroscopy suggested the presence of alizarin, and this was confirmed by paper chromatography, using the solvent system, Industrial Methylated Spirit/water (1/1 by volume). Development with methanolic potassium hydroxide produced a purple spot at Rf 0.6, comparable with that from an alizarin standard; this spot was absent in the colorants from wild madder and lady's bedstraw. Therefore, it is highly likely that the dye used in York was indeed from *R. tinctorum*.

Approximately two-thirds of the woven textiles and a much lower proportion of the cords and raw wool showed evidence of dyeing. This does not mean that the remainder were undyed: in some cases a dye may simply have decayed beyond detection. Yellows in particular are very difficult to detect and identify and their absence here does not mean that they were not used.

Table 25 shows that even the coarsest textiles might be dyed, but that kermes and lichen purple have only been used in the finer wool and silk fabrics, some or all of which are imports. Madder and indigotin on the other hand have been used for both fine and coarse textiles, several of which are almost certainly local products. Indeed, unexpected confirmation of dyeing being carried out locally came with the discovery of the remains of dye plants in soil samples from Anglo-Scandinavian levels of Coppergate. Madder, *Rubia tinctorum* L., dyer's greenweed, *Genista tinctoria* L. and a clubmoss, *Diphasium complanatum* (L.) Rothm. (formerly *Lycopodium complanatum* L.), were the first to be identified (A.R. Hall et al. 1984) and more recently woad, *lsatis tinctoria* L., has been discovered (AY 14/7, in prep.).

Madder

Madder was by far the most common dyestuff in the textiles of both sites, being found in both wool and silk textiles and, in two instances, raw wool. That fibre was being dyed before it was spun is an interesting indication of the dyeing practices of the period. Madder dye, which gives a strong brick-red, is derived from the roots of *R. tinctorum*. A similar dye may also be obtained from other Rubiaceae and from lady's bedstraw, *Galium verum* L. In all the cases where the dye was present in any strength, however, it was possible to identify it as *R. tinctorum* rather than the native madder, *R. peregrina* L. or *G. verum* (see above). *R. tinctorum* is native to Asia Minor, the Caucasus, Greece and other parts of southern Europe (Schaefer 1941, 1398) but may have been grown in Gaul as early as the Roman period (Wild 1970,81). Charlemagne in his *Capitulare de Villis vel Curtis lmperialibus* (no. 70, Loyn and Percival 1975, 73), recommended that madder should be cultivated in his empire; and a 9th century forged charter of King Dagobert, purporting to authorise the inhabitants of Quentovic to sell madder at the fairs of St Denis (Pertz 1874, pt 2,140-1, no.23) indicates that the madder trade was important to the merchants of northern France at this time.

In English documents madder appears in two leechdoms and a herbal of the 11th century5 but it is not clear how far these are based on classical texts rather than personal

observation. The same problem may attend a 10th-11th century document in which the planting of madder is referred to as one of the duties of a reeve (Gerefa, Corpus Christi College Cambridge MS 383, in Swanton 1975,26). There is therefore no definite evidence that madder was cultivated in England in the Anglo-Scandinavian period. However, in the 12th-13th centuries, when madder seems to have been the most commonly used dye (Walton 1984,30) there is no record of the import of the dyestuff (Carus-Wilson 1954, 218). Carus-Wilson suggests that the plant was being grown in this country and that native supplies were sufficient to meet demand. Be that as it may, in the following centuries madder was certainly being imported, from Flanders and, later, The Netherlands (ibid., \ 170; Schaefer 1941, 1400), and there are records of York merchants in the 16th century importing it through Hull (Willan 1976, 15).

Of particular interest among the medieval textiles is the striped piece of 13th-14th century date, 1417 (PI.XXXIVa). This includes areas of probably undyed wool alternating with narrow stripes of red and brown. Both of these stripes on analysis proved to contain madder, although the red gave a much stronger spectrum than the brown. While it is possible that the madder in the brown stripe has bled from the adjacent red, it is more probable that this is a case of two different mordants being used in conjunction with the same dyestuff to produce different colours. A mordant is necessary to fix some dyes permanently on to the fibre, and in the medieval period the most commonly used with madder for a good red was alum (de Poerck 1951, 1, 168-71); if iron is substituted for alum, the result is brown. It is possible that alum was more difficult to obtain in the Anglo-Scandinavian period and that the clubmoss *Diphasium complanatum* (L.) Rothm., which was found at 16-22 Coppergate (see above), may have been used as a substitute (Høeg 1976).

Woad

Indigotin was present in a much smaller number of textiles than madder. This is a blue dye derived by a complicated process of fermentation and oxygenation from the leaves of either the woad plant, *Isatis tinctoria* L., or indigo, Indigofera tinctoria L. The two silks, 1343 and 1347, being eastern in origin, could conceivably have been dyed with indigo from India, but since the use of indigo as a dye, rather than a pigment, was not apparently known to Europe before the 15th century (Taylor and Singer 1956,365), it can be assumed that the indigotin in most of the York textiles is from woad.

Woad was originally a plant of southern and eastern Europe, but had arrived in Britain by the time of Caesar (Forbes 1964, 100, 110). Evidence for its cultivation after the Roman occupation includes an impression of its seed in Anglo-Saxon pottery from Somersham, Suffolk (Jessen and Helbaek 1944, 58) and the seeds themselves in the 9th century Oseberg ship-burial in Norway (Holmboe 1927). The sowing of woad seed is also mentioned in the same Anglo-Saxon document as the planting of madder (see above). In the medieval period woad continued to be grown in England but was supplemented by supplies from the Continent (Salzman 1923,208; Brunello 1973, 147-59). There are records of woad being traded into York in 1251 (Carus-Wilson 1954,218).

Both madder and indigotin have been identified in the textiles of 7th century Sutton Hoo (Whiting 1983, 465), the 9th–11 th century finds from Milk Street, London (Pritchard 1983, 22), the medieval textiles of Perth and Baynard's Castle, London (Whiting, pers. comm.) and the 16th and 17th century textiles from Newcastle upon Tyne (Walton 1981, 198; 1983,227). Clearly these were two fundamental dyes, the main sources of red and blue over a long period of time. Together with a yellow, such as the dyer's greenweed found at 16-22 Coppergate, they would make available a range of colours (and, in fact, the combination of madder plus woad for purple was identified in a textile, 567, from 6-8 Pavement). However, the repeated use of the same two dyestuffs suggests that even among the Anglo-Saxons and Anglo-Scandinavians, for whom textile production was largely home-based, it was preferable to obtain dyestuffs in the market place rattler than to search out the hedgerow plants which could have given a similar range of colours, if in less concentrated form.

Kermes

Kermes is obtained from the bodies of an insect, *Kermes vermilio* (Planch.) Targ. (Schweppe 1986, 159), which, when dried and ground, produces a red dye, a true vermilion with an alum mordant, or a full scarlet if acid is added to the dye bath (Mairet 1916,31). \ The insect lives on the leaves of the kermes oak, *Quercus coccifera* L., which grows in the countries bordering the Mediterranean. It was used in this region from the earliest times and all the silk-weaving centres of the Mediterranean and the Near East would have had ready supplies of the dye (Brunello 1973,61-2,96-7,123-4,364). Kermes was imported into England in the medieval period (Carus-Wilson 1954,51,218), and is to be found in the better-quality textiles of that period (Walton 1984, 30-31). It was always an expensive dye, however, and it is not surprising that the cheaper madder was the more common red to be used in the wool textiles.

Lichen purple

Perhaps the most significant of the dyes encountered is the one identified as lichen purple. There are a wide range of lichens which give similar shades of purple and which showed little variation one from another in tests (Taylor and Walton 1983). The most important lichens in the ancient world were the ones which grew on the shores of the eastern Mediterranean, probably *Rocella tinctoria* and *R.fuciformis.* These produced the dyestuff fucus which was used either to extend the more expensive Tyrian (shellfish) purple, or as a substitute for it, or to add a violet hue to red and blue dyes. The use ofpurple appears to have declined towards the end of the Roman Empire (Kok 1966, 250) and there are no more records of lichen purple in Europe until its supposed re-introduction under the name of 'orchil' as a Florentine monopoly in the early 14th century (Brunello 1973, 133, 384). This has led some authors to assume that dyeing with lichen purple was completely abandoned in post-Roman Europe (ibid.), but the evidence of the York textiles cannot support this conclusion.

The lichen purple-dyed silks from 16-22 Coppergate, *1349* and *1352*, may indeed be from the eastern Mediterranean silk manufactories where the use of lichen dyes would have continued uninterrupted. The same may be true of a group of figured silks and embroideries of Anglo-Saxon design from Maaseik, Belgium, which also included lichen purple (Taylor and Walton 1983, 15). In some of these, as at 16-22 Coppergate, the dye was combined with others (madder in the Coppergate textiles, indigotin in the others), a practice noted by both classical and later authors, where the dye's tendency to fade and the necessity of over-dyeing it with faster dyes is frequently mentioned (Kok 1966,249,251, 267). However, the fine wool chevron twill dyed with lichen purple, 1306, was described above as being the product ofa European weaving centre. To the evidence of this piece may be added three chevron twills of similar structure from 9th-10th century Milk Street, London (Pritchard 1984); two of these were definitely dyed with lichen purple, one of them combined with woad, and a third may also have been dyed with the same dyestuff. An 11 th-13th century fine wool twill from Petergate, York, also contained lichen purple (Walton, in prep. b) and although there is some doubt as to the exact date of this particular textile, it certainly predates the Florentine trade in orchil.

Annette Kok, in her detailed survey of the history of lichen purples, has pointed out that the species of lichen known to have been used in the eastern Mediterranean is also found on the south coast of France. Other species which produce a similar dyestuff are found in the region of the Alpes Maritimes and the Massif Central and still more grow in eastern and northern Britain, Ireland and Scandinavia (although not in southern Britain or northern France) (Kok 1966,252). She considers that the knowledge of the use of this dye would not have been lost after the collapse of the western Empire, but rather may have received fresh impetus from the demands of the new kingdoms of the post-Roman period, which would have inherited the association of purple with aristocracy from the Romans. Furthermore, she points to the medieval records of the Norwegian lichen dye, 'lacmus', and the similar Scottish dye 'corcur' or 'korkir' as a possible indication of a continuing tradition of dyeing with lichen purple in north-west Europe (ibid., 251-4). Now to her body of evidence must be added the important findings from these Anglo-Scandinavian and late Anglo-Saxon chevron twills, conclusive evidence that the dye was in use in western Europe between the Roman period and the 14th century.

Undyed textiles

It has been stated above that where dye has not been detected, the textile may still have been dyed originally. Dye may never have been applied, however, where naturally brown, grey or fawn wool has been used. Natural pigment can be seen under a high-powered microscope as granules in the fibre, the closer together the granules, the darker the colour of the fibre. In 1303 a very dark, naturally pigmented yarn in the warp has been combined with a non-pigmented yam in the weft, to give what would once have been a striking pattern

of dark brown and white twill diagonals (PI.XXIVa). In 1259 (PI.XVlla) an overall brown would have been achieved, while in 1264 (PI.XIXb) a mixture of white and brown fibr~ has produced an overall mottled effect which is still visible to the naked eye.

It was not always possible to identify which of the textiles from 6-8 Pavement incorporated pigmented wools, but it is clear from the report (pp.127-32, 164, *AY* 17/3) that some naturally dark yarns were used and also that brown and white yarns were combined in the same textile for pattern effects (e.g. 666). It was also evident that in one case, 663, a textile had been dyed even though it was made from up to 30% pigmented fibres, which would have detracted from the purity of its colour. However, this seems to have been a rare practice: for example, three late Saxon textiles which made use of pigmented yarns also gave negative results to dye-testing (Pritchard 1982,22).

Pigmented wools were only used in the coarse and medium-coarse textiles and it would appear from the literature of the period that dyed yarns were generally much preferred, since the wealthy and aristocratic are regularly described as wearing brightly coloured clothes, while only the poor and the pious wore undyed wool cloth (Owen 1976,533; 1979, 203-4). Silk, however, may also have been used undyed on occasion: an Anglo-Saxon leechdom describes a jaundiced patient as *ageolwað swa god seoluc* ('yellow as good silk') (Cockayne 1865, 2, 106-7), which suggests that silk's natural golden colour was well known.

Linen on the other hand was probably for the most part bleached rather than dyed, to provide a clean white fabric suitable for undergarments and bed-linen, although some of the patterned linens may have been dyed for outer clothing. Attempts to analyse the carbonised linens, however, proved unsuccessful.

Needlework on the Anglo-Scandinavian Textiles

Stitching has been recorded on several Anglo-Scandinavian textiles from 16-22 Coppergate but not on any of the medieval finds. The needlework is functional and non-decorative except for some embroidery on the silk reliquary, 1408. Some embroidery on a piece of leather (sfI1580, *AY* 17, in prep.), is also discussed here. The stitching-some functional, some decorative-on the textiles from 6-8 Pavement was not discussed in detail in *AY* 17/3 and is included here.

Several different types of hems were found on silk, linen and wool textiles, their technique for the most part varying with the different fibres and the different thicknesses of fabric (Figs. 168-9). Silk has almost always been given a rolled hem which thus tidies up the edge and keeps it from fraying, while using the minimum area of this valuable material (1343..1345.. 1349 and 1372, Fig.168a). Only on one silk object is there a deeper hem, at the front edge of 1349, possibly a child's head-dress, where a band 15mm wide has been folded back and stitched (Fig. 154, PI.XXXla).

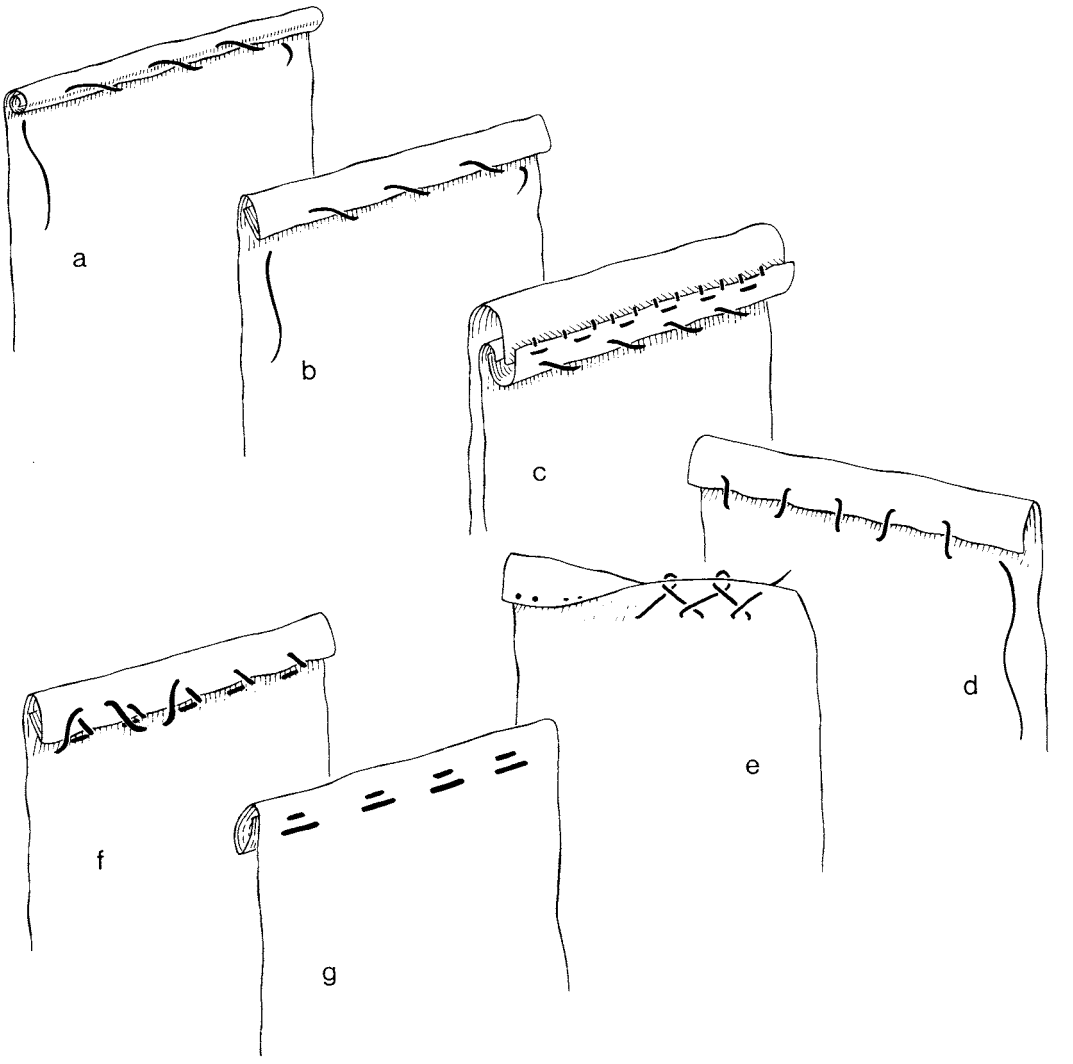
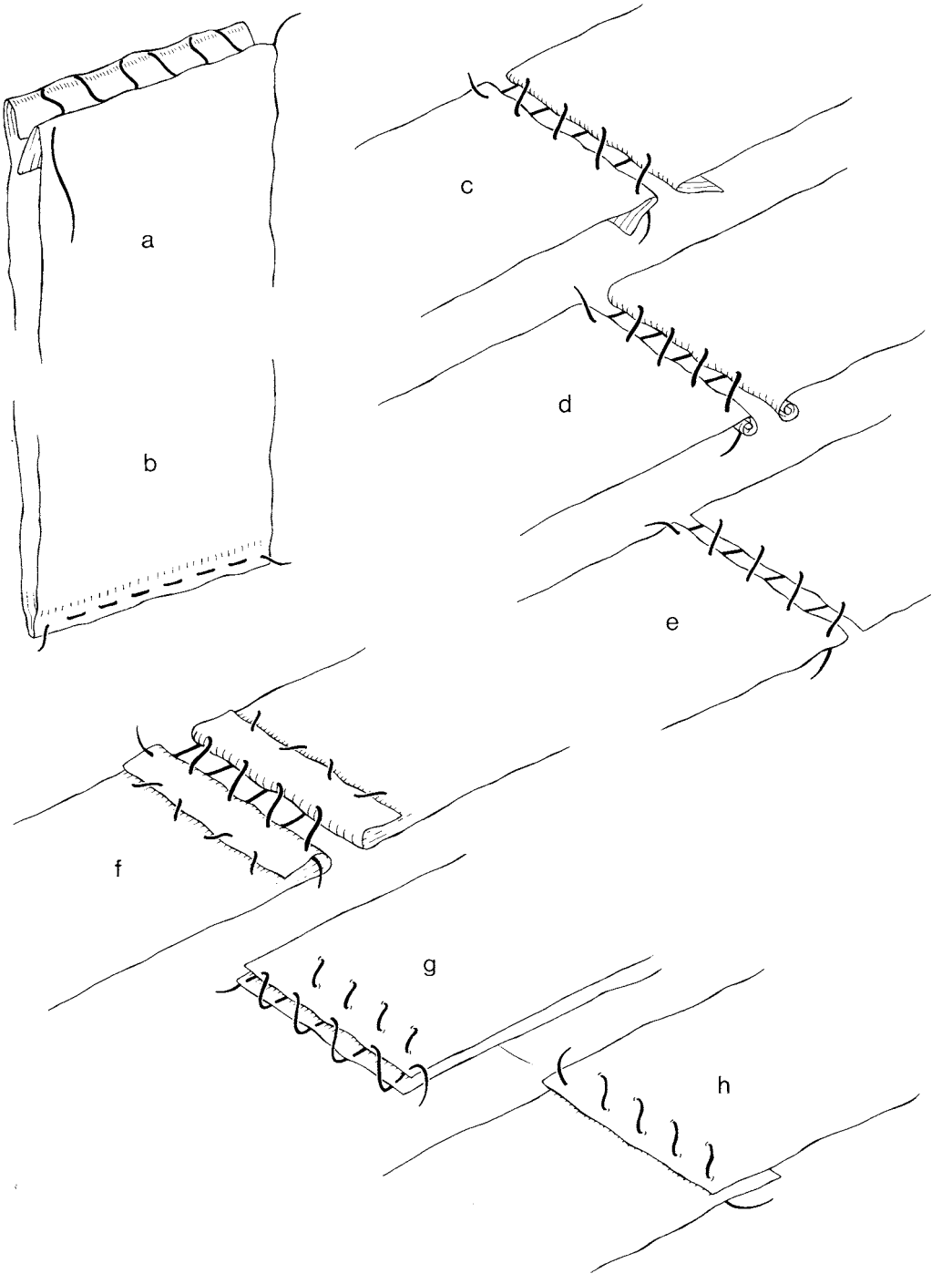


Fig. 168 Hems on the Anglo-Scandinavian textiles: a, rolled, on silk, as on 1343*; b, raw edge, turned under twice, on linen, as on* 1321*; c, two raw edges bound together and turned under once, on wool, as on* 1460*; d, raw edge turned under once and hemmed with an upright stitch, on wool, as on* 1259*; e, herringbone on wool as on* 663 *from 6–8 Pavement; f and g, as d but with added decorative stitching as on wool fragment* 669 *from 6–8 Pavement. Not to scale*

The carbonised textiles, assumed to be linens, have been hemmed by folding in the raw edge twice and working the same hemming stitch as for the silks (1321, 1333J 1397, Fig.168b). Since linen is less valuable than silk and takes folds more easily, this is an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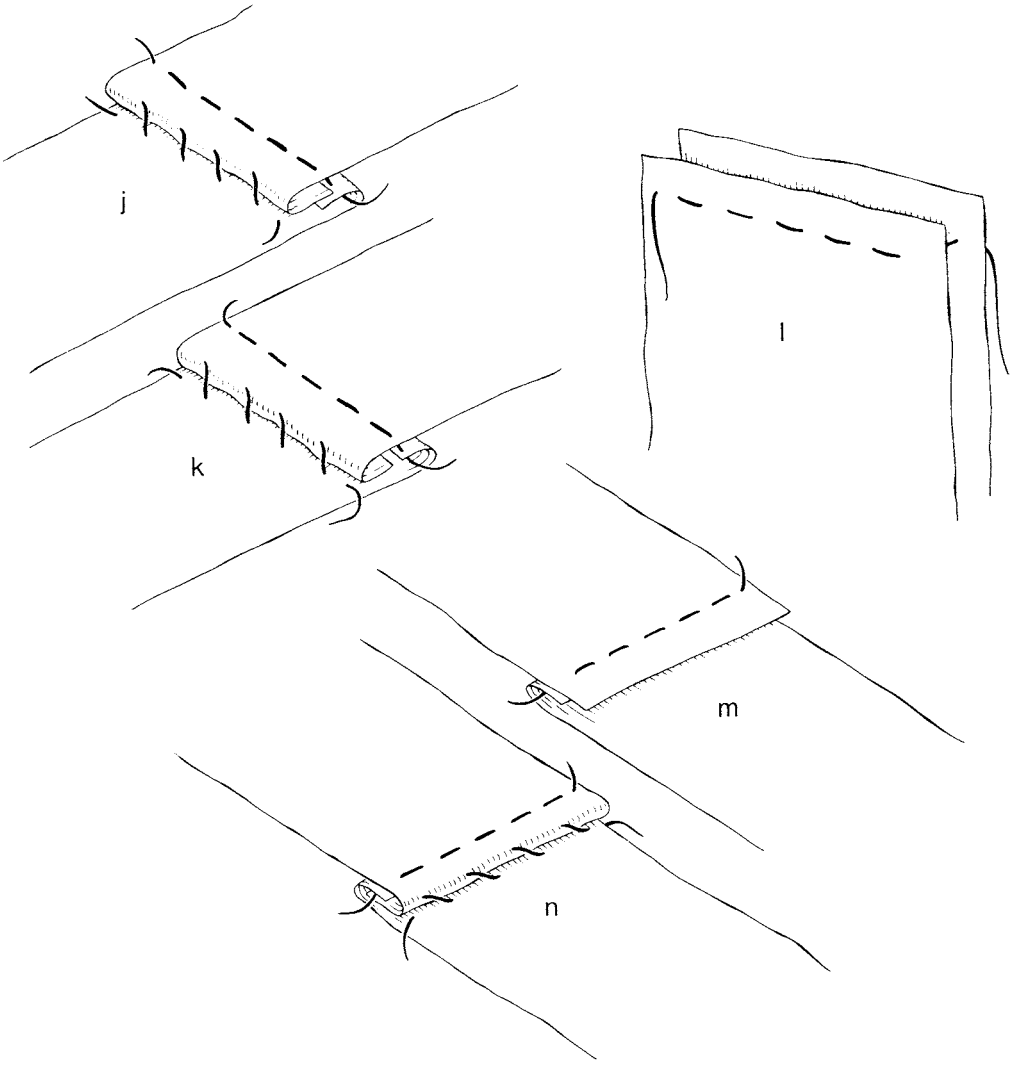

Fig. 169 Seams on the Anglo-Scandinavian textiles; a, raw edges turned in and joined with a simple catch-stitch, on silk, as on the reliquary pouch 1408; b, as a, with addition of running stitch along the fold, as on 1355; c, overcast, on silk, as on 1355; d, overcast with rolled hems, as on the silk head-dress 1372; e, raw edges overcast, on wool, 1460a; f, overcast on wool, 1259; g, overcast on double layer with diagonal running stitch on silk, 1349; h, diagonal running stitch joining two selvedges, as on linen piece 1397; j, run-and-fell on linen, as on 1390; k, run-and-fell seam joining 1320 and 1328; l, m and n, method of constructing a run-and-fell seam. Not to scale

appropriate type of hem to use here. One of the medium-weight wool textiles from 6-8 Pavement (662, p.164, *AY* 17/3) was also hemmed in this way.

Most of the coarser wool textiles were only folded under once, presumably because of their greater bulk. This then presented the problem of how to finish off the still-visible raw edges, a problem resolved in several ways. In 1460 (PI.XVIII), two layers of the same thick textile were bound together at the edges by a strip of much finer fabric, before being folded under and hemmed (Fig.168c). On two other textiles, 1259 and 1263, a more upright stitch has been used to create less pull on the threads at the edge of the fabric (Fig. 168d). Along the curved edge of fragment 663 from 6-8 Pavement (p.164, AY 17/3), a herringbone stitch has been worked, again to prevent fraying; further along, this same edge has been turned in, suggesting that it may originally have been hemmed (Fig. 168e). No hems have been found on the finer wool textiles from 16-22 Coppergate, although there are some irregular stitch holes, approximately four per centimetre, at the edge of two fragments of diamond twill, 1267 and 1268, on the skeleton (pp.331-2). However, a fine diamond twill (669) from 6-8 Pavement (p.164, *AY* 17/3), was given an ordinary hem (Fig. 168d), with more decorative stitching added in a contrasting shade. Unfortunately the structure of this stitching is not clear, although its appearance is as shown in Fig. 168f and g.

The seams used to join two pieces of textile also vary according to fabric-type. The raw edges of both inner and outer pouches of the silk reliquary, 1408, were turned in and joined with a simple catch-stitch (Fig. 169a), and the same method appears to have been used to join one of the silk ribbons, 1355, to another fabric no longer present (Fig.155b). On both these items a running stitch has been worked along the fold to keep it firm (Fig. 169b). Where a flat join was required, silk was usually overcast from the outside (1350, 1355, 1408b, 1460, Fig. 169c), in the case of the silk cap, the raw edges being given rolled hems to neaten them up (1372, Fig. 169d, Pl. XXXa). This overcasting can also be seen in two wool textiles, but in one case, 1460a (Fig. 16ge), this is probably just the joining of a tear and the other, 1259 (Fig. 169f), is very loose and its function not clear.

One double layer of silk has been stitched by overcasting the edge and then working a kind of diagonal running stitch a little further in (1349, Fig.169g). This last is a useful stitch for loose, open fabrics, causing less strain on any particular thread of the weave. It has also been used on one of the coarsest of the linens, 1397, to join two selvedges (Fig. 169h), and on a finer linen, 1398, to join two overlapping pieces. However, most of the linen flat seams are a reversible type called 'run-and-fell' (1320, 1328, 1390, 1395, 1401 Fig.169j and k). These are constructed by laying the two fabrics together and working either a running stitch or backstitch some distance in from the edge (Fig. 1691); one of the raw edges is then trimmed shorter than the other, the fabric opened up and the edges pressed to one side (Fig. 169m). The upper raw edge is then turned under and hemmed in place. It is usual to tuck the longer raw edge under the lower, as in Fig. 169n, but there is probably not any significance in the variants found at 16-22 Coppergate, Fig. 169j and k. This seam, being flat and with no raw edges on either side, is suitable for underclothes, shirts and bed-linen.

The sewing thread of these hems and seams (see Table 26) for the most part matches the fibre of the fabric being stitched, wool on wool, linen on linen and silk on silk; however

Table 26 Anglo-Scandinavian sewing yarns used for seams and hems of textiles

	Fibre	Spin/Ply	Diameter in mm	Comments
1259	wool	Z2S	1·8	combed wool
1263	wool	Z2S	0·7	combed wool
1303	wool	Z2S	1·8	combed wool
1309	wool	Z2S	1·5	
1321	carbonised	?Z2S	0·5	
1328	carbonised	Z2S	0·5	
1390	carbonised	Z2S	0·4	
1395	carbonised	Z2S	0·6	
1398	carbonised	?Z2S	0·5	
1401	carbonised	Z2S	0·6	
1342	silk	I	0·7	
1343	silk	S	0·5	
1345	silk	Z	0·1–0·2	used double
1349	silk	S	0·5	brown
	silk	Z	0·4	red
	silk	Z	0·4	brown
1351	silk	I	0·5	
1355	silk	S	0·5	?dyed with kermes
	silk	S	0·4–0·5	?dyed with madder
1372	silk	S	0·4	head-dress
1408a	silk	I	0·5	reliquary
b	silk	S	0·5–0·7	
b	silk	S	0·4	

in some cases linen has been used on silk, as is evidenced by the stitch holes with decayed remains of vegetable fibre in, for example, the hems of the silk cap, 1372. Both wool and linen sewing thread is usually two-plied, S-twisted from Z-spun threads, the wool yarn mostly being of combed wool and thus very smooth. Silk on the other hand is often used singly, twisted either in the S or Z direction and sometimes without any twist at all.

The silk is of course finer than the other sewing yarns, 0.3-0.8mm in diameter, and the stitching closer together, 4-6 stitches per centimetre. The linen plied threads are also mainly fine, 0.4-1.0mm diameter and 3-5 stitches per centimetre, but wool yarns are 0.8-1.5mm diameter and 1-3 stitches per centimetre. There was usually too little of the sewing thread to allow a dye test, but it is apparent that occasionally they were dyed, sometimes in a different colour from the ground weave.

Apart from the functional seams and hems, there are two examples of embroidery and two decorative braids worked along folds or seams. One piece of embroidery is the cross on the silk reliquary, 1408, which is so abraded that the stitch is difficult to identify, but is probably a crude chain stitch (PI.XXVIIa). The other embroidery is worked on a strip

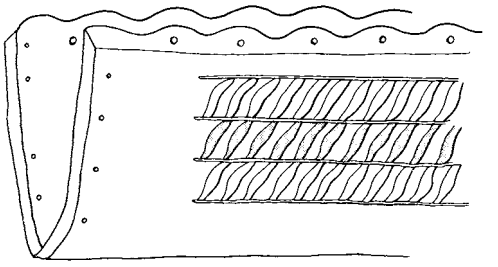

Fig. 170 Strip of embroidered leather from the Anglo-Scandinavian period, sf11580. Diagram showing sloping overstitching in pink and natural silk. Scale 3:1

of leather, 0.30m long and 20mm wide (sf1580, *AY* 17/16, 2003). This has been folded in half lengthways and parallel lines scored into the surface of one face. Rows of sloping overstitching have been worked by picking up the surface of the leather between the scored lines. The embroidery thread is reeled silk, the outer rows in natural, the middle row in pink (Fig. 170). The edges of the strip have obviously originally been sewn, but this thread is no longer present.

A braid worked in wool on textile 574 from 6-8 Pavement was described by Hedges as having 'nine longitudinal threads acting as a warp for a tenth which was woven backwards and forwards between them' (p.114, *AY* 17/3). At this period such decorative braids were often produced by an elaborate form of stitch work (e.g. Hald 1980, 283), but examination of this particular braid showed it to be a diagonal plait stitched with a separate thread to the fold. Another braid, this time in silk, was worked along a fold of the silk, 651, from 5-7 Coppergate (Fig.152b, Pl.XXXIb; p.136, *AY* 17/3) but the structure of this particular braid or embroidery has not been determined.

Discussion

Most of the seams and hems recorded here have been commonly used over a long period of time and are still in the repertoire of the present-day hand-sewer. The simple hemming stitch of Fig.168a and b is certainly a universal technique and this and overcast seams have been recorded from several sites, for example Roman Iron Age Feddersen Wierde, 8th century Elisenhof, Viking period Hedeby and medieval Oslo (Ullemeyer and Tidow 1981, 85; Hundt 1981, 195; Hiigg 1984b, 149-152; Kjellberg 1982, 149). Run-and-fell has also been found at Elisenhof (Hundt 1981, 195), 7th-8th century Hessens (Tidow and Schmid 1979, Abb 4), Oslo (Kjellberg 1982,149) and as far away as Islamic Egypt (G. Eastwood, pers. comm.).

The herringbone hemming stitch shown in Fig.168e seems to be relatively rare, although it has been found on a fragment of a wool garment from Hedeby (Hiigg 1984a and b,40, 150). However, a similar stitch, and another of the type shown on Fig.168d, have been used elsewhere not to bind edges but to join seams, for example, in an Iron Age find from Huldremose, Denmark (Hald 1980,280,358), and in another from Elisenhof.

The particular method of binding raw edges with a finer fabric described here does not appear to have been recorded from other sites as yet, although a flat strip of firmer cloth had been used to edge a cloak at Leksand church, Sweden (Nockert 1983, 101). According to the documentary record, a worsted binding tape called 'caddis' was being used in England by the medieval period (Edwards and Nevinson 1970, 11).

As far as embroidery is concerned, the rough chain stitch of the reliquary, 1408, bears little relationship to the skilful embroideries of opus anglicanum, for which England was renowned in the Anglo-Saxon and medieval periods. The embroidered piece of leather, however, has several parallels in 12th–13th century Europe. It is undated, but similar scored strips without any stitching remaining, have been found in medieval levels at 16-22 Coppergate (*AY* 17, in prep.). The embroidery of shoes at this date seems to have been relatively common among the wealthy, several examples surviving among the relics of clergy and royalty in continental treasuries (e.g. Schmedding 1978, 100, 101). Shoes with a strip of embroidery along the front vamp seam are known from 12th century London (Pritchard, pers. comm.), but the strip from 16-22 Coppergate, with its embroidery on one half only, is more likely to be an edging for the ankle opening (called a 'top band'). Arne Larsen of the Historisk Museum, Bergen University, writes (pers. comm.) that in Norway this style of decoration most commonly occurs in 12th-13th century shoes, from sites such as Bryggen, the medieval docks area of Bergen.

The Textiles in Context

Anglo- Scandinavian

The fragments from 16-22 Coppergate appear to be remnants of everyday textiles, used for clothing, furnishings and sacking, along with debris from cloth-making, such as cut-off ends of yarn and raw fibre. The majority of these finds seem to have been unwanted pieces, casually thrown down on to the muddy walkways of the site, lost in the corners of the earth floors of the houses, or discarded in the middens and cess pits of the backyards. Thus their survival, or at any rate the survival of those worked in wool and silk, was assured by early burial in the damp soil of this riverside area.

Some also were burned, possibly in a house fire, and left lying about outside: to the charring process of such a fire is owed the unusual survival of linen textiles. As well as these, some more precious items such as the silk reliquary were probably not deliberately disposed of, but lost accidentally amongst the general accumulation of rubbish which surrounded the buildings; and there is also one example of the remains of a garment found in association with a human burial.

Together, these discoveries represent a cross-section of the textiles in use in a busy workshop area of York during the Viking Age. The catalogue of fabrics shows a considerable variety, ranging from the coarse heavy-duty wool tabbies, through thick and warm twills

and piled fabrics, to finer patterned weaves, again in wool, together with thinner linens and lightweight silks. In the earlier pages these finds have been described in detail along with their parallels from elsewhere. It should now be possible to fit the Coppergate textiles into the rather fragmentary picture of contemporary textile manufacture and trade which can be built up from the documentary and archaeological evidence, and to suggest a place of origin for some of the fragments.

The textiles themselves, however, are not the only evidence for textile production. The site was littered with textile implements (see *AY* 17/14, 2000) such as spindles and whorls, loom weights, pin-beaters, a weaving tablet, linen smoothers, needles, shears, a wool- comb and spikes associated with wool and flax preparation, as well as raw wool and flax fibre, lengths of spun yarn and a considerable volume of dyeing materials. Work is still in progress in plotting the distribution of these finds and it is not yet clear whether there is any concentration in any particular building at any particular date. However, such a volume of textile production within four tenements of a 10th-11th century town may well be significant. The 10th-12th centuries saw considerable changes in the organisation of textile-making, away from home-based weaving towards professional production of cloth for trade, and it is possible that the Coppergate site marks the first steps in these changes.

Organisation of weaving

In the two centuries after the Romans left Britain, long-distance trade deteriorated and regional self-sufficiency probably became necessary in most raw materials (Hodges and Whitehouse 1983,52-3,76,79-84). Weaving at this stage seems to have been largely the responsibility "of the womenfolk of the household (who on death were buried with their textile tools) and geared to the needs of the family (Hoffmann 1964,258-61). As trade conditions improved, some types of cloth were exchanged, but even by the late Anglo- Saxon period it was considered that wealthier estates should be able to supply their own wool, flax and dyestuffs and prepare, spin, weave and dye their own textiles: see Gerefa (reeve), in Corpus Christi College Cambridge MS 383 (in Swanton 1975, 26). This document is particularly relevant to textiles from the York region as it was probably written or reworked by Wulfstan, Archbishop of York, 1002-23 (Cooper 1970, 11-12).

Such estates were apparently able to employ servants and slaves to work on textile manufacture; for example the will of Wynflaed, a prosperous woman of the mid 10th century, mentions that two of her slaves were a 'woman-weaver and a seamstress' (Owen 1979,222). The 10th century will of £thelgifu also mentions a non-free fuller on one of the estates (Whitelock 1968, 6). Some of the larger estates may have housed the spinners and weavers together in gynaecea of the type described in the late 8th century Carolingian 'capitulary, Capitula Te de Villis vel Curtis lmperialibus (nos.43 and 49, Loyn and Percival 1975,70). Such a weaving house may have existed close to the mid 9th to late 10th century manor at Goltho, Lincolnshire, where pin-beaters and other textile tools have been found on the floor of a large outbuilding (Beresford 1987, 55-8, 68).

To some extent there were regional specialities and cloth did occasionally enter into trade, particularly as trading conditions improved through the 7th-8th centuries. At the time of Offa, Britain seems to have been sending cloaks to Charlemagne's empire (letter from Charlemagne to Off a, AD 796, Whitelock 1955,781-2), perhaps a continuation of the Roman trade in British byrrt. (Wild 1967,648). Anglo-Saxon England was also noted for its silk and gold embroidery of vestments and hangings (Dodwell 1982, 45-9; Budny and Tweddle 1984). Piled fabrics from Iceland and Ireland were traded (Guoj6nsson 1962, 70), along with 'Frisian' cloth, the identity of which is discussed above (p. 339) and below (p.416). By the 9th-10th centuries, the monastic houses of the Continent were taking in tithes of wool and flax (as well as woven cloth), weaving them up in their own gynaecea, and probably selling their surplus at local fairs (Pounds 1974,62).

Through much of Europe, however, the majority of the everyday fabrics must have been literally 'homespuns', produced in the home by and for the family. In the Viking homelands, as in England, weaving had for many centuries been a household chore, carried on alongside other crafts such as boneworking (Foote and Wilson 1980,90). However, with the stimulus to trade of the Viking expansions, specialist craftsmen began to settle in towns (Hodges 1982, 52, 78-85). Elsewhere in Europe a similar process of urbanisation can be seen, as craftsmen left the countryside for the greater freedom of town life (ibid., 163, 170; Heard 1973,24).

York also saw a period of urban renewal as, under Scandinavian influence, it became an increasingly prosperous merchant town with trade links from Ireland to Samarkand. In the Coppergate area new tenements were laid out and metalworking and other specialist crafts began to be practised on the site (R.A. Hall above pp.294-6; *AY* 8/4, in prep.). It seems unlikely, in this atmosphere of energetic trade, that textile production would have remained geared only to home consumption.

Self-sufficiency in textiles would have been impossible for the occupants of the four tenements, who would have had to obtain raw materials for spinning and dyeing from outside. Yet all the textile crafts from fibre preparation, spinning and dyeing through to weaving, cutting and sewing were clearly being practised on the site. Moreover, in York's growing and increasingly wealthy population, there must have been a market readily available for any surplus cloth which could have been produced. It therefore seems reasonable to suppose that at least some woven goods were offered for trade in the stalls of the street frontage or in the market which probably existed only a short distance away at the Coppergate-Ousegate-Pavement junction (Radley 1971,39).

At least as early as 1164 York had an important gild of weavers, a body of professional craftsmen producing cloth for sale (see below). The textile workers of Anglo-Scandinavian Coppergate had not yet reached such a stage of organisation, but it is possible that these tenements housed the beginnings of the move away from home-orientated production towards the medieval urban craft guilds, geared to larger-scale production and trade.

The products

What then were the types of textile being produced by the weavers from Coppergate? A few spun wool yarns (1310-11) were found as loose threads, but these were mainly coarse in quality, comparable with the yarns of the coarsest tabbies and twills. The wool-comb (sf10786, *AY* 17/6, 1992) indicates that the smoother yarns spun from combed wool were being produced, but it is more likely that they were being plied into combed-wool sewing yarns-several examples of which were recovered loose from Anglo-Scandinavian levels (1269,1314-15 and 1385)-rather than woven into the rarer, finer, combed-wool tabbies.

The finding of several annular loom weights (*AY* 17/14, 2000.) indicates that the warp-weighted loom was in use in the area. This loom is capable of producing tabbies, twills and the broken diamond and chevron weaves which have been found at 16-22 Coppergate. The weights so far examined are light to medium when compared with those from the Continent (Zimmermann 1982), but lighter loom weights cannot be taken as an indication of finer cloth (Hoffmann 1964,21). There is therefore no evidence that the finest fabrics from 16-22 Coppergate were being produced on the site.

Stems and seeds of the flax plant were also found on the site (*AY* 14/7, in prep.). While the seeds may have been used for the production of oil, the stems were used for rope, and probably also for linen cloth; some of the many iron spikes found about the site (AY 17/6, in prep.) may have been used in flax preparation. Most probably the Coppergate linen production was limited to simple tabbies, to be used as bed-linen and undergarments, as only a very few patterned weaves were found and at least one of these has proved to be quite foreign to this country.

Dyeing materials such as madder, woad, dyer's greenweed and clubmoss were recovered from the site, along with some fragments of medium-coarse twill saturated in a red dye, which stained the surrounding soil. Wool, and perhaps flax and woad, would have been brought to the York markets from the countryside, but the clubmoss must have been imported, probably from Scandinavia (A.R. Hall et al. 1984). The presence of dyes in itself suggests a certain quality of cloth, as undyed wool seems to have been an indication of poverty or servitude.

In summary, although it would appear that the weavers were producing wool and linen cloth of good serviceable quality, there is no evidence that they were responsible for the fine, evenly spun and woven, diamond and chevron twills, or the patterned linens. In fact, there is reason to suppose that some of the better-quality fabrics were imported.

Traded goods

It has been shown (above, p.337) that broken (i.e. 2/2 diamond and chevron) twills were produced as far back as the Iron Age in northern England and continued to be ptoduced by native weavers in the Roman period. Clearly the technology to produce these weaves was present in the area from an early date. Diamond twill continues to appear in early Anglo-Saxon graves, where it regularly occurs with a Z-spun warp and S-spun weft, unlike most of the other weaves in the same graves.

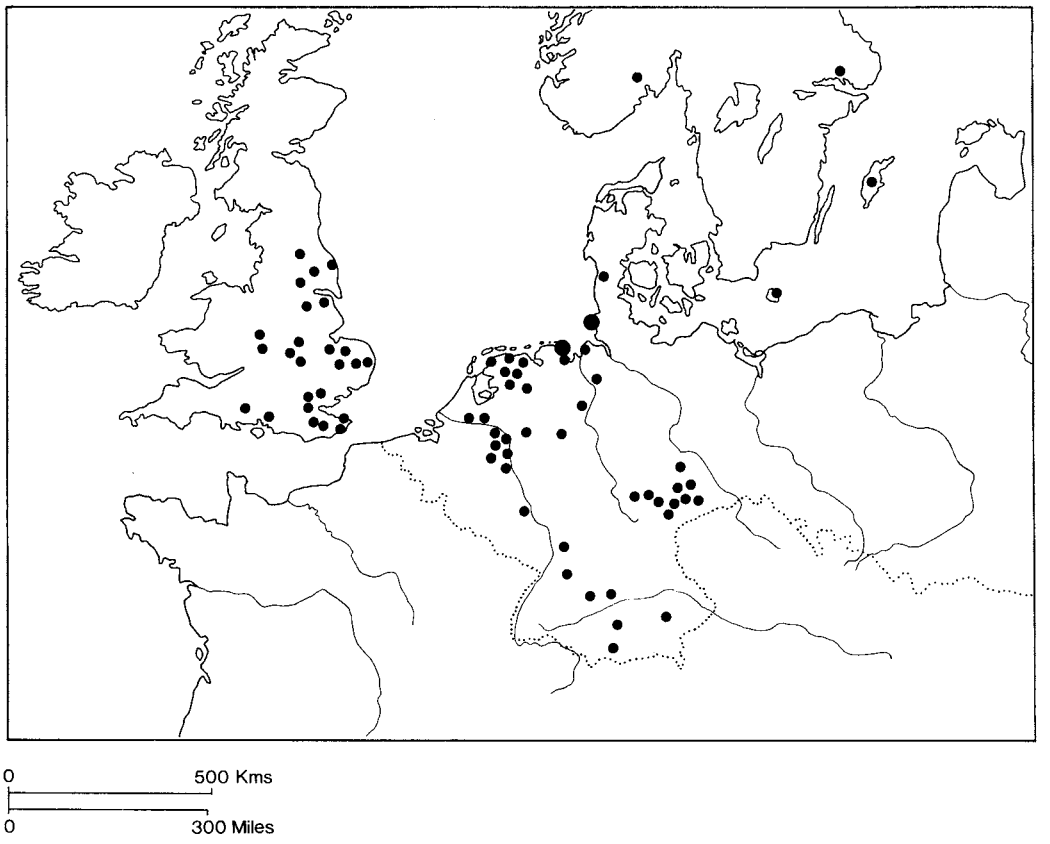

Fig. 171 Distribution, from recorded areas of Britain and Europe, of ZS broken twills (chevron and diamond). Larger black dots represent large clusters of finds. Boundary line marks area of textile finds

By the late Anglo-Saxon and Viking Age, ZS spinning had spread to most types of wool textiles (in England) and ZS broken twills, particularly chevron twills, appear in a range of qualities. The coarser examples are no doubt 'homespuns', but the finer more lightweight broken twills show considerable craftsmanship in their production. While the skill of the home-weaver should not be underestimated, these finer textiles display the quality to be expected from a specialist weaving centre. Moreover, pieces exactly resembling the finest Coppergate broken chevron twills in dye, thread-count and spin have been found in contemporary London, suggesting that these fabrics were involved in trade.

A weaving centre within England cannot be discounted since nothing suggests that these textiles were outside contemporary Anglo-Saxon weaving traditions. Scandinavia was not the source, since the majority of broken twills from that area are quite different in warp- count and spin from the English examples. A survey of the areas where ZS broken diamond or chevron weaves have been recorded so far (although knowledge of textiles in

some European countries, notably France, is limited) shows that there is a concentration of finds in the northern Netherlands and Germany (Fig.171).

This is the region known as Frisia and one authority on European textiles has already suggested that the better-quality ZS twills and broken twills may be identified with pallia fresonica (Bender J0rgensen 1984a, 131-2), 'Frisian cloth', which appears in documents of the 9th century and later (see above, p.339, and for discussion of the documentary evidence see Hoffmann 1964,227-57 and Ingstad 1979b). This Frisian cloth seems to have been noted for its colours, as is indicated in a poem, composed by Ernoldus Nigellus c.826-8, in which the River Rhine speaks to the Vosges: 'It was a useful decision to sell wine to the Frisians and coastmen, and to import better ware For, a coat dresses our people in a variety of colours, that was never known to you, 0 Vosges,6 (van Uytven 1983, 153). It may therefore be significant that three medium-fine broken twills from London and York have been found to be dyed with a rich purple derived from lichens, a dyestuff which is not to be found in any of the coarser textiles of either town (above, pp.340-1). This is both a further indication that the broken twills of good quality are likely to be imports and provides another tentative link between them and the Frisian cloth.

Frisians were trading in London at least as early as the 7th century (Bede, Ecc. Rist., 4, 22) and some were living in York in the 8th (Altfrid, Vita Liudgeri, 1, 11-12, in Whitelock 1955,725). Contacts between Yorkshire and Frisia were also being established at this time through the missionary work of the English church (Levison 1946, 49-59). Evidence of a Frisian contact in York before the Viking invasions can also be seen in the archaeological record, in coins from Dorestad (Dolley 1966, 1-7), the principal Frisian trading town, and in copper-alloy bow-brooches from the same region (Roesdahl et al. 1981; *AY* 17, in prep.).

Through the 8th-9th centuries, the Scandinavians gained supremacy over the Frisians in the North Sea and sacked Dorestad in the mid 9th century. However, the Viking incursions probably did not bring the trade to an end, as Frisians continued to have close contacts with Scandinavians trading in their cities (Foote and Wilson 1980, 98), while some Scandinavians may also have settled in Frisia (Graham-Campbell 1980, 32). If Frisia is indeed the source of the finer broken twills, then they may have been brought to York by either Frisian or Scandinavian merchants.

Another group of textiles which probably travelled a similar route are the patterned linens, which were found together, stitched into some curious sort of patchwork garment or hanging (1317, 1319-21, 1324-5, 1327-8, 1331-6, 1338-9, from a Period 4B level). As stated above, the majority of the linen fabrics from 16-22 Coppergate are in tabby weave, and this group of unusual textiles, most notably the honeycomb weave and the plaited diamond mesh, with no parallels in this country, should almost certainly be regarded as imports.

Other examples of the honeycomb weave have been found in wealthy 7th century graves in Sweden, in two 8th century row-grave cemeteries in West Germany and in an 8th-9th century site near Magdeburg, East Germany (see pp.356-8). The evidence of monastic

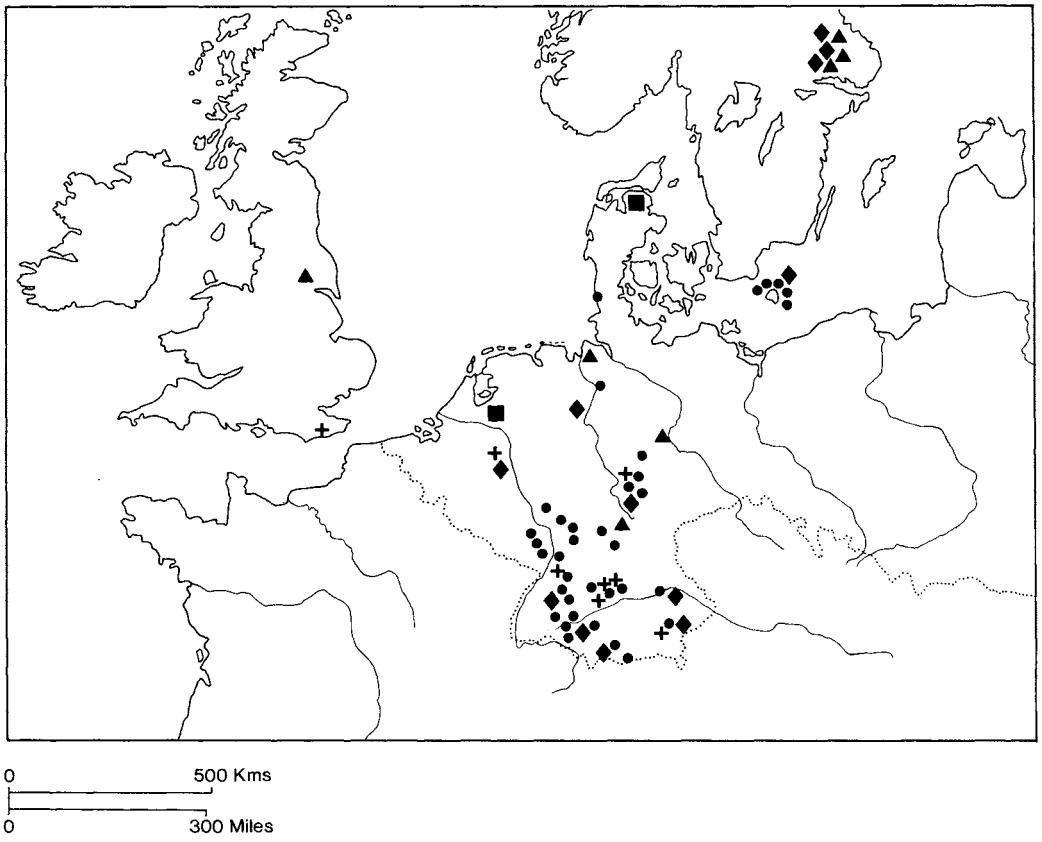

Fig. 172 Distribution, from recorded areas of Britain and Europe, of patterned weaves; crosses indicate rosette twill (Rosettenköper) *; triangles, honeycomb weave* (Wabengewebe); *circles, ribbed twill* (Ribbenköper); *diamonds, warp float tabbies* (Wolltuche mit musterkette); s*quares, composite twills. Adapted from Bender Jorgensen 1984a, fig. 11 & 1986, fig. 244, with additional English finds. Boundary line marks area of textile finds*

tithes suggests that flax and linen production was a speciality of the Low Countries and the Rhineland, at any rate at the time of Charlemagne (Pounds 1974,62). Since several other patterned linens, particularly weaves based on the same 2/1 structure (Fig. 172), have been found in the Frankish row-graves of West Germany, the Rhineland seems a possible source for this group of textiles.

Evidence for trade with this area is not hard to find in York. Quernstones made from Mayan lava and Tating, Badorf and Pingsdorf ware from the Rhineland have been found in Viking Age sites within the city (Roesdahl et al. 1981, 126); Pingsdorf-type pottery was also found in Anglo-Scandinavian levels at 16-22 Coppergate, including some sherds from

Period 4B (see *AY* 16/5, 1990.). Once brought down the River Rhine to the North Sea ports, these goods would have travelled alongside the Frisian merchandise into England. Some of the pottery vessels probably brought Rhineland wines to York (ibid.) and it is not difficult to imagine that Rhenish cloth and garments occasionally passed along the same route.

The Scandinavian connection

So far the textiles under consideration have proved to be from England or the Continent. But what of the Vikings who settled in York in the late 9th and early 10th centuries, and whose influence can be seen in so many of the other artefacts from 16-22 Coppergate? What effect did they have on the textile crafts? The answer is that very few of the textiles show any distinct Scandinavian influence and the majority fit quite easily into the general pattern of Anglo-Saxon textiles. Admittedly the coarser textiles of the two cultures cannot easily be distinguished, but most of the better-quality fabrics, not just the traded goods discussed above, appear to belong to the Anglo-Saxon/continental weaving tradition rather than the Scandinavian.

Most of the textiles which do display affinities with Scandinavian textiles were found together in a group, in a Period 4B context, dated to c. AD 930-75. They consisted of the sock in nalebinding, 1309, a piece of twill with dark glossy warp and soft pale weft, 1303, and a piled fabric, 1295. Also in the same context were some raw wool, 1289, a handful of horse-tail or mane hair, 1316, a dyed wool cord, 1312, and a knotted bundle of short lengths of yam, 1315.

Nalebinding is undoubtedly part of the Scandinavian textile tradition, since the technique is quite unknown in England, although well documented in Scandinavia (and at a later date in other parts of Europe). The twill, 1303, with a dark combed-wool warp and a slightly matted surface also has many parallels among Scandinavian textiles. Piled fabrics are not so obviously Scandinavian, since they are occasionally found in early Anglo-Saxon cemeteries, but they also occur in Viking graves and are known to have been traded out of Ireland and Iceland, both countries with strong Scandinavian connections at this time (above, p.336). Moreover, another piled fabric, 1460, from Viking Age levels, was edged with a fine combed-wool tabby of a type often found in Scandinavia.

At first sight this group of finds appears typically Scandinavian, yet the technique of the sock is a greatly simplified version of nalebinding, and not one which has so far been discovered in Scandinavia. Moreover, the twill has some reverses in the diagonal, which is unlike the Scandinavian parallels. Further, in most piled textiles from outside York, the pile has been woven in rather than darned in by hand as at 16-22 Coppergate. This needle-worked pile can also be seen in two textiles from the nearby site of 6-8 Pavement (579 and 581, p.122, *AY* 17/3), which suggests it is a local technique. It has to be allowed that this group of finds may not be directly Scandinavian in origin but could be copies made by native Anglians of their invaders' textiles.

Silks

If the impact of the Vikings on the local textile crafts is slight, evidence of their presence can be seen more clearly in the volume of silk recovered from the site. Out of 106 woven textiles from Anglo-Scandinavian levels, no less than 23 (22%) were in silk, which is a high proportion, considering the relative value of silk and the distance it must have travelled. It is undoubtedly due to the far-reaching trade contacts of the Vikings that these silks appear on the Coppergate site.

It has been mentioned above, p. 371, that silk is a rare find on archaeological sites in Britain before the Viking Age. In the 6th, 7th and 8th centuries some silks were reaching England as donations to churches and as diplomatic gifts, but they were rare and costly: Bede mentions in the Lives of the Abbots of Wear mouth andJarrow that two lengths of figured silk were enough to buy three hides of land (Alexander 1979,202). Simple silk tabbies are not to be compared with the more elaborate patterned silks, but even so they must have been of considerabl~ value. Even in the silk-weaving centres such as Byzantium, silk cloth was treated with respect and its manufacture and sale regulated (Lopez 1945); and the cost of transporting goods across many miles of difficult terrain must have further increased the price to the buyer in England.

There are several possible sources for the silk tabbies. In the centuries before the Viking expansion, silk weaving had spread from China, through Asia to Persia, Syria and Byzantium. The spread of Islam had taken it into North Africa and southern Spain; the great Italian silk manufacturing centres had not as yet been established. There were many different routes by which silks could reach northern Europe, most of them from Byzantium and the Eastern Arab world, and many of these routes were plied by Scandinavians.

By the early Viking period, Scandinavians had moved into Russia (where they were known as the Rus) and were living in trading towns such as Novgorod and Kiev. By the 9th-10th centuries they were travelling down the Don to the Black Sea and down the Volga to the Caspian and on into the heart of the Eastern Emirate (Toynbee 1973,447-51). In Yorkshire, hoards of coins from the USSR/China border, dated to AD 920-7, bear witness to this trade; an Arabic forgery of a Samarkand dirham of Is ma'i I ibn Ahmad (AD 903-7/8) has also been found at 16-22 Coppergate (AY 18/1, 47, 17). Judging from the dates of coin hoards in Russia and Scandinavia, there were two main phases during which this trade took place, the first c. AD 800-820 and the second c. AD 890-950 (Hodges and Whitehouse 1983, 115-125). The second of these phases coincides with the deposition of eighteen of the 23 silk textiles from 16-22 Coppergate, in periods 4A and 4B, c. AD 900-975. Only a head-dress, a piece of silk, the reliquary pouch and one fragment of ribbon belong to later phases, Periods 5A and 5B, c.975-early/mid 11th century.

The Russian trade routes brought Vikings into contact with the silk route, which carried Chinese and central Asian silks to the west. At the same time the Rus were trading with Byzantium, and occasionally raiding too (Toynbee 1973, 62, 445-59). They were given certain privileges there, although they were still very restricted in the types of silk they could buy (ibid.). Silk seems to have been the most important item they wished to obtain there (Lopez 1945, 34-5).

Although the main routes by which silks reached the Viking world were along the Russian rivers to the Baltic, there are other paths which the Coppergate silks may have travelled. In the mid 10th century, and possibly in the 9th century too, Vikings were raiding Spain and the western Mediterranean (Toynbee 1973,447). Unfortunately, at present, silk tabbies from the western Islamic centres are indistinguishable from those of Byzantium or further east, but future research, particularly in the field of dyes, may eventually resolve this problem.

Raiding into southern England may also have yielded silks, since Anglo-Saxon England also had its trade connections, indirectly, with Byzantium. Byzantine silks at this time were being carried by sea to northern Italy and then by road and river to northern Europe (Dodwell 1982, 149-54). Pilgrims travelled this route to Rome and the Holy Land and often took home with them ribbons and other silks which had been sold to them on the way (ibid.): Theodred, Bishop of London, for example, bought two chasubles, one white and one yellow, at Pavia on the Po in the 10th century (The Will of Bishop Theodred, in Whitelock 1930, 5). Cnut records, in a letter to the English, how he was given silks on his visit to Rome in 1027 (Whitelock 1955,417). The Carolingian Empire, with which England traded, also had a trade route from Mainz through Prague and Crakow to Kiev, where it joined the path of the Scandinavians travelling from the Baltic (Pounds 1974,346).

The simple non-figured silks appear to have arrived as several lengths of fabric and to have been cut up on the site, probably for making into caps. At least two definite examples of caps, and scraps which could be from others, have now been found in the Coppergate area, while another very similar cap has been found at Lincoln (above, p.374). The Lincoln cap could even have been made at Coppergate, since its fabric and shape are remarkably like the York examples. Some of the York caps may also have been reaching Dublin where other examples have recently been found (Pritchard 1988; Heckett 1987), since the route to the west coast and across the Irish Sea must have been well travelled at this time, when York and Dublin were so closely connected politically and ethnically.

The uses of the textiles

One of the most important contributions which the textile finds have made is in the evidence they provide for dress in what is an uncertain area for the costume specialist. The silk caps are clearly a relatively common style among the Scandinavians in the British Isles and yet there was no knowledge of such a piece of headgear before the York excavations.

Other finds show that narrow silk ribbons, sometimes dyed red, were stitched to edges of garments; that fine purple wool tapes were probably used as puttee-like leg-bindings; that co loured cords were used, perhaps for binding hair or tying garments; that fitted wool socks were worn, at least occasionally; and that cloaks made from piled fabrics may have had a double layer, or perhaps a collar of sorts. There is also some evidence to suggest that simple wool hangings were used instead of the more luxurious drapes known to have decorated wealthier houses.

Chronological summary

If the finds are considered in chronological order, it can be seen that there are very few textile finds before the mid 9th century. After the Romans left York, the Coppergate area seems to have been relatively unused until that time (above, p.294; AY 8/4, in prep.). Only one textile, 1459, the mineralised remains on the iron spearhead/sword-beater, may predate the Viking invasions.

Shortly after the mid 9th century, in Period 3, several bodies were buried in a haphazard fashion on the site. One man, buried in a shallow pit, had been wearing a cloak, or perhaps a tunic, of a type of diamond twill which, as we have seen, is typical of England and the Continent, but unlike the Scandinavian textiles. It is perhaps not fanciful to see in this man's careless burial an Anglian victim of the Viking attacks on York.

In Period 4B, four tenement buildings were set up (above, p.294) and from this period there is one group of textiles which is undoubtedly of Scandinavian influence if not necessarily of Scandinavian origin. However, most of the textiles from this and successive phases continue to be of a type similar to those of Anglo-Saxon England and the Continent, rather than Scandinavia.

The tenements seem to have housed a variety of craftsmen, no doubt supplying the needs of an increasingly prosperous town. At this time, a certain amount of spinning, weaving and dyeing seems to have been carried out on the site, and caps were probably being made, from imported silks, for exchange or sale. As well as the silks, some fine wool textiles and patterned linens seem to have been acquired, the former possibly from Frisia, the latter of uncertain origin, perhaps from the Rhineland.

The Anglo-Scandinavian period, and in particular the 10th century, then, seems to have been a time of vigorous activity for both manufacture and trade of textile goods.

Medieval

Of the 47 finds from post-Conquest levels (Period 6), 32 are yarns, cords and rope, mostly recovered from pits in the backyard areas of the tenements. The sparse survival of textiles, in relation to cordage, may be due to the extensive modern disturbance of upper levels of the site at the street frontage (above, p.296), where most domestic debris would be expected. The wool yarns resemble those of the contemporary textiles and suggest that some textile activity was still being carried out on the site. Most of the cords and rope, however, probably played a role in some other industrial activity.

Although the woven remains from medieval layers are few in number, comparison with textiles from other sites of similar date has shown that they represent the period well. Most interestingly, the wool textiles show a marked contrast with those of the Viking Age in several aspects of their production, from raw material to weave and finishing process. Some of these changes had taken place by the 12th-13th century when the earliest post- Conquest textiles were deposited, although others do not become obvious until later in the medieval period.

The first alteration which can be seen in the textiles from 16–22 Coppergate is in the wool. The coarse wools common in the Viking Age are rarely present in the later textiles and this is reflected in the softer handle of the cloth. A second, more obvious difference, is in the apparently deliberate matting of the later wool fabrics. The 2/1 twills of the 12th-13th centuries are rather rough, poorly finished fabrics, but the matting is more obvious in the later tabbies. This type of finish was achieved by fulling, which causes the fibres to felt together. This process became much easier and faster after the introduction of the water-driven fulling mill in the 12th century (Carus-Wilson 1952, 409-13). The shorter-fibred, crimpier wools of the medieval period are much better suited to fulling than the hairy and medium wools of the Anglo-Scandinavian period.

There may also be a greater degree of standardisation in the later textiles from 16-22 Coppergate. This was certainly true of a large 15th-16th century group from Newcastle upon Tyne (Walton 1981) where the finds could easily be divided into worsteds and woollens and then subdivided according to the weight of the cloth and the degree of finish. The range of quality and design which can be seen in pre-Conquest finds was not to be seen in this Newcastle group. In the earlier, 12th-13th century, finds from medieval England, such as those from 16-22 Coppergate, the evolution towards fewer weaves appears to have begun: one weave, simple 2/1 twill, far outnumbers any other until the mid 14th century, when its place is taken by tabby weave. Colour patterning was sometimes introduced but on the whole monochrome fabrics seem to have been preferred. Apart from a certain variety in the weight and finish of the cloth, the textiles throughout medieval north-west Europe seem to be very much alike.

Development of the textile industry

There are probably several reasons for a greater degree of standardisation. For example, the fashion for heavily fulled fabrics in the later medieval period would have meant that the weave was no longer visible on the surface, so that the more complicated weaves became redundant. However, large-scale production of standard types of fabric of regular quality must have more to do with the changes in the organisation of the textile industry, which began to take place in the 11 th century, and the introduction of new implements and techniques in the 11th-13th centuries.

With increasingly large populations in towns and improved trade connections, it became possible for craftsmen to work full-time in specialist occupations, selling their products locally in the town or to merchants from abroad. Whereas the textile crafts had previously been practised together on one site (as can be seen at Anglo-Scandinavian Coppergate) there now evolved a division of labour, with weavers, dyers, etc., forming their own gilds: by the late 14th century no less than fourteen different trades associated with textile production were recorded in the York poll tax returns (Bartlett 1953; Leggett 1971). Although wool-carding and spinning probably remained part-time work, carried on in the home by women and servants, the other branches of textile production had become the province of professional craftsmen.

The new horizontal loom, which probably arrived in the 11 th century, must have stimulated this change, with faster production of cloth. Other technological advances of the 12th-13th centuries, such as the fulling mill and the spinning wheel, would have contributed to the development of the textile industry in the same way. Once cloth could be produced at speed by a largely professional workforce, standardisation was inevitable.

Local weaving

Spindle whorls, cut-off ends of yarn and a wooden object which may be a heddle-support for a horizontal loom suggest that spinning and perhaps weaving continued at 16-22 Coppergate into the 12th and 13th centuries (AY 17, in prep.).

Documentary evidence shows that York was one of the earliest English towns to establish a reputation as a weaving centre. With the supply of wool from its hinterland and a ready market in the townsfolk of what was then a busy port, this is not surprising. The York weavers are first mentioned in the Pipe Roll of 1164 and again, as a gild, in the following year, when they appear to be of some standing (Heaton 1920,3). The fabrics of York and Beverley were of high quality, some of them the prestigious 'scarlet', a fine teaselled and sheared wool fabric used for the royal wardrobe and traded abroad (Munro, 1983). None of the Coppergate fragments has been given the teaselled finish of 'scarlet' and they are therefore likely to be the more workaday textiles of the town, or even the cheaper rural fabrics which were increasingly being produced in the West Riding of Yorkshire (Heaton 1920,7).

The single striped fabric, 1417, is of much better quality, but evidence discussed above, pp.389-90, shows that it may be an import from Flanders. Flanders certainly had a well-developed textile industry at the time that the Coppergate fragment was deposited (de Poerck 1951), probably technologically in advance of the English (Woodger 1981). Yorkshire had many contacts with Flanders, since Flemings settled in the county after the Conquest and Yorkshire wool was being exported from an early date to feed the Flemish textile industry (Lloyd 1977, 4-5).

The source for the other medieval textiles, the linens and the combined linen-wool textile, need not necessarily be looked for outside the city. Linen weaving continued in York into the 16th century, well after the weaving of wool cloth had gone into decline under competition from the West Riding (Palliser 1972,92). It is not clear whether the linen- wool fragment is a braid or the remains of a weft-faced weave such as tapestry. If the latter, then it is relevant that tapiters (weavers of rugs, coverlets and hangings) were a prominent gild by the 16th century (Palliser 1973,44-5) and some of their number lived in the vicinity of Coppergate (Bartlett 1953).

Nevertheless, the similarity of fabrics over a wide area of Europe, and the progressive falling-away of the quality of textiles which may be described as 'homespuns', makes it difficult to distinguish imports from local fabrics in the medieval period. In a busy port such as York, many foreign fabrics could have arrived by all sorts of means. At best, it can be said that fabrics of the same type as those found at Coppergate were probably being made within the town, with the possible exception of the striped weave.

Conclusion

Since the late 1960s considerable advances have been made in the field of textile research, as detailed analyses of more and more large groups of excavated textiles have been published. It is now becoming possible to see general trends in the pattern of development of weaves, dyes, raw material and finish and to some extent to relate these to the documentary record. Most importantly, textile research is becoming a useful tool for the archaeologist in highlighting trade and cultural contacts and even on occasion providing evidence for dating.

There are, however, still gaps in our knowledge and the textile finds from 16-22 Coppergate have proved valuable in the new information they have provided. Fabric types over the 9th-14th centuries have been charted and unexpected evidence for Viking Age dress has been of some importance. Some pointers to the changes in the social organisation of weaving have been found, but the textiles have been especially significant in revealing some of the trade contacts of this busy northern port.

The Conservation of the Finds

The textile finds were conserved by the author in the York Archaeological Trust (YAT) conservation laboratory under the guidance of the qualified staff.

On site the finds were disturbed as little as possible and kept in the damp conditions in which they were found. When lifted from the ground they were placed in trays, then each was transferred by the Finds Assistant into two clip-top polythene bags, one inside the other. A few drops of fungicide (Panacide 0.1 % in water) were added before sealing. Only the textile remains, 1266-8, adhering to the skeleton were treated differently: bone, textile and surrounding soil and organic matter were transferred together on to a large tray and covered with aluminium foil.

In the laboratory the finds were unsealed and a record made of their condition. Any significant details of the surrounding debris, such as organic matter, or cinders, or unusual colouration, were also noted, before preparations were made to remove this dirt. A rigid plastic grid covered with either cotton or nylon mesh (experience showed that nylon was preferable as it was easier to wash and dry after each use) was then laid in the bottom of a large tray filled with de-ionised water. The textile, in its inner polythene bag, was then placed in the tray and the find emptied on to the support under water, to cause as little disturbance to it as possible.

The carbonised finds were generally too fragile for further wet-cleaning and were removed after this brief preliminary rinse. They were allowed to dry naturally and surface dirt was picked off with tweezers or sometimes dusted away with a soft paintbrush. In later years it was discovered that by reversing the air-flow of vacuum tweezers, a fine jet of air could be used to remove fine soils gently and efficiently.

In general, no attempt was made to consolidate these carbonised textiles, since the rigidity imparted by most consolidants makes investigation of weave, fibre, stitching, etc., difficult. Instead, great care was taken over packaging and providing adequate support for the finds. However, in 1978 three particularly fragile fragments of diamond twill, 1404, were sprayed with soluble nylon (3% in Industrial Methylated Spirits (IMS)). Since 1978 it has been discovered that soluble nylon will cross-link with time (Sease 1981) and it is therefore no longer used on textiles at the YAT conservation laboratory. The diamond twill has remained in a stable state, however, and as yet shows no signs of ill-effect from its treatment.

The non-carbonised textiles were in general well preserved and strong enough to benefit from more prolonged wet-cleaning. A few drops of non-ionic detergent (Synperonic NDB, formerly Lissapol NDB; less than 1%) were added to the water and the finds were gently unfolded using soft paintbrushes and fingertips. Notes were made of any interesting folds and the relationship of one fragment to another. It was important at this stage to look out for any decayed vegetable fibres which might have formed the lining or stitching to an otherwise wool or silk textile. It was often the case with the silk finds that brown matter would wash out from the inside of hems and analysis would show this to be a vegetable bast fibre used as a hemming thread. Since this information could be lost easily, the water in the tray had to be kept as clear as possible: a continuous, gentle flow of water, introduced by pipe from the tap, was found useful for this.

The textile was gently tamped with the fingers or with a paintbrush, to help the water and detergent to penetrate the interstices of the weave. Second or third washes with detergent were often necessary. The process could be speeded up considerably by placing the textile in the ultra-sonic tank, but only the textiles in the very best condition, mainly silk, could be treated in this way, since wool fibres, if they are at all brittle, will start to fracture under ultra-sonic vibration. The maximum length of ultra-sonic treatment for anyone fragment was a total of fifteen minutes (with several changes of water in that time) and most received only two to six minutes.

A few of the finds which came from cess pits were covered with a hard grey-brown encrustation, sometimes as much as 25mm thick. It was possible to begin the removal of this concretion by mechanical means, using dental pliers to break up the outer layers, but this was too harmful a technique to use close to the weave. Various chemical methods were tried to dissolve the hard matter: Calgon (10-15% aqueous solution) and organic solvents had little effect and although hydrochloric acid (3%) did dissolve the concretion, considerable care had to be taken in applying it to the textile. Eventually, it was found that prolonged treatment with the disodium salt of Ethylene Diamene Tetra-acetic Acid (EDTA) in solution (3g/lt), using up to fifteen baths over a period of one week, was the most efficient way of removing the encrustation without harming the fibres.

The first textile to be treated this way was *1417,* a red and brown striped textile with natural-coloured ground. The EDTA treatment revealed these colours so well that it was decided to experiment with it on other textiles. EDTA had proved to have no harmful effect on either animal or vegetable fibres, but there was some concern that it might affect any dye or mordant present. Dr Taylor therefore carried out the usual dye analyses (see pp.398–400) on weighed samples from two wool textiles, one sample each for before and after treatment. These tests showed that there was no decrease in the amount of dye present after three hours' treatment in a 3% solution of EDTA. In both cases the dye on the textile was the red mordant dye, madder, and whether other dyes from buried textiles remain stable in EDTA is not yet certain. Further work by Dr Taylor on modem dyed samples does suggest that EDTA has no deleterious effect on the dye-stuff (Taylor, pers. comm.).

One bath of 3% EDTA was therefore used to clean a small group of textiles to be displayed in the Jorvik Viking Centre. This was most effective in removing the patchy iron stain which had discoloured many of the finds: the textiles were left several shades lighter in colour, thus revealing the weave more clearly.

The EDTA treatment was restricted to the encrusted textiles and those fragments required for display. The remainder of the finds were cleaned only with detergent and water. All of the finds were then rinsed in a continuous flow of tap-water for 30 minutes (or more if pre-treated with EDTA) then given final rinses in de-ionised water.

The netting support on which the textile rested was then lifted out of the water and laid on the bench. Several layers of paper towelling were laid on top with a sheet of glass on top of that. The whole 'sandwich' was then turned over and the nylon mesh of the support peeled away. More paper towelling was then used to blot up surface water and the textile gently straightened out. Robert Janaway of Leeds University pointed out that glass microscope slides make useful weights for folds and edges which are difficult to hold in place. More layers of paper towelling were then laid on top of the textile and a second sheet of glass on top of that. Apart from the microscope slides, no glass was allowed to come into contact with the textile, as this flattens and distorts the threads. Every few hours, the textile, between its towelling and glass supports, was turned over and the upper layer of towelling replaced. When the textile was almost dry (usually some 36 hours later) the upper glass sheet was removed and the find left to dry out completely with only a single layer of towelling on top to prevent dust accumulating and to protect the textile from daylight.

Final records were then made of the textile's construction and if dye and fibre samples had not already been taken they were taken at this stage. It was not until 1981, with the arrival of Dr Taylor and, later, a Perkin-Elmer spectrophotometer, that it became possible to identify dyestuffs in the Trust's conservation laboratory. It soon became clear that the ,best time to take dye samples is before cleaning begins, since the fibre-mordant-dye complex may have broken down during burial, thus leaving the dye free to be washed away even with the gentlest cleaning methods. On the other hand, if the textile being treated is

a folded and stitched object, it is often difficult to determine the best place from which to take the sample until after cleaning.

Different fibre types may require different methods of treatment, so the fibre of a textile should be identified before cleaning begins. It was generally possible with the textiles from 16-22 Coppergate, however, to differentiate vegetable from silk and other fibres with the naked eye, and it was not necessary to take a sample until later, to identify more precisely which vegetable or animal fibre was present.

The treated textiles were wrapped in acid-free tissue and placed, with a support of acid-free card, in individual polythene bags with holes punched in the side. They were later transferred to supports of netting mounted in acid-free card frames (Lister in prep.). The finds not on display will eventually be stored at the Yorkshire Museum in conditions of controlled temperature, humidity and light.

The silk cap, *1372*, and the *nålebinding* sock, *1309*, required further conservation work to prepare them for display in the Jorvik Viking Centre. They were given a preliminary wash in detergent and de-ionised water, as described above, then, when dry, sent for specialist conservatiqn to the North West Museum and Art Gallery Service, Blackburn. Jean M. Glover, Senior Textile Conservation Officer there, describes below the work she carried out on these two objects.

The silk cap, 1372 (Fig.151, PIs. XXVIII, XXIXa andXXXa-c)

Measurements

	Before conservation	After conservation
Front edge (selvedge) (0.54 m)	c.24in. (0.61m)	21½ in. (0.55 m)
Front corner to centre-back seam, along lower edge (0.19 m)	7in. (0. 18m)	7½in. (0.185 m)
Distance from lower edge to groups of stitches indicating position of fastening	c.5in. (0.125m)	5in. (0.125m)
Seam length (lower edge to point of dart)	c.14in. (0.355m)	No record
Thread-count readings taken in 3 areas; selvedge composed of paired warps 39 x 2	Warp: c.66 ends per inch	68-70 ends per inch
	Weft: c.51 picks per inch	48-50 per inch

Composition

Warp threads: silk, with Z twist.

Weft threads: silk, spun very loosely, without discernible twist.

Condition on receipt

The khaki-coloured silk fabric was frail but supple and fairly lustrous. A certain amount of the soil of burial remained with the fabric. Two kinds were observed: hard grey clay, as grains adhering tenaciously to the surface, and very fine brownish silt, embedded in the twist of the yarns. Apart from the darkening of the silk during burial, there seemed to be no evidence of dyes having been used. (Visual examination only.)

Physical damage consisted, at the right-hand side, of four prominent holes extending into tears, with several smaller holes and areas of weakness, and a short tear in the rolled selvedge. At the left-hand side, the fabric was more degraded, with pieces missing near the back seam, at the lower edge, and near the centre. A triangular fragment forming the left front corner was stronger, but detached from the cap on receipt.

Two prominent holes near the lower edge, at the back of the cap were probably caused by friction during the period of normal use. That at the left-hand side had been repaired, on the outside, with an irregular patch of matching silk, which was received as a separate fragment, having been dislodged during excavation.

Most of the stitching had disappeared leaving part of the seam undone, and hems loose but sharply defined. Only 3½ in. (0.115m) of oversewing remained, at the lower end of the centre-back seam, but fine needle holes and impressions left by fine thread , indicated clearly the positions and types of stitching used in all hems, the dart, the i seam, and around the edges of the patch.

The fabric was distorted by sharp creases. Some running parallel to the lower edge, radiating from the positions of fastenings, and a group running parallel to the selvedge, on top of the head, seemed to date from the period of use, and to indicate a very close fit, whilst random creasing was the result of pressure during burial.

Treatment

After preliminary investigation and examination, the cap was photographed from several angles, to record its condition, and details of fabric, construction and stitching. Two hand-sewn reproductions were made in fine buff-coloured cotton, sewn with silk, to test the construction techniques, order of assembly, and size, and to provide a more robust shape for handling. A third reproduction had to be made after conservation of the original cap, before constructing a display mount, when movement of the original silk during washing and smoothing caused minor changes in length and breadth.

Cleaning

This was carried out in three stages:

1. Working under x 1.5 magnification, the dry silk fabric was manipulated gently, using a tamping action on both sides, to dislodge loose particles of dust and fine grit.
2. Working under x10 magnification, over the entire surface of both faces of the fabric, each woven thread was probed very gently to release grains of finely pulverised soil (hard grey clay and fine brown silt).

3. Wet-cleaning. The cap, prepared for washing with lightweight Melinex film separating the layers of silk, and enveloped in soft nylon netting, was wet-cleaned, to remove remaining dirt and to relax strong creases, by floating it for six hours in several changes of deep soft (tap-) water, containing non-ionic detergent, followed by rinsing in running de-ionised water. The cap was dried flat, in the netted support, on absorbent towels. Seen under magnification, the fabric was now paler and unstained, and honey-coloured instead of khaki.

Smoothing

A soft pad, cut to the size and shape of the cap and covered with thin Melinex, was used as a support for the dry silk, whilst first the right-hand side, then the more fragmented left, was smoothed with the fingers to straighten the weave, held with fine entomological pins, then sprayed with a mist of de-ionised water to relax sharp creases induced by pressure. Each side was dried quickly then released, so that wanted creases could reform, though less prominently.

Support

Transparent plain-woven, pure silk Crepeline was used as a support. This, and split silk threads for stitching, were dyed with a mixture of liquid Dylon dyes to match the 10th century silk, then two Crepeline copies of the cap (one to act as the lining and the other as the outer covering), were cut, and the centre-back seams partly sewn, to correspond with remaining stitching on the cap.

The lining was fitted first, with the fragmented cap on top (the loose repair patch having been repositioned over the hole) then these were covered with the second layer of Crepeline. Great care was needed to align the woven threads of the three layers of silk, and several attempts were needed, to achieve a satisfactory result.

The three layers of silk were secured with lines of fine running stitch, arranged in alternating rows, parallel to the warp threads. Additional short lines were worked across badly fragmented areas, close to the edges of the holes, and outside the raw edges forming the curved part of the back seam, enclosing them. At this point in the conservation, it was discovered that the $\frac{3}{8}$in. (9.5mm) discrepancy in the length of the right and left sides had been caused by gradual easing of the left-hand side on to the right, during original stitching of the seam (Pl. XXXa).

The front and lower edges of the Crepeline were cut, and neatened on the under- side with hand-run hems and mitred corners, positioned so that the original hems and stitch marks were not obscured. The dart at the crown of the cap was reformed, and oversewn on the outside, as before, the stitching being continued to complete the curved upper part of the back seam, where it had been open when received. In order to accommodate the surplus fabric from the left hand side, the middle section of the back seam had to be overlapped, instead of being joined edge-to-edge. The surviving stitching in the lower third of the seam remains protected by a minimal amount of Crepeline, but is less easily observed than before. To overcome the difficulty, detailed photographs of this and other features of the construction were taken before the Crepeline was applied, as well as afterwards.

Sock in nålebinding, 1309 (Fig. 140, Pls. XXII-XXIII)

Measurements

	Before conservation	After conservation
Length from toe to heel	(estimated) 9½in. (0.23m)	10¼in. (0.26m)
Girth at broadest part	10¼in. (0.26m)	$10\frac{5}{8}$ in. (0.27m)
Circumference at ankle	(estimated) 11¼ in. (0.285m)	$12\frac{7}{8}$ in. (0.325m)

Composition

Wool, 2-ply yarn, spun with S twist and plied with Z twist.

Condition on receipt

Preliminary treatment, carried out in the Y A T conservation laboratory, had removed superficial dirt, leaving the fabric clean, but still with very finely ground silt embedded in and clinging to the twisted strands of wool. Following long-term burial, the fabric was characteristically dark brown in colour, with a darker red-brown border, around the ankle edge of the sock, said to be of wool dyed with madder.

The sock was essentially complete, although there were prominent holes at each side of the toe, around the heel, and on top of the foot, extending inwards from the ankle edge. The sole, in the area previously covered by a repair patch, was thin, felted, and split from side to side. When viewed at x 10 magnification, the wool fibres in this area were seen to be abraded, split, and stubbly. Beneath the heel, approximately 1½ in. (40mm) was missing from the length of the sole. The ankle band was torn in several places. Although the sock fabric was quite badly broken around the heel and ankle, none of the loose pieces was completely severed.

Whilst the wool was degraded, reduced in strength, and shedding fibres readily, and the remaining fabric disfigured by sharp creases, it was nevertheless in relatively good condition with the *nålebinding* technique clearly defined.

Treatment

Cleaning

Preliminary examination and photography were followed by cleaning: dry manipulation and very gentle agitation of individual strands of yarn (working with x 10 magnification) to release compacted pulverised soil, followed by wet-cleaning in de-ionised water.

The sock was prepared for washing by slipping Melinex film inside it, to separate the sole and the upper part, and securing all loose edges with fine soft thread. It was then soaked in de-ionised water, to which had been added a few drops of non-ionic detergent (Synperonic N), for a total of sixteen hours. Little dirt was released by soaking alone, but a very gentle fingertip tamping action released a 'cloud' of finely pulverised silt. The sock was washed by this method in five changes of detergent solution, until no further dirt was

being released. It was rinsed (supported on rolled nylon monofilament screening) first in tap water, and then for 20 minutes in a bath of continuously flowing de-ionised water. After being blotted, the sock was dried, still supported on rolled screening, in a current of cool air, for a period of two hours.

Smoothing and reshaping

The Melinex support having been removed, the dry sock was eased over a prepared flat sole-shape, of $\frac{3}{8}$in. (9.5mm) expanded polystyrene sheet, covered with polythene film. Working from the toe, in sections, first the upper, and then the underside of the sock was straightened, held in position with fine stainless steel pins, inserted between the wool threads, dampened, and dried, so that long-standing creases were reduced, and the lines of *nålebinding* straightened. At the same time the edges of tears were brought together so that the sock began to regain its original shape.

Reconstruction and support of sock fabric

When the smoothing was complete, a temporary reconstruction of the broken heel and ankle area was attempted, using fine entomological pins and minimal stitching, with fine soft thread, to draw edges together. Since the shaping at the ankle and heel had upset the regular pattern of loops, found elsewhere on the sock, it was not immediately evident which edges should fit together, and also how much, or from where, fabric had been lost.

With this temporary stitching still in place, the sock was replaced over the polystyrene former and very fine nylon bobbin netting (dyed to match the sock) was fitted closely around the outside. This was eventually to form a supporting lining. It was seamed and darted to follow the contours of the sock closely but in positions which would be concealed when the lining was in place.

After the prepared lining was positioned inside the sock, an outer covering, to protect the most damaged heel and toe areas by 'sandwiching' them between two layers of netting, was applied in two sections. The first covered the underside and sides of the sock, from toe to instep, the second the remainder of the sole, the heel and the ankle band. The netting was secured with stab stitches and running stitch, in very fine silk thread, dyed to match the sock and the netting. The stitches were made by passing the needle through the three layers of fabric, between the *nålebinding* loops. As each section of netting was secured, the temporary stitches, which were holding the fragmented sock together, were clipped and withdrawn. The top side of the sock, between the instep and the toe, was supported by the netted lining only, leaving the well-preserved *nålebinding* accessible for close examination.

Mounting for support during storage and exhibition

A firm but resilient three-dimensional support, which holds the sock in its correct shape, was constructed from non-woven Vilene interlining fabric, covered with a thin layer of polyester wadding, and with cotton stockinette, dyed dark brown. The support was shaped like a toe-less slipper, with a flat sole, to which was sewn a combined arched vamp and heel-back. Separate padding, of polyester wadding, covered with brown stockinette, was eased into the toe of the sock.

Catalogue

The entries are arranged by Period, chronologically; those in Period 6 are chronological within each group. The entries are grouped by type of fibre—wool, other animal fibre, vegetable fibre, silk—and within these groups by fibres, textiles, yarns and cords; the weaves of the textiles within each group are arranged from coarse to fine. Exceptions to these arrangements are indicated. Each entry ends with the small find number, prefixed sf, preceded by context number; a list of provenances is on p.443. The catalogue numbers follow consecutively from those on p.272, *AY* 17/4.

The direction of spin and an approximate measurement of the yarn diameter are given for both warp and weft of each textile, alongside the thread-count (number of threads per centimetre). Thus the code Wa/16/Z/0·4 × We/10/S/0·6 indicates that the warp has sixteen threads per centimetre, is Z-spun, each yarn approximately 0·4mm diameter; the weft has 10 threads per centimetre, is S-spun, yarn 0·6mm diameter. Where warp and weft cannot be differentiated (i.e. when there is no selvedge, gore or other indicator), the terms 'system 1' and 'system 2' are used.

Fleece types: where fleece type is not stated the specimen was not well enough preserved to allow measurements of fibre diameters.

Dyes: only the mineralised and carbonised remains, some of the silks, and a few fragments, too small to allow a sample of yarn to be removed, were not tested for dyes.

The fibres of *1271*, *1277–8*, *1316* and *1386–7*, were identified by H.M. Appleyard, those of *1327–8*, *1332–4*, *1336* and *1390*, by J. Evans, T. Hill and M. Card, and those of *1338–9*, *1405–6* and *1454*, by A.R. Hall and P.R. Tomlinson.

Period 3: c.850–c.900

Wool

Fibres

1254 Fibre, thin staple of raw wool, 25mm long, with no crimp. Fibres too decayed to measure accurately, but most appear to be in the range of 25–65μm. 27868 pit fill, sf14123

1255 Several light brown staples with no crimp, 25mm long. Fibre roots present; hairy fleece type. 34882 cess pit fill, sf13584

1256 About 6g of matted dark brown fibres; dyed with madder. 26977 sf10156

Textiles

1257–62 are in tabby weave, *1263–8* are twills

1257 Fragments, 25 × 20mm and 20 × 20mm, of mid brown tabby, Wa/4/Z/1·5–2·0 × We/2–3/S/2·0, with a fringe of knotted warps (Fig.127e). Warp and weft both hairy fleece types. 32722 pit fill, sf13499

1258 Piece, 0·17 × 0·14m, dark brown, loose tabby, 6/Z/1·0 × 5/S/1·5. Yarn smooth but uneven in diameter. Fleece types, Z hairy, S generalised medium. Dyed with indigotin. Hem (see Fig.168d). Found with *1263*. 34882 cess pit fill, sf13326

1259 Three fragments, largest 140 × 90mm, of black, loose tabby, 12/Z/0·5 × 8/S/0·9. Yarn smooth but irregularly spun. Fleece types Z hairy, S hairy medium; natural pigment in both systems; no dye detected. Two pieces have been joined together by overcasting hemmed edges (Figs.168d and 169f). Sewing thread mid brown combed wool, Z2S, 1·8mm diam.; hems 12mm deep, stitches 2–3 per cm. 34910 pit fill, sf13382 (Pl.XVIIa)

1260 Three fragments, 0·2 × 0·1m, 70 × 50mm, 45 × 30mm, of dark brown tabby, Wa/12–16/Z/0·8 × We/6/S/1·0. Warp almost covers weft. Simple selvedge (Fig.127a). Warp (Z) medium fleece type, weft too decayed to measure. Dyed with ?madder. 26977 sf10152

1261 Fragment, 25 × 20mm, of fawn, calcified, loose tabby, 15/Z/0·4 × 9–10/S/0·6. Fibre probably wool, smoothly spun. 26944 pit fill, sf9740

1262 Fragment, 50 × 50mm, of dark brown tabby, 18–22/Z/0·6 × 11/S/0·8. Z-spun system almost covers S-spun. Yarn smooth, ?combed. Fleece types, medium in warp and weft. No dye detected. 25990 sf10397

1263 Two pieces, together 0·18 × 0·15m, of mid brown non-reversed 2/2 twill with a weft gore (Figs.129 and 131), Wa/11/Z/0·7 × We/11/S/1·0. Warp and weft both medium fleece type. Hems: single fold, 6mm deep on two adjacent edges. Hemming thread combed wool, plied Z2S, 0·7mm diam., stitches 2 per cm (as on Fig.168d). One stitch in similar thread passes through fabric well away from hems. No dye detected. Found with *1258*. 34882 cess pit fill, sf13326 (Pl.XIXa)

1264 Four fragments, 0·21 × 0·15m, 0·12 × 0·12m, 0·13 × 0·19m, 0·17m × 70mm, of mottled brown 2/2 chevron twill (Fig.134c), 9/Z/0·7 × 7/S/1·2. Fleece types: Z hairy medium, S hairy; some natural pigment in both systems. No dye detected. 34882 cess pit fill, sf13464 (Pl.XIXb)

1265–8 were found in pit fill 30963, *1266–8* in association with a skeleton, context 30944 (see p.331 and Fig.138)

1265 Small fragments, largest 5 × 5mm, poorly preserved, probably non-reversed 2/2 twill, 12/Z/0·6 × 10/S/0·5. Fibre decayed but clearly wool. sf12313

1266 Two fragments, 15 × 10mm, 7·5 × 5mm, of mid brown non-reversed 2/2 twill, 14/Z/0·6 × 12/S/0·5–0·7, possibly the same as diamond twill *1268*. Fibre decayed but clearly wool. No dye detected. sf12376

1267 Fragments, largest 60 × 20mm, of mid brown 2/2 chevron twill (Fig.132a), 14/Z/0·6–0·8 × 10/S/1·0. Reverses every 12S. Similar to diamond twill *1268*, but no reverses over 20Z threads. Stitch holes along one edge, c.3mm apart. Fibre decayed. sfs12381, 16048

1268 Fragments, largest 50 × 40mm, of mid brown 2/2 diamond twill (Fig.135c), 12–14/Z/0·6–0·8 × 10–14/S/0·8–1·0. Reverses after 14Z and 12 or 16S threads. Stitch holes along one edge, c.3mm apart. Fibre decayed. sfs12381, 16048

Cord

1269 Dark brown plied cord, 40mm long, c.8mm diam., Z2S, combed wool. 26718 cess pit fill, sf14262

1270 Dark brown plied thread, 0·14m long, S2Z, 1·2mm diam. Hairy fleece type. Dyed with madder. 34882 cess pit fill, sf13471

Other animal fibre

1271 Calf hair, a small number of fibres adhering to a cattle metatarsal. H.M. Appleyard: pigmented animal fibre with smooth profile and regular diameter, fairly wide medulla; a cross-section was prepared and its appearance indicates that it is almost certainly calf hair. Very little of the scale structure was observed but what there was also indicates calf hair. 31061 pit fill, sf16047

?Vegetable fibres

Textiles

1272 Fragments, largest 40 × 30mm and 50 × 20mm, of carbonised textile with pieces of charcoal adhering. Loose tabby weave with a knot in system 2, 8–9/Z/0·5–0·9 × 8/Z/0·6. 30619 pit fill, sf11807

1273 Three fragments, 20 × 10, 30 × 15, 15 × 10mm, of carbonised, non-reversed 2/2 twill, 9–10/Z/0·6–0·9 × 7–8/Z/1·0–1·2. 30648 cess pit fill, sf11860

Period 4A: c.900–c.930/5

Wool

Cord

1274 Tightly plied mid brown cord, 0·28m long, 3–4mm diam., Z14S (or possibly 2 S-twist cords of 6Z and 8Z each, S-twisted together). Hairy medium fleece type. Natural pigment. 31161 pit fill, sf11070

1275 Mid brown plied cord, 0·26m long, of extremely variable diameter, average 4mm, Z4S. At one end a loop has been formed by knotting the cord, dividing it into two 2-ply threads and reknotting it. Generalised medium fleece type. No dye detected. 31161 pit fill, sf11070

1276 Two lengths of mid brown cord, 0·23m and 0·16m long, 3mm diam., loosely twisted Z2S. Medium fleece type. 27921 cess pit fill, sf10609

Other animal fibres

1277 Human hair, 2·7g of glossy, dark brown fibres, 60–70mm long, with shallow waves. H.M. Appleyard: the fibres have the cross-sectional appearance and scale pattern associated with human hair. Their ellipticity and cuticle thickness is like that of European hair. 31161 pit fill, sf11085

1278 Calf hair, 0·7g of light brown fibres in 'staples' c.30mm long. H.M. Appleyard: the fibres have all the characteristics in whole mount, scale cast and cross-section of calf hair. 27921 cess pit fill, sf10610

?Vegetable fibre

Textile

1279 Three fragments, largest 190 × 165mm of carbonised 2/2 chevron twill (Fig.148), 13–14/Z/0·9 × 13–14/Z/0·9. 30290 sf11197

Silk

1280 Fibres, golden pink, 25mm long, loosely S-twisted together, 2mm diam. Too small for dye-testing. 30352, sf14263

Textiles

1281 Eight fragments, largest 90 × 15mm, of dull mid brown silk tabby, 20/Z/0·1 × 20–40/I/0·3–0·4. Spacing of I-system very variable. Dyed with madder. 30039 sf10487

1282 Fragment, 40 × 20 × 30 × 20mm of golden brown tabby, Wa/20–26/Z/0·2 × We/24–30/I/0·3–0·5. Reinforced selvedge, 8mm wide, consisting of 26 paired warps. No dye detected. 30039 sf10496

Period 4B: post and wattle structures, c.930/5–c.975

Wool

Fibres

1283 Three staples, 8mm long, red. Medium fleece type; dyed with madder. 32570 pit fill, sf13405

1284 Several staples, each 50mm long, hairy medium fleece type. 34291 sf14481

1285 7·2g mid brown fibres, mostly matted together, but some in separate staples, 50–60mm long, with shallow wave. Found with *1314*. Hairy fleece type. 34558 pit fill, sf13020 (Pl.XVa)

1286 1·4g light brown fibres, some matted, some in intact staples, 20–50mm long. Fibre roots present. Hairy fleece type. 28432 sf10527

1287 Single staple, dark brown, 50mm long, hairy fleece type. 32225, sf12662

1288 0·2g light brown fibres, matted, hairy fleece type. 32225, sf12662

1289 Single staple, 100mm long, with shallow wave. Hairy medium fleece type. 32725, sf13525

1290 6·5g light brown fibres, some matted together, some in intact staples, 20–40mm long. Hairy medium fleece type. 28432 sf10519

1291 Several light brown staples, 90–130mm long, hairy fleece type, plus others 20–50mm long, also hairy fleece type. 28432 sf10519

1292 Single staple, mid brown, 30–40mm long, hairy medium fleece type. 28432 sf10539

1293 Matted pad, 90 × 90mm, light brown, of two different qualities, hairy and generalised medium fleece types. 28432 sf10538

1294 0·8g light brown fibres, with two intact staples, one 90–100mm long, generalised medium fleece type, the other 30–40mm long, hairy medium fleece type. 28432 sf10539

Textiles

1295–1299 are in tabby weave, and *1300–8* are twills

1295 Fragment, 65 × 30mm, of dark brown tabby, 5/Z/1·0 × 4/S/2·0. Several strands of loosely S-spun wool, 2mm diam., mostly 90mm long, have been darned in at odd angles to give a long pile. Fleece type of warp, weft and pile is hairy. No dye detected. 32725, sf13520

1296 Fragments, largest 200 × 100mm, of grey-brown loose tabby, 3–4/S/0·8–2·0 × 3/S/1·5–3·0. 27093 sf9560

1297 Fragments, largest 65 × 60mm, of loose tabby, 4/Z/1·5 × 3–4/S/0·8–1·5. Yarn uneven. Fleece types, Z medium, S hairy medium. No dye detected. 28432 sf10519

1298 Fragments, largest 40 × 10mm, decayed, grey-brown, probably tabby, 6/Z/1·0 × 4–5/S/1·0. Fibre in poor condition but clearly wool. 35264 sf13797

1299 Fragment, 12 × 8mm, of dark brown tabby, 14/Z/0·4 × 8/S/0·7. 34291 sf14481

See also *1317* below

1300 Fragments, largest 260 × 80mm and 190 × 80mm, of light brown non-reversed 2/2 twill, 14/Z/0·3–0·7 × 7/S/1·0–1·5. Fleece types, Z generalised medium, S hairy. No dye detected. 28432 sf10535

1301 Fragments, largest 20 × 15mm, of red non-reversed 2/2 twill, 14/Z/0·5 × 12/S/0·7. Dyed with madder. Found in association with *1330*; possibly part of diamond twill *1308*, from same context. 8804 pit fill, sf2033

1302 Fragments, largest 140 × 100mm, of mid brown 2/2 chevron twill, 8/Z/0·9 × 5–6/S/1·2 (Fig.134a). Yarn soft and unevenly spun. Fleece type, Z medium, S hairy. Dyed with indigotin. Hard concretions containing cess-like material adhere to parts of the textile. 34558 pit fill, sf13019

1303 Fragment, 140 × 60mm, of 2/2 chevron twill, with dark combed warp and lighter non-combed weft, and selvedge (Figs.127c, 132b). Wa/10–11/Z/0·7 × We/6–7/S/1·1. Warp hairy fleece type, naturally pigmented, weft hairy medium fleece type, not pigmented. No dye detected. The softer weft has become heavily matted in places. The side of the fragment opposite the selvedge has been cut. There are two overstitches, possibly part of a hem at right-angles to the selvedge: sewing yarn plied wool, S2Z, 1·8mm diam. 32725 sf13524 (Pl.XXIVa)

1304 Fragments, largest 110 × 35mm, of dark brown 2/2 chevron twill, *Kreuzköper*, 10/Z/0·8 × 8/S/0·8 (Fig.133b). Fleece types, Z hairy, S hairy medium. No dye detected. 34291 sf14481

1305 Fragment, 45 × 20mm, of light brown 2/2 chevron twill, 16/Z/0·5 × 12/S/0·7–1·0 (Fig.133a). Fleece types, Z generalised medium, S hairy medium. No dye detected. Found rolled up with *1306*. 27093 sf9633

1306 Five fragments, largest 79 × 70mm, of dull red 2/2 chevron twill with a selvedge (Figs.127b and 134b), Wa/18/Z/0·5–0·6 × We/16/S/0·5–0·6. Fleece types, Z hairy medium, S medium. Dyed with lichen purple. Found rolled up with *1305*. 27093 sf9633 (Pl.XXIa)

1307 Fragment, 70 × 35mm, of light brown 2/2 diamond twill, 11/Z/0·4 × 7/S/1·2 (Fig.137a). Yarn smooth and evenly spun. Warp and weft both hairy medium fleece type. No dye detected. 34291 sf14481

1308 Tattered fragments, largest c.40 × 30mm, of reddish 2/2 diamond twill, 14–16/Z/0·4 × 11–13/S/0·7 (Fig.137b). Fleece types, Z medium, S hairy medium. Dyed with madder. See also *1301*. 8804 pit fill, sf2034 (Pl.XXa and see also Pl.XXb)

1309 Ankle sock worked from plied (S2Z) wool yarn in *nålebinding* technique (Fig.141). 260mm long from toe to heel; circumference at ankle 325mm and at broadest part of foot 270mm. A narrow band at the ankle has been dyed with madder; no dye detected in the rest of the sock. Remains of stitching in plied Z2S wool yarn, 1·5mm diam., outlines a rectangular shape around the ball of the foot. (See pp.341–5.) 32725, sf13517 (Figs.140–142a, Pls.XXII–XXIII)

Yarn and cord

1310 S-spun strand, 95mm long, 2mm diam. 32225 sf12661

1311 Z-spun strand, 15mm long, 2mm diam. 32225 sf12661

1312 Dark brown cabled cord, 175mm long, 5mm diam., S2Z8S. Hairy medium fleece type; dyed with madder. 32725 sf13518

1313 Mid brown plied wool thread, 230mm long, 0·4–0·6mm diam., S2Z. Fluffy, irregularly spun yarn. Hairy medium fleece type; dyed with an unidentified ?yellow dye. Found with *1285*. 34558 pit fill, sf13020

1314 Plied yarn, 100mm long, 1mm diam., Z2S. ?Combed wool. 34291 sf14481

1315 Several lengths of dark brown yarn, 1·5mm diam., tied together in an overhand knot. Yarn is plied, S2Z, probably from combed wool. Total length 105mm. Generalised medium fleece type. Dyed with madder. 32725 sf13526

Other animal fibre

1316 Horse-tail hair, a bunch of very coarse black fibres, 260mm long, plus a second group 110mm long. H.M. Appleyard: the fibres are very black and in whole mount it was not possible to see any detail, except to see that they have very smooth profiles and are regular in thickness. Scale casts were attempted with limited success, but, what could be seen, together with the good detail from cross-sections, shows that these are horse-tail hair. The stellate medulla and pigment distribution is typical of horse-tail hairs. 32725 sf13522

Vegetable fibres

1317, 1319–21, 1324–5, 1327–8, 1331–6 and *1338–9* were found together as a group in context 19737 and were recorded as sfs 12857, 12804, 12847 and 12823; their relationship one to another is described above, p. 350.

Textiles

1317–26, *1327–29* and *1331–6* are carbonised; *1317–26* and *1329–31* are ?vegetable fibre; *1330* is mineralised (Pl.XXV)

Tabby weave

1317 Fragment, 30 × 30mm, of carbonised tabby, 5/Z/1·2 × 5/S/1·2. Possibly wool (see p.345). 19737

1318 Fragments, largest 30 × 20mm, of carbonised tabby, 5/Z/1·0 × 6/Z/1·2–1·5. 35549 sf14070

1319 Three fragments, 45 × 20mm, 25 × 20mm and 20 × 20mm, of carbonised tabby, 7/Z/0·9 × 6/Z/1·2. Yarn rough in appearance. 19737

1320 Fragments, largest 30 × 15mm, of carbonised tabby with simple selvedge, Wa/8–10/Z/0·6–0·9 × We/6–8/Z/1·2. Yarn rough in appearance. One fragment stitched to *1328* with run-and-fell seam (Fig.169k). 19737

1321 Fragments, largest 100 × 100mm of carbonised tabby with simple selvedge, Wa/11/Z/0·7–1·0 × We/7/Z/1·0–1·2. Warp-count higher close to selvedge, 18 per cm. One piece has a hem, stitched with plied yarn, ?Z2S, 1mm diam., 3 stitches per cm (see Fig.168b). 19737

1322 Two fragments, 40 × 30mm and 20 × 15mm, of carbonised tabby, 12/Z/0·4–1·0 × 6/Z/1·0. Irregularly spun yarn. 22926 sf13283

1323 Fragment, 35 × 15mm, of carbonised tabby, 12/Z/0·8 × 10–11/Z/0·7. Smooth, evenly spun yarn. 27017 cess pit fill, sf9476

1324 Fragments, largest 30 × 30mm, of carbonised tabby, 12/Z/0·7 × 11/Z/0·7. 19737

1325 Fragments, largest 60 × 55mm, of carbonised tabby, Wa/13/Z/0·7 × We/9/Z/0·7, with simple selvedge. Warp closer set near selvedge, 18 per cm. 19737

1326 Fragment, 35 × 30mm, of carbonised, loose tabby, 14/Z/0·5 × 12/Z/0·6. Yarn smooth and even. 27018 pit fill, sf9496

1327 Fragments, largest 110 × 50mm, of carbonised textile, a diamond mesh with tabby weave upper and lower borders. Upper tabby Wa/18/Z/0·6 × We/10/Z/0·6, count of lower tabby, 22 × 7. Seam and hem (Fig.168b). Fibre, flax (see p.312). 19737 (Fig.147, Pl.XXVIb)

1328 Fragments, largest 100 × 50mm, of carbonised tabby with simple selvedge, Wa/20–28/Z/0·4 × We/13–18/Z/0·4. Yarn smooth and even. Fibre flax, with one fibre of animal hair (see p.312). One fragment stitched to *1333* another to *1320* (Fig.169k). Sewing yarn Z2S, 0·5mm diam., 2–3 stitches per cm. 19737

1329 Fragment, 12 × 11mm, carbonised tabby, 24/Z/0·2 × 18/Z/0·2. 27299 sf15745

1330 Fragments, largest 80 × 50mm, of mineralised grey tabby, 20/Z/0·5 × 18/Z/0·5. Found in association with *1301*. 8804 pit fill, sf2033

Twills

1331 Two fragments, 30 × 20mm and 25 × 20mm, of carbonised non-reversed 2/1 twill, 11/Z/0·6 × 8/Z/1·0 (Fig.145c). Some paired threads in system 1. 19737

1332 Three fragments, 60 × 50mm, 30 × 20mm and 70 × 50mm, of carbonised non-reversed 2/2 twill, 8/Z/1·0 × 8/Z/1·0. Fibre, flax (see p.312). 19737

1333 Fragments, largest 105 × 65mm, of carbonised 2/1 chevron twill, 11–13/Z/0·6 × 9–12/Z/0·6 (Fig.145d). Fibre, flax (see p.312). One piece stitched to *1328*, another to *1334*. 19737

1334 Fragments, largest 125 × 45mm, of carbonised 2/2 chevron twill (Fig.145a), 10–11/Z/0·7 × 7–8/Z/1·0. Yarn smooth and even. Fibre, vegetable but not flax, possibly nettle (see p.312). One piece stitched to *1333*, another to *1336*. 19737

1335 Two fragments, 30 × 30mm and 35 × 10mm, of carbonised 2/2 chevron twill (Fig.145b), 13–14/Z/0·8 × 9–11/Z/1·0. 19737

1336 Two fragments, 55 × 45mm and 55 × 35mm, of carbonised honeycomb weave, 15/Z/0·8 × 15/Z/0·8. Yarn smooth and even. Fibre, flax (see p.312). One piece stitched to *1334*. 19737 (Fig.146, Pl.XXVIa)

Cords

1337 Plied, 65mm long, 8mm wide, Z-twisted from two ?S-twist bundles of vegetable fibre. 22574 pit fill, sf7718

1338 Five pieces, each 40mm long, 5mm diam., probably originally a 5-ply cord, S-twisted together, from vegetable ?bast (see p.394). 19737

1339 A piece of semi-rigid cord or binding, ?Z-twisted from S-twist strands, 45mm long, 9mm diam., from vegetable ?bast (see p.394). 19737

Mixed fibres

1340 Remains of a silk and linen tablet-woven braid. Eight loosely 3-plied yarns, S and Z twist, 1·47m long, tied together at one end with two knots (Fig.160a). Irregularities in yarn, and black material between cords, indicate that this was originally a tablet-woven braid, approx. 5mm wide, worked on four-holed tablets, each tablet threaded with three silk and one ?vegetable fibre warp thread. Some yarns dyed with madder, others with madder plus ?indigotin. (See pp.381–2.) 35448 sf14025 (Fig.160, Pl.XXXII)

Silk

Textiles

All in tabby weave except *1356*

1341 Fragment, 25 × 8mm , of golden brown tabby, 18–24/Z/0·1–0·2 × 20/I/0·3–0·4. Too small to test for dye. 35560 sf16070

1342 Fragments, largest 145 × 30mm, of dark brown loose tabby, 18/Z/0·1 × 23/I/0·4. Dyed with ?kermes. One short edge has been turned under twice for a narrow hem, sewing thread silk, single, I-twist, 0·7mm diam. c.4 stitches per cm. 35264 sf13789

1343 Fragment, 165 × 25mm, of golden brown tabby, Wa/20–22/Z/0·1 × We/22/I/0·3–0·4, very worn in places. Reinforced selvedge, 12mm wide, consisting of at least 41 paired warps. Dyed with indigotin. One edge has been turned in and hemmed with a dark brown silk yarn, single, S-twist, 0·5mm diam., then all four edges have been turned in opposite direction from hem (Figs.153b and 168a): stitch holes along fold, 2 per cm. 28432 sf10528

1344 Fragment, 8 × 10mm, of light brown tabby, 20/Z/0·1 × 24/I/0·4. Not tested for dyes. 35673 sf15953

1345 Fragment, 165 × 95mm, from a ?cap, of light brown tabby, 24/Z/0·15 × 20/I/0·25. Dyed with madder. Two rolled hems (Fig.168) on adjacent edges have stitch holes, c.5 stitches per cm, but only brown matter, probably originally vegetable fibre, in the holes. A third edge has been hemmed with silk, two Z-twist yarns, 0·1–0·2mm diam., used together, 5 stitches per cm (Fig.153a). 35672 sf14157

1346 Tattered fragments, largest c.25 × 30mm, of mid brown loosely woven tabby, 24–28/Z/0·1 × 14/Z/0·1. No dye detected. 15761 (floor), sf15959

1347 A rectangle, 120 × 50mm, of brown tabby, with a selvedge on one side and three cut edges. Wa/24/Z/0·2 × We/34/I/0·4. Selvedge, 16mm wide, reinforced with, from outside edge, 17 paired, 1 single, 21 paired warps. Dyed with indigotin. 25270 (floor), sf8324

1348 Fragments, largest 30 × 15mm, of mid brown, loose, open tabby, 30–40/Z/0·1–0·2 × 16–20/Z/0·1–0·2. Not tested for dyes. 15761 (floor), sf16049

1349 400 × 145mm, red-brown loose tabby, Wa/28/Z/0·1 × We/20/Z/0·1. Reinforced selvedge, 9mm wide, consisting of 39 paired warps. Dyed with madder plus lichen purple. Folded and stitched (see p.367). Sewing thread: overcasting at outer edge of selvedges, brown silk yarn, single, S-twist, 0·5mm diam.; at front fold, red silk yarn, single, Z-twist, 0·5mm (Fig.169g); rolled hems and other seams, brown silk yarn, single, Z-twist, 0·4mm. ?child's head-dress. 35483 sf14011 (Figs.154, 168a and 169a, Pl.XXXIa)

1350 Fragment, 30 × 5mm, of red tabby, 24–32/Z/0·1 × 14/I/0·5. Dyed with madder. Seam (see Fig.169c). Found in association with *1351*. 34290 sf14513

1351 Two fragments stitched together, 35 × 12mm, different tabbies, (a) 40–48/I/0·1 × 24/I/0·3 and (b) 40/Z/0·1 × 28/Z/0·1. Not tested for dyes. Sewing thread silk, I-twist, 0·5mm diam. Found in association with *1350*. 34290 sf14513

1352 Four strips, measuring 270 × 5mm, 260 × 5mm, 105 × 5mm, 120 × 5mm, of reddish brown tabby selvedges, Wa/60 pairs/Z/0·2 × We/10 singles/Z/0·2. Dyed with madder plus lichen purple. 29844 sf12973

1353 Ribbon fragment, complete width, 17mm, surviving length, 16mm, light brown tabby, Wa/56/S/0·3 × We/26/S/0·2, c.86 warps wide. Simple selvedge on either side. Folded in half, stitch holes along fold. Not tested for dyes. 25084 (floor), sf15954

1354 Ribbon fragment, 20 × 4mm, tabby, Wa/56/S/0·15 × We/20/S/0·15, 106 warps wide. Simple selvedges on short sides, cut edges on others. Not tested for dyes. 29222 sf12715

1355 Mid brown ribbon, 135 × 19mm, made up of two similar pieces, 110 and 40mm long, stitched together, tabby, with simple selvedges, Wa/48–52/S × We/30–36/S, c.90 warps wide. Dyed with kermes. Stitching (a) running stitch along fold, mid brown silk, single, S-twist, 0·5mm diam., 5 stitches per cm; dyed with ?kermes, (b) loose overcasting along selvedges, some red, some brown, both single, S-twist, 0·4–0·5mm diam., 6 stitches per cm; dyed with ?madder, (c) seam joining two pieces of ribbon worked in overcast stitch from the outside in brown yarn as (a) (Fig.169b and c). See *1359*. 32113 sf12597 (Fig.155, Pl.XXIXb)

1356 Three tattered, light brown fragments, largest 15 × 10mm. Too many missing threads to identify weave but some areas resemble weft-faced compound twill, Z × I, warp all singles. 23843 sf15730

Yarns

1357 Pinkish fawn thread, 50mm long, 0·3–0·4mm diam., plied Z from 3 S-twist threads, S3Z. 22797 sf15956

1358 Tangled cluster of reddish brown threads, tight Z-twist, 0·1mm diam. 25084 (floor), sf15954

Unidentified fibres

1359 Decayed textile fragment, 3 × 2mm, probably tabby weave, approximately 16/Z/0·4 × ?14/S/0·5. Found inside fold of *1355*. 32113 sf12597

1360 Textile: two soil blocks, 110 × 50 and 80 × 60mm, containing several layers of badly decayed yellow-brown tabby, 16/Z/0·4–0·5 × 14/Z/0·6. Fibre too decayed to identify. 22943 (floor), sf8199

Period 5A: c.975

Wool

Fibre

1361 Single black-stained staple, 35–40mm long, hairy fleece type. 22256 pit fill, sf11494

1362 Three staples of wool, two ginger coloured, one carbonised, all 15mm long, fine fleece type. 8799 sf2423

Vegetable fibres

Textiles

1363–6 are carbonised and are ?vegetable fibres; *1369* is probably flax

1363–1366 were found layered together in a solid lump, 20 × 20mm. 8402 sf1295

1363 Dimensions not clear; loose, open, tabby, 5/Z/1·0 × 5/Z/1·0

1364 Fragment, 7·5 × 5mm, of ?tabby, approximately 8/Z/0·8 × 7/Z/0·8

1365 Fragment, 20 × 20mm, of tabby, 8/Z/0·7 × 6/Z/0·8

1366 Dimensions not clear. Tabby, 14/Z/0·7 × 7/Z/0·8

1367 Fragments, largest 30 × 15mm, of tabby, 14/Z/0·4 × 16/Z/0·3–0·5. 22124 sf10932

1368 Fragment, 20 × 15mm, of tabby, 16/Z/0·3–0·6 × 16/Z/0·5. 8368 sf1293

1369 Two fragments, both less than 10 × 10mm, of grey tabby, 14/Z/0·5 × 12/Z/0·7. Fibre ?flax. 27388 pit fill, sf10023

Cord

1370 Plied, 90mm long, 6mm diam., Z-twisted from 2 S-twist strands, S2Z. ?Vegetable fibre. 22044 pit fill, sf7082

Silk

Textiles

1371 Piece, 100 × 25mm of mid brown, loose, open tabby, 16/Z/0·2 × 34–60/Z/0·2–0·3. Folded twice longitudinally, with some stitch holes along the folds, possibly originally a stitched tuck. Dyed with ?madder. 27679 pit fill, sf12754

1372 Head-dress, 0·59 × 0·18m, golden brown tabby, Wa/24–25/Z/0·1–0·3 × We/19–20/I/0·35, with reinforced selvedge, 11mm wide, consisting of ?40 paired warps; hems (Fig.169d). Not tested for dyes. Sewing thread, silk, S-twist, 0·4mm diam. Construction of head-dress described on pp.360–1. 22976 pit fill, sf8129 (Figs.151–2a, 168a, Pls.XXVIII, XXIXa and XXXa–c)

Period 5B: c.975–early/mid 11th century

Wool

Fibres

1373 Several mid brown staples, c.90mm long, hairy fleece type. Fibre roots present. 1473 sf417

1374 Single staple, 90mm long, hairy fleece type. Fibre tips and roots present. 1473 sf407 (Pl.XVI)

1375 Several staples, 80–130mm long, hairy medium fleece type. 1473 sf416

1376 Several mid brown staples, c.70mm long, hairy medium fleece type. Fibre roots present. 1473 sf417 (Pl.XVI)

1377 Single staple, 30mm long, generalised medium fleece type. Fibre roots present. 1473 sf407 (Pl.XVI)

1378 Fibre. Dark brown wool staple, 50mm long with little or no crimp. Too decayed to identify fleece type; M.L. Ryder suggests medium. 15530 sf4378 (Pl.XVI)

Textiles

1379 Approximately 40 × 40mm of decayed red textile, set in soil which has been stained a similar colour. Non-reversed 2/2 twill, 7/Z/1·0 × 5/S/1·8–2·0. Smooth, coarse yarn, weft variable in diameter. Fibre too decayed to identify fleece type. Dye of textile and surrounding soil is madder. 21510 pit fill, sf9380

1380 Textile fragment, 75 × 25mm, calcified grey-brown 2/2 diamond twill (Fig.135a), 15/Z/0·5 × 11/S/0·7. Fibre not identifiable but yarn smooth and evenly spun. 21510 pit fill, sf9187

1381 Fragments, largest 30 × 25mm, of reddish grey 2/2 diamond twill, 14/Z/0·5 × 11/S/0·7 (Fig.135b). Yarn smooth and evenly spun. Fibre too decayed to identify fleece type. Dyed with madder. 29386 sf12912

1382 Fragment, 65 × 40mm, of dark brown 2/2 diamond twill (Fig.136), Wa/22/Z/0·3–0·4 × We/12/Z/0·5; selvedge (Fig.127d). Fleece type warp and weft, hairy. No dye detected. 1473 sf421 (Pl.XXIb)

Cord

1383 Cabled, 125mm long, 4mm diam., Z6S2Z. Hairy medium fleece type. Natural pigment. 1473 sf16050

1384 Mid brown, cabled, 180mm long, 4mm diam., Z2S12Z. Possibly combed wool. Hairy medium fleece type. 15645 sf4559

1385 Plied thread, 165mm long, 0·9mm diam., Z2S, combed wool. 1473 sf417

Other animal fibres

1386 Tufts with no crimp, 25–35mm long, probably goat hair. H.M. Appleyard: this sample is from a double coated type of animal and is undyed. The fine fibres do not contain any pigment or medullation and the scale structure is very clear. The coarse outer coat fibres have wide medullae and some are pigmented, they are straight, fairly smooth in profile and regular in diameter. The scale pattern on these is typical of goat hair. The transitional stage was found between the near waved mosaic on the length of the fibre and the crenate pattern towards the tip. These fibres are shorter than would be expected for goat hair but even so the features seen were certainly of the goat hair type. 1473 sf417

1387 A small number of loose dark brown fibres, tentatively identified as mohair. H.M. Appleyard: the fibres are animal, undyed, of smooth profile and regular in diameter. The little scale structure visible is crenate with near margins. These are very similar to present-day mohair fibres and their general appearance suggests mohair. 1359 sf468

Vegetable fibres

Textiles

1388 Fragments, largest 45 × 10mm, of greyish white linen tabby, 24/Z/0·3–0·5 × 20/Z/0·4, adhering to a twig. 21677 sf10181

1389 Fragment, 15 × 10mm, of decayed grey-brown tabby, 13/Z/0·7 × 11/Z/0·7. Fibre badly decayed but probably a vegetable bast fibre such as flax. See *1402*. 21510 pit fill, sf9152

1390–1401 and *1403–4* are carbonised, and, except *1390*, ?vegetable fibre; *1402* is calcified

1390–1 and *1396* are from context 21746 and share sfs10311, 10314, 10355, 10383–7, 10420, 10423 and 10427

1390 Many fragments, largest 160 × 90mm, of tabby, Wa/22–26/Z/0·3–0·4 × We/18–20/Z/0·4; selvedge. Fibre, flax (see p.312). Several run-and-fell seams (Figs.144, 169j), sewing thread plied, Z2S, 0·4mm diam. ?Part of a child's shirt-like garment. Found in association with *1391*, *1396*. (Pl.XXIVb)

1391 Fragments, largest 60 × 35mm, of tabby, 10/Z/0·8 × 6/Z/0·8–1·3. Found in association with *1390*, *1396*.

1392 Fragments, largest 25 × 20mm, of tabby, 10/Z/0·8–1·0 × 8/Z/0·8–1·2. Some paired threads in system 1. 29465 sf10928

1393 Fragment, 60 × 40mm, of tabby, 17/Z/0·4 × 10–16/Z/0·4. 8444 sf1670

1394 Fragments, largest 30 × 20mm, of tabby, 14/Z/0·4 × 8/Z/0·6. Folded together with *1395*. 14515 sf9749

1395 Many fragments, largest 100 × 70mm, of tabby, 20/Z/0·4 × 16/Z/0·4. Yarn smooth and evenly spun. Several flat, run-and-fell seams (Fig.169j–n), sewing thread, Z2S, 0·6mm diam. 14515 sf9729

1396 Fragments, largest 100 × 60mm, of loose tabby, with simple selvedge, Wa/16/Z/0·2–0·3 × We/14/Z/0·3–0·4. Warps closer-set at selvedge, 16 in 4mm. Found in association with *1390–1*.

1397 Fragments, largest 100 × 90mm, of loose tabby, with selvedge, Wa/8/Z/0·8–1·2 × We/5/Z/1·0. Warp count higher at selvedge. Two long weft ends have been stitched into the selvedge (Figs.143, 169h). 19637 sf9299

1398 Fragments, largest 40 × 15mm, of tabby, 20/Z/0·5 × 15/Z/0·5. Two pieces are held together, one on top of the other, by a running stitch worked in ?plied thread, ?Z2S, 0·5mm diam. (Fig.169h). 29103 sf10085

1399 Tabby, 20/Z/0·4 × 20/Z/0·3, dimensions not clear, interfolded with *1400*. 29465 sf10851

1400 Fragments, crumpled up together, largest 140 × 60mm, of loose tabby, 26–30/Z/0·2 × 26–28/Z/0·2, with seam. Interfolded with *1399*. 29465 sf10851

1401 Fragments, largest 80 × 60mm, of tabby, 22/Z/0·4 × 20/Z/0·4, with seams (Fig.169j). Similar to *1390*. Sewing thread, Z2S, 0·6mm diam. 21746 sf10403

1402 Two textile fragments, both less than 5 × 5mm, of calcified grey tabby, approximately 13/Z/0·7 × 11/Z/0·7. Similar in appearance to *1389*, and from same context. 21510 pit fill, sf9173

1403 Fragment, 40 × 25mm of, non-reversed 2/2 twill, 8/Z/0·8–1·2 × 8/Z/0·9. 19637 sf9299

1404 Three tattered fragments, largest 30 × 15mm, of 2/2 diamond twill (Fig.149), 15–18/Z/0·5 × 13/Z/0·5. 7232 sf1025

Cord

1405 Plied, 100mm long, 5mm diam., S2Z. Fibre, vegetable ?bast. 2467 ditch fill, sf527

1406 Plied, 180mm long, 5mm diam., S-twisted from bundles of vegetable bast fibre. 6434 pit fill, sf5312

Silk

Textiles

1407 Red-brown ribbon, 225 × 33mm, tabby, with simple selvedges, Wa/42–50/S/0·2–0·3 × We/32/S/0·2, 168 warps wide. Occasional weaving fault where a warp passes over three wefts; a knot in one warp. Dyed with madder. The ribbon has been folded in half longitudinally;

stitch holes along the fold, at edges and along centre of ribbon: about three stitches per cm. Three lengths of silk thread were inside fold: one, 45mm long, plied Z2S, 0·3mm, purplish red; the other two 140 and 75mm long, single, S-twist, dark red-brown. Thread dyed with lichen purple. 21766 sf9735 (Fig.155a, Pls.XXIXb, XXXd)

1408 Reliquary, made up of (a) an outer pouch, 33 × 30mm, of weft-faced compound twill, and (b) an inner pouch, approximately 24 × 20mm, of two tabbies.
Outer pouch: Wa/18–20 singles + 16–17 pairs (i.e. 50–4)/Z × We/40 + 40 (80)/I; selvedge; dyed with kermes plus an unknown dye-stuff.
Inner pouch: one tabby, 40/S × 60/I; the other, 20 pairs/S × 52/I. Not tested for dyes.
The outer pouch is stitched with single strand I-twist silk, 0·5mm diam., and has a cross embroidered on one face. The inner pouch is stitched with single strand S-twist silk, 0·5–0·7mm and 0·4mm diam.
(See pp.369–71, 378–81.) 8023 sf1921 (Figs.156, 169a, b and c, Pl.XXVIIa)

Yarn

1409 Single Z-twist yellow silk thread, 30mm long, 0·2mm diam. 15608 sf16051

Gold

1410 Yarn, five short lengths of gold thread, 0·20–0·25mm diam. See p.314. 21265 sf8489 (Pl.XVIIb)

Viking Age (Period uncertain)

1411 Fragment, 75 × 45mm, of grey, partially calcified tabby, 12/Z/0·8 × 8/S/0·8, adhering to a twig. A few fibres have survived, clearly wool. 28890 sf11131

Period 6: Norman or later

Wool

Fibres

1412 Staples, 50mm long, hairy medium fleece type. Fibre roots present. 11–12th century; 6026 cess pit fill, sf2206

1413 Staples 40mm long, shortwool fleece type. Fibre roots present. 13th–14th century; 4829 sf16063

Textiles

1414 Two tattered fragments, 40 × 20mm and 20 × 15mm, of dark brown, non-reversed 2/1 twill, 14/Z/0·6 × 7/S/1·0. S-spun yarn, extremely irregular. Fleece types, Z generalised medium, S shortwool. Dyed with an unidentified orange mordant dye. 12th–13th century; 17059 pit fill, sfs4588–9

1415 Wool fragment, 140 × 115mm, of mid brown, non-reversed 2/1 twill, 11/Z/0·6 × 6–7/S/ and Z/0·5–1·0 (2 S-spun alternate with 2 Z-spun in system 2). Slightly matted on one face. System 1 (Z) medium fleece type, system 2 (Z) shortwool, S hairy medium. 13th century; 10879 sf2703 (Pl.XXXIIIa)

1416 Fragment, 60 × 35mm of mid brown, non-reversed 2/1 twill, 12/Z/0·5 × 7/S/0·8; one side matted. S-spun softer and more irregular than Z-spun. Z medium fleece type, S hairy medium. 13th century; 10877 pit fill, sf2699

1417 Tattered fragments, largest 110 × 20mm, of light fawn tabby, Wa/9/Z/0·5 × We/9–10/S/0·5, with stripes of extended tabby in the weft (Fig.161), We/15–18/S/0·5, of red, brown and pale fawn; selvedge. Warp and weft of simple tabby, both generalised medium fleece type. Red stripes dyed with madder; brown stripes also gave a weak madder result; fawn yarns were probably originally white. 13th–14th century; 10904 pit fill, sf2764 (Pl.XXXIVa)

1418 Fragment, 70 × 60mm, of reddish brown tabby, 13/Z/0·8 × 9–10/S/0·8. A weaving fault, where one Z-spun crosses over five S-spun. Slightly matted, more on one face than the other. Z and S both generalised medium fleece type. Dyed with madder. 13th–14th century; 10758 cess pit fill, sf2667 (Pl.XXXIVb)

1419 Two fragments, 65 × 35mm and 40 × 35mm, of dark brown tabby, 12–14/Z/0·7 × 12–14/S/0·7. Matted on both faces. 13th–14th century; 10758 cess pit fill, sf16064

1420 Two wedge-shaped fragments, 145 × 30mm, 100 × 30mm, of golden brown tabby, 13–14/Z/0·8 × 13–14/S/0·5. Slightly matted. All edges cut. Z and S both shortwool fleece type. Dyed with ?madder. 13th–14th century; 10758 cess pit fill, sf2667 (Pl.XXXIVb)

1421 Fragment, 45 × 10mm, of non-reversed 2/2 twill, 11/Z/0·6/green-blue × 8–10/S/0·8–1·0 pale fawn. S-spun yarn much softer and more irregular than Z-spun. Z-spun dyed with indigotin; S-spun, no dye detected. 13th–14th century; 12561 ?cess pit fill, sf3307

1422 A strip, 50mm long, 8mm wide, consisting of 16 parallel wool threads, S-spun, 0·8mm diam. These are crimped in such a way as to indicate that they were once part of tabby weave, ?weft-faced. No crossways threads are now visible apart from a few decayed vegetable fibres. Original thread-count probably 4 vegetable × 20 wool per cm. The wool yarn is dark brown but there is also a darker, almost black, thread of the same type found in association with the others. Dyed with madder and dark thread with indigotin. ?Tapestry. 14–15th century; 10903 pit fill, sf2677

Yarn

1423 Several pieces wool yarn, 20–50mm long, mid brown, Z-spun, 0·4mm diam. Hairy fleece type. 13th century; 10879 sf2692

1424 Bundle, light brown, tied in a knot. Z-spun, 0·9mm diam. 13th–14th century; 5668 ?cess pit fill, sf3266 (Fig.165b)

1425 Several pieces of light brown yarn, 20–30mm long, S-spun, 1mm diam. Found in association with *1426* and *1434*. 13th–14th century; 5668 ?cess pit fill, sf2484

1426 Short lengths, Z-spun, 0·7mm diam., knotted together, total length of bundle, 20mm, fibres in poor state of preservation. Found in association with *1425* and *1434*. 13th–14th century; 5668 ?cess pit fill, sf2484

1427 Brown, Z-spun, 150mm long, 0·8mm diam. Shortwool fleece type. 13th–14th century; 5668 ?cess pit fill, sf3268

1428 Two bundles, light brown, tied together in a knot, total length of bundle, 400mm. 31 Z-spun yarns, 0·5–1mm diam., are tied to 22 Z-spun, 0·4–0·8mm, and 15 S-spun, 1·0–1·5mm. S-spun yarn is noticeably softer and spun more loosely than the Z-spun. S medium fleece type. 13th–14th century; 12548 cess pit fill, sf3258 (Fig.165a, Pl.XXXIIIb)

1429 Blue thread, Z-spun, 0·8mm diam. Buried in grey concretion, length not clear. Dyed with indigotin. 13th–14th century; 12548 cess pit fill, sf16055

1430 Several pieces, longest 120mm, light brown, Z-spun, 0·6mm diam. 13th–14th century; 12548 cess pit fill, sf16056

1431 Fawn, 15mm long, S-spun, 1·5mm diam. 13th–14th century; 12548 cess pit fill, sf16057

1432 Several black and dark brown yarns, 20–50mm long, Z-spun, 0·4mm diam. Yarn smooth and even, but kinked regularly, as if used in weaving. 13th–14th century; 15008 pit fill, sf2485

1433 Cluster of black threads, mainly 40mm long, Z-spun, 0·3mm diam. Crimped as if once woven. No dye detected. 13th–14th century; 15008 pit fill, sf15955

Cord

1434 Pieces of light brown, plied cord, 15–40mm long, 2mm diam., Z2S, fibres in poor state of preservation. Found in association with *1425–6*. 13th–14th century; 5668 ?cess pit fill, sf2484

1435 Five pieces, light brown, one 150mm long, others c.40mm, tightly plied, Z2S, 2·5mm diam. Fibre poorly preserved. 13th–14th century; 5668 ?cess pit fill, sf3268

1436 Light brown, 100mm long, 2·5mm diam., tightly plied Z2S. Fibre poorly preserved. 13th–14th century; 12544 pit fill, sf3254

1437 Six pieces, one 380mm long, the others 120mm long, all 2mm diam., tightly plied Z2S. Fibre poorly preserved. 13th–14th century; 12548 cess pit fill, sf3258

1438 Light brown, cabled, 120mm long, 3mm diam., Z3S2S. 13th–14th century; 12548 cess pit fill, sf3258

1439 Pieces of light brown plied thread, longest 65mm. Z2S, 2mm diam. 13th–14th century; 12548 cess pit fill, sf16052

1440 Mid brown, 25mm long, 1·2mm diam., plied Z2S. 13th–14th century; 12548 cess pit fill, sf16053

1441 Blue, plied, 30mm long, 1mm diam., Z2S. Dyed with indigotin. 13th–14th century; 12548 cess pit fill, sf16054

1442 Light brown, 10mm long, 2mm diam., plied Z2S. Fibre poorly preserved. 13th–14th century; 12561 ?cess pit fill, sf2511

Vegetable fibres

Textiles

1443 Two fragments, both c.10mm × 10mm, of carbonised tabby, 20–22/Z/0·5 × 14–16/Z/0·5. ?Vegetable fibre. 12th century; 5289 cess pit fill, sf2999

1444 Fragment, 60 × 40mm, of grey-brown, mineralised tabby, 22/Z/0·4 × 22/Z/0·4. ?Vegetable fibre. 13th century; 12332, sf14284

1445 Several fragments, Largest 15 × 12mm, of greyish white tabby, 20/Z/0·3–0·8 × 12/Z/0·5–0·7. Fibre flax, comparatively well preserved; probably bleached. 13th–14th century; 12548 cess pit fill, sf3259 (Pl.XVb)

Ropes

1446 Plied rope, 200mm long, 10mm diam., worked from bundles of untreated flax stems. 12th century; 5655 ?cess pit fill, sf1950

1447 A 3-strand plait, 270mm long, 25mm diam., worked from bundles of hair moss, *Polytrichum commune* Hedw. 12th century; 9323 pit fill, sf1421

1448 Two 3-strand plaits, 280mm and 125mm long, 40mm diam., worked from bundles of *P. commune*. A fresh bundle of fibres is worked in at each turn of the plait (Fig.166), the raw ends at the back of the plait being 70mm long. 12th century; 17599 sf16058

1449 3-strand plait, 200mm long, 30mm diam., worked from bundles of *P.commune*. Worked in the same way as *1448*, but raw ends only 30–40mm long. 12th century; 17551 sf16059

1450 3-strand plait, now broken into several pieces of irregular width, of *P.commune*. 12th century; 17599 sf16060

1451 3-strand plait, 170mm long, 25mm diam., worked from bundles of *P.commune*. Late 12th–13th century; 5406 pit fill, sf1963

1452 3-strand plait, 230mm long, 30mm diam., worked from bundles of *P. commune*. 13th century; 6257 pit fill sf3332

1453 3-strand plait, 200mm long, 40mm diam., worked from bundles of *P.commune*. 13th century; 12564 sf16062

1454 3-ply rope, 100mm long, 10mm diam., plied from bundles of untreated flax stems (*Linum usitatissimum* L.). 13th century; 5755 pit fill, sf1969

1455 Bundle of *P.commune* stems, some still with leaves; 140mm long, maximum diam. 15mm. ?13th century; 13244 sf16061

Silk

Yarn

1456 Six pieces of pale golden plied yarn, longest 220mm; I2S. Crimped as if used in weaving or sewing. 13th–14th century; 10795 sf2687

Cord

1457 Golden brown cord, 60mm long, plied I2S, 0·4mm diam. 13th–14th century; 10904 pit fill, sf2764

Unidentified fibre

1458 Impression of a textile in a small piece of lead spill. Only four threads were visible in either system, but the weave appears to be tabby, approximately 12/Z/>0·3 × 12/?S/>0·3. 13th century; 18256 sf4833

Watching Brief, 1982.22

1459 came from the same pit as the Anglian helmet (sf155, *AY* 17); *1460–2* from Anglo-Scandinavian levels

1459 The cast of a textile was found in patches in the external corrosion of an iron artefact, possibly a large spearhead or a weaver's sword-beater (sf157, *AY* 17, in prep.). Most of the remains are on the haft, the largest area 5 × 5mm. Tabby weave, 12/Z/0·5 × 12/Z/0·5. Similar Z-spun threads were found on the blade. 1777 sf157

Wool

Textile

1460 Three pieces sewn together, 230 × 60mm, (a) mid brown tabby, 5/Z/1·0–1·5 × 5/S/1·5, with locks of loosely twisted wool darned into the fabric, to give a pile 25–30mm deep. Z, S and pile all hairy fleece type. Dyed with madder. The raw edges have been bound with (b) a finer, dark brown, combed tabby, with at least one selvedge (possibly another tucked in behind the hem), Wa/24/Z/0·4 × We/16/Z/0·4. The binding is sewn into place with a fine combed wool yarn, Z2S, in an upright hemming stitch, 3 per cm, and an irregular running stitch. A similar plied yarn has been used double, to hem the bound edge down on to the fabric and to join the three pieces of the main fabric together. 2070 sf247 (Figs.128, 168c, 169c and e, Pl.XVIII)

Cord

1461 Mid brown, plied, 260mm long, 7·5mm diam., S11Z. Generalised medium fleece type. Dyed with madder. 2072 sf248

?Vegetable fibre

Textile

1462 Padded pleat, 50 × 20mm (dimensions when folded), of carbonised 2/2 twill, 9/Z/0·8 × 7–8/Z/1·0. Folded as shown in Fig.150. Z-spun threads, 1·5mm diam., have been stitched along the inside of the folds to form the pleats. 2050 sf231

Unstratified

1463 Wedge-shaped offcut, 250 × 25mm, of dark brown wool tabby, 8/Z/0·8 × 8/S/0·8. A thick nap has been raised on both surfaces of the cloth, to give a fabric 2mm wide. Hairy medium fleece types in both warp and weft. Dyed with madder. sf223

1464 Several fragments, largest 80 × 110mm, of carbonised tabby, 28/Z/0·2–0·4 × 16–20/Z/0·4. Some flat seams, sewn with plied yarn, ?I2S, 0·4mm diam., 5 stitches per cm. Unnumbered

Provenances

Finds were recovered from contexts on each site as follows; context numbers are given in Roman characters, catalogue numbers in italics.

16–22 Coppergate, 1976–81.7

1359: *1287*; 1473: *1373–7, 1382–3, 1385–6*; 2467: *1405*; 4829: *1413*; 5289: *1443*; 5406: *1451*; 5655: 1446; 5668: *1424–7, 1434–5*; 5755: *1454*; 6026: *1412*; 6257: *1452*; 6434: *1406*; 7232: *1404*; 8023: *1408*; 8368: *1368*; 8402: *1363–6*; 8444: *1393*; 8799: *1362*; 8804: *1301, 1308, 1330*; 9323: *1447*; 10758: *1418–20*; 10795: *1456*; 10877: *1416*; 10879: *1415, 1423*; 10903: *1422*; 10904: *1417, 1457*; 12332: *1444*; 12544: *1436*; 12548: *1428–31, 1437–41, 1445*; 12561: *1421–2*; 12564: *1453*; 13244: *1455*; 14515: *1394–5*; 15008: *1432–3*; 15530: *1378*; 15608: *1409*; 15645: *1384*; 15761: *1346, 1348*; 17059: *1414*; 17551: *1449*; 17599: *1448, 1450*; 18256: *1458*; 19637: *1397, 1403*; 19737: *1317, 1319–21, 1324–5, 1327–8, 1331–6, 1338–9*; 21677: *1388*; 21265: *1410*; 21510: *1379–80, 1389, 1402*; 21746: *1390–1, 1396, 1401*; 21766: *1407*; 22044: *1370*; 22124: *1367*; 22256: *1361*; 22574: 1337; 22679: *1371*; 22797: *1357*; 22926: *1322*; 22943: *1360*; 22976: *1372*; 23843: *1356*; 25084: *1353, 1358*; 25270: *1347*; 25990: *1262*; 26718: *1269*; 26944: *1261*; 26977: *1256*; 27017: *1323*; 27018: *1326*; 27093: *1296, 1305–6*; 27299: *1329*; 27388: *1369*; 27868: *1254*; 27921: *1276, 1278*; 28432: *1286, 1290–4, 1297, 1300, 1343*; 28890: *1411*; 29103: *1398*; 29222: *1354*; 29386: *1381*; 29465: *1392, 1399, 1400*; 29844: *1352*; 30039: *1281, 1282*; 30290: *1279*; 30352: *1280*; 30619: *1272*; 30648: *1273*; 30963: *1265*; 30944: *1266–8*; 31061: *1271*; 31161: *1274–5, 1277*; 32113: *1355, 1359*; 32225: *1287–8, 1310–11*; 32570: *1283*; 32722: *1257*; 32725: *1289, 1295, 1303, 1309, 1312, 1315–16*; 34290: *1350–1*; 34291: *1284, 1299, 1304, 1307, 1314*; 34558: *1285, 1302, 1313*; 34882: *1255, 1258, 1263–4, 1270*; 34910: *1259*; 35264: *1298, 1342*; 35448: *1340*; 35483: *1349*; 35549: *1318*; 35560: *1341*; 35672: *1345*; 35673: *1344*

Watching Brief, 1982.22

1777: *1454*; 2050: *1462*; 2070: *1460*; 2072: *1461*; u/s: *1463–4*

Acknowledgements

York Archaeological Trust and the author wish to express their thanks to those who have contributed to the production of this report. The following have generously allowed the author to quote from their unpublished work: Lise Bender Jørgensen, Elisabeth Crowfoot, Elizabeth Heckett, John Hedges, Märta Lindström, Gale Owen-Crocker and Frances Pritchard. Help with translations was provided by Carolyn Bagwill, Charles Bonny, Allan Hall, Patrick Ottaway and Dagmar Pickles. For typing of tables and sections of the text the author is grateful to Rosemary Middleton and Nancy Walton. She would also like to thank Dominic Tweddle for help with documentary sources and Lise Bender Jørgensen, Elisabeth Crowfoot, Allan Hall, Richard Hall, Michael Ryder, George Taylor, Dominic Tweddle and John Peter Wild for reading and commenting on parts of the text. The author is grateful to T. Rubidge of the Materials Quality Assurance Directorate (M.O.D.) for his explanation of the various factors involved in the decay of textile fibres on archaeological sites. Finally, thanks are due to the staff of the York Archaeological Trust conservation laboratory and to Carol Brown, Anne Grauer, James Rackham and Tom Srahan for their help, in many ways, in the preparation of the text.

Figures for this fascicule were drawn by David Patrick, with the exception of the follow- ing: Figs.140 and 151 which were drawn by Sheena Howarth, Figs.136 and 170 by Karen Guffogg, and Fig.120 by Terry Finnemore. The distribution plans (Figs.121-3) were prepared by Kaye Haworth and the histograms (Microfiche I) by Bruce Lamden. All figures were subsequently prepared for publication by Karen Guffogg.

Figures and text were scanned, and the digital edition prepared by Lesley Collett.

Photographs were taken as follows: PI.XV by the author, Pls.XVI-XXI, XXIV-XXV, XXVlb, XX lXi?, XXXla, XXXII-XXXIV by Simon Hill and Pls.XXII, XXllla, XXVla, XXVlla, XXVIII, XXXd and XXXlb by M.S. Duffy. The photographs of the reliquaries for PI.XXVllb-d were provided by Dominic Tweddle. The North West Museum and Art Gallery Service kindly supplied the photographs on Pls.XXlllb, XXIXa and XXXa-c.

The summary was translated into French by Mr B. Randoin and into German by Mrs K. Aberg. The fascicule has been edited by Rosalind Hawkes who also reorganised the catalogue for publication; she has been assisted latterly by Wendy Sherlock. It is published with a generous grant from English Heritage.

Summary

211 examples of raw fibre, cordage and wool, silk and linen textiles were recovered, 162 from Anglo-Scandinavian levels, 47 from medieval; and two unstratified. The presence of raw fibre, spinning and weaving implements and dye plants suggests that wool and linen cloth were being produced on the site.

The Anglo-Scandinavian finds include a sock in *nålebinding* technique, a piece of twill and a combed-wool binding, all of which betray a Scandinavian influence if not a Scandinavian origin. The majority of the finds, however, have more in common with the textiles of Anglo-Saxon England and the Continent. Among the wool finds are some fine broken chevron twills, one of which has been dyed with lichen purple: these are probably traded goods, possibly imported from Frisia. A group of patterned linens, including a honeycomb weave, may originate in the Rhineland. However, the fabrics with a darned-in pile are likely to be a local product and the same may be true of some of the broken diamond weaves as well as the coarser tabbies and twills. A hairy type of wool, probably a local fleece, has been used for many of the coarser products.

Tabby weave silks appear to have been cut up and sewn on the site, probably for silk head-dresses. One complete example of a head-dress was found, which has parallels in another York site and in Lincoln and Dublin. Other silks include the remains of a narrow tablet-woven braid, ribbons dyed with madder and kermes and a small pouch-reliquary with an outer covering in compound twill.

The medieval textiles include 2/1 twills and fulled tabbies, both of which were prevalent in north-west Europe at this time; a striped piece, probably woven in Flanders; and remains of a possible piece of tapestry. The differences between these and the earlier group of textiles reflect the changes in the tools, techniques and organisation of the textile industry over the 9th–15th centuries.

Résumé

211 exemplaires de fibres brutes, cordage et textiles de laine, soie et lin ont été découverts, 162 proviennent de niveaux anglo-scandinaves, 47 de niveaux médiévaux et deux sont hors stratigraphie. La présence de fibres brutes, d'accessoires de filage et de tissage ainsi que de plantes utilisées pour la teinture suggère que des tissus de laine et de lin étaient fabriqués sur le site.

Parmi les découvertes anglo-scandinaves, on note une socquette réalisée en *nålebinding*, un fragment de sergé, et un fragment de bordure en laine peignée, qui trahissent tous une influence scandinave, si ce n'est une origine scandinave. La majorité des découvertes ont cependant plus de points communs avec les textiles de l'Angleterre anglo-saxonne ou du continent. Parmi les fragments de laine se trouvent quelques très fins sergés interrompus à chevrons, l'un d'entre eux a été teint avec un violet de lichen. Ce sont probablement des produits commercialisés, peut-être importés de Frise. Un groupe de toiles à motifs, comprenant un tissage en nid d'abeilles, peut provenir de Rhénanie. Cependant, les tissus à 'poil cousu' sont vraisemblablement un produit local, ainsi que quelques uns des sergés interrompus à losanges, de même que les toiles et les sergés plus grossiers. Une laine de type poilu, probablement de tonte locale, a été utilisée fréquemment pour des productions grossières.

Des toiles de soie semblent avoir été coupées et cousues sur le site, probablement pour des foulards de soie. Un foulard complet, qui a des parallèles provenant d'un autre site à York, et de Dublin et Lincoln, a été découvert. Les autres soieries comprennent les restes d'un étroit galon tissé aux cartons, de rubans teints en garance et en kermès et une petite bourse reliquaire avec une enveloppe de samit.

Les textiles médiévaux comprennent des sergés 2/1 et des toiles foulées, qui dominent tous deux dans l'Europe de nord-ouest à cette période; un fragment rayé, probablement tissé en Flandres; et les restes d'un fragment peut-être de tapisserie. Les différences entre ces tissus et les exemplaires du groupe antérieur reflètent les changements dans l'outillage, les techniques et l'organisation de l'industrie textile entre le IXe et le XVe siècle.

Zusammenfassung

211 Fundstücke an Roh- und Seilfaser, sowie Woll-, Seiden- und Leinentextilien wurden sichergestellt; 162 stammten aus den anglo-skandinavischen und 47 aus den mittelalterlichen Schichten; zwei konnten nicht zugewiesen werden. Das Vorhandensein von Rohfasern, von Gerätschaften zum Spinnen und Weben sowie von Färberpflanzen deutet an, daß hier Woll- und Leinentuche hergestellt wurden.

Unter den anglo-skandinavischen Funden befinden sich ein Socken in *Nålebinding*, ein Stück Köper und ein Kammgarnsaumband, die alle skandinavischen Einfluß, wenn nicht sogar skandinavischen Ursprung verraten. Der Großteil der Funde zeigt jedoch eine größere Übereinstimmung mit Textilien aus dem angel-sächsischen England und aus Europa. Unter den Wollfunden befinden sich einige feine Spitzköper, von denen einer mit Flechten dunkellila gefärbt worden war. Diese Stücke waren wahrscheinlich Handelsware und möglicherweise aus Friesland importiert. Eine Gruppe gemusterter Leinentextilien, einschließlich eines Wabengewebes, könnten aus dem Rheinland stammen. Jedoch scheinen die Textil mit eingestopften Noppen mehr ein einheimisches Produkt gewesen zu sein; das gleiche trifft für die gebrochenen Rautenköper sowie für die gröberen Tuchbindungen und Köper zu. Eine haarige Wolle, möglicherweise ein einheimisches Vlies, ist für viele gröbere Waren verwendet worden.

Es hat den Anschein, daß an dieser Fundstelle Seide in Tuchbindung zugeschnitten und möglicherweise zu Kopfbedeckungen verarbeitet wurde. Unter den Funden befindet sich eine komplette Kopfbedeckung. Vergleichbare Stücke sind an einer anderen Fundstelle in York und ebenso in Lincoln und Dublin belegt. Unter den weiteren Seidenfunden befinden sich schmale Brettchenborten, Bänder, die mit Krapp und Kermes gefärbt waren, sowie ein kleines Taschenreliquiar mit einem äußeren Überzug aus Samittum.

Zu den mittelalterlichen Textilien gehören 2/1 Köper und gewalkte Tuche; beide waren zu dieser Zeit in Nordwesteuropa vorherrschend. Ein gestreiftes Stück ist wahrscheinlich in Flandern hergestellt worden, und einige Überreste könnten möglicherweise von einem Stück Gobelin stammen. In den Unterschieden zwischen diesen Fundstücken und der älteren Gruppe von Textilien spiegeln sich die Wandlungen in den Werkzeugen, den Techniken und der Organisation der Textilindustrie in der Zeit vom 9. bis zum 15. Jahrhundert wieder.

Notes

1 . . .*parietes et superna cortinis et auleis, sedilia tapetiis contexuntur* (*Liber Confortatorius*, Appendix C of *Vita Ædwardi Regis* (F. Barlow (ed.) 1962, 93).

2 Some reconstructions of costume of the Baltic region in the 7th–8th centuries, based on excavations at Rjasan (Herrmann 1982, 47), include a close-fitting woman's head-dress similar to that of the Princess Elizabeth (D. Tweddle pers. comm.).

3 The latest loom weights found seem to be those from St Cross, near Winchester, which are late Saxon in type but were found in association with 11th–12th century pottery (Hedges 1978, 33–9). Woodger (1981) has suggested, however, that the warp-weighted loom may have continued in use into the 13th century, alongside the horizontal loom, being reserved for certain broader types of fabric.

4 Tests on the colorant in Tyrian Purple (6, 6′-dibromoindigotin, a synthetic sample kindly provided by Prof. Whiting) suggested that this dye would not be extracted from textiles by pyridine/water.

5 Herbal c. AD 1000: *Đeos wyrt þe man gryas oðrum naman mædere nemmeð by cenned fyrmust in lucania* . . . (This wart, which is named grias, is produced principally in Lucania . . .) (Cockayne 1864, **1**, 154).
Herbal c.1050: *Herba gryas þæt is mæderu* (The herb grias, that is, madder)(ibid., 1, 24).
The Herbal of Apuleius Barbarus (MS Bodley 130), c.1100, also includes an illustration of 'grias' which depicts *Rubia tinctorum* L. (Apuleius Barbarus).

6 *Utile consilium Frisionibus atque marinis Vendere vina fuit et meliora vehi... Nam toga vestit eos vario fucata colore, Quae tibimet nusquam, Wasace, nota foret*. From *Carmen in honorem gloriossimi Pippini regis*.

Abbreviations

BL	British Library
RS	Rolls Series
sf	small find
SS	Surtees Society
YAJ	*Yorkshire Archaeological Journal*
YAT	York Archaeological Trust

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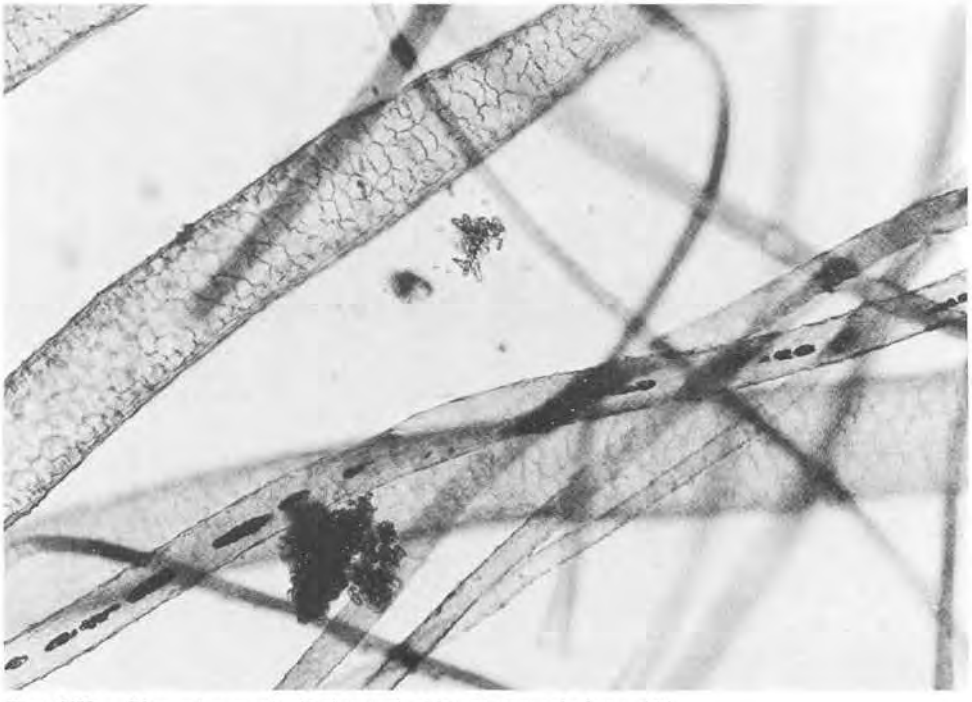


Plate XVa Photomicrograph of hairy wool, 1285*; photographed at* × *100*

Plate XVb Photomicrograph of flax fibres from 1445*; photographed at* × *400*

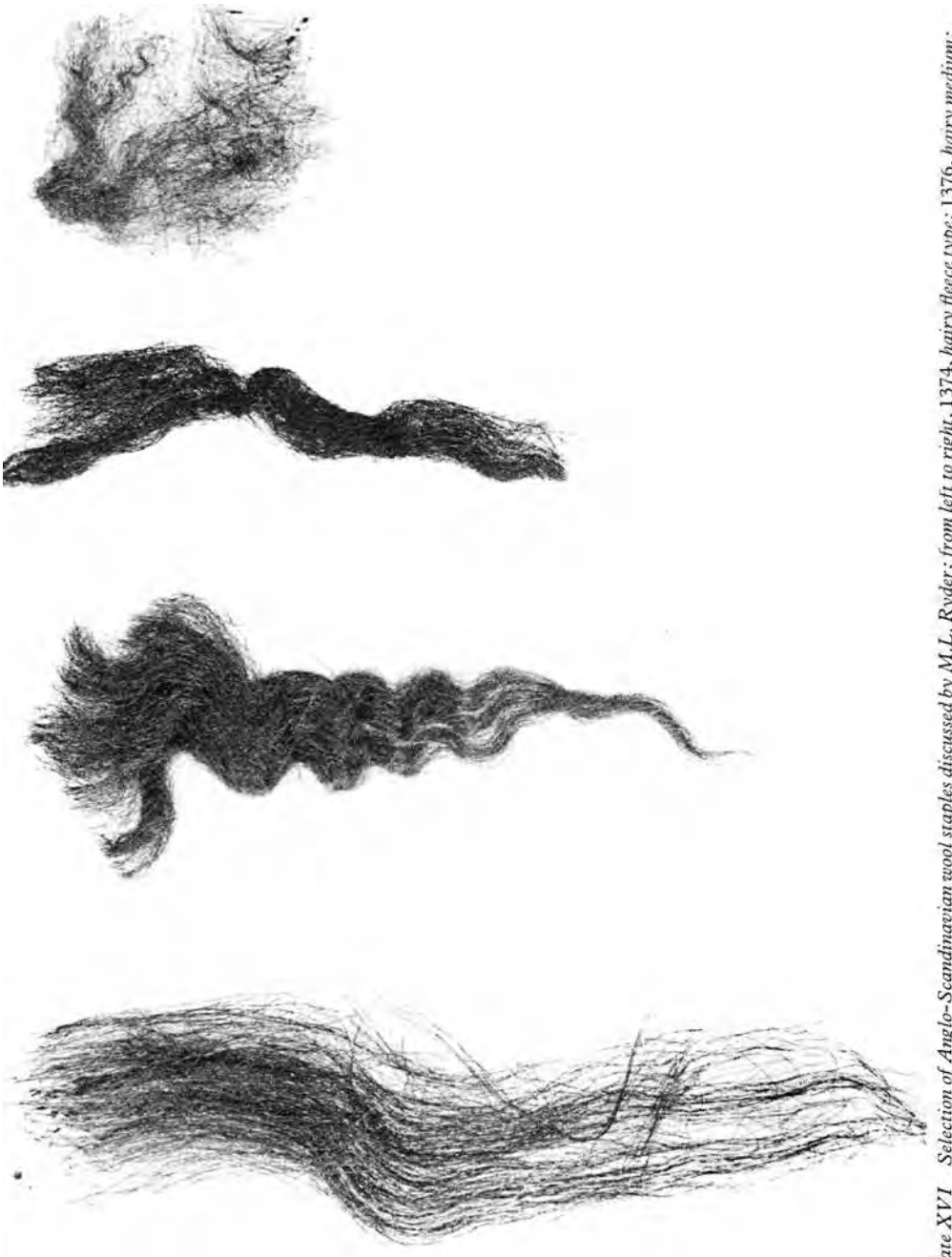


Plate XVI *Selection of Anglo-Scandinavian wool staples discussed by M.L. Ryder; from left to right*, 1374, *hairy fleece type*; 1376, *hairy medium*; 1378, *M.L. Ryder suggests medium*; 1377, *generalised medium. Length of* 1374 90 *mm.*

Plate XVIIa Wool tabby, 1259 *(Period 3). For stitching see Figs.168d and 169f. Width at lower edge 155mm*

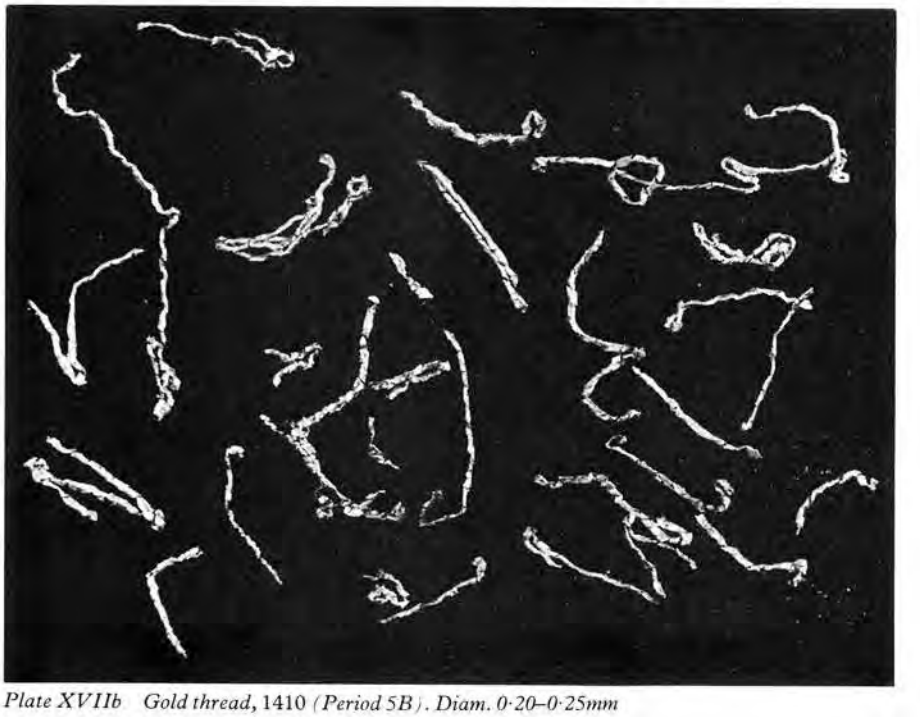
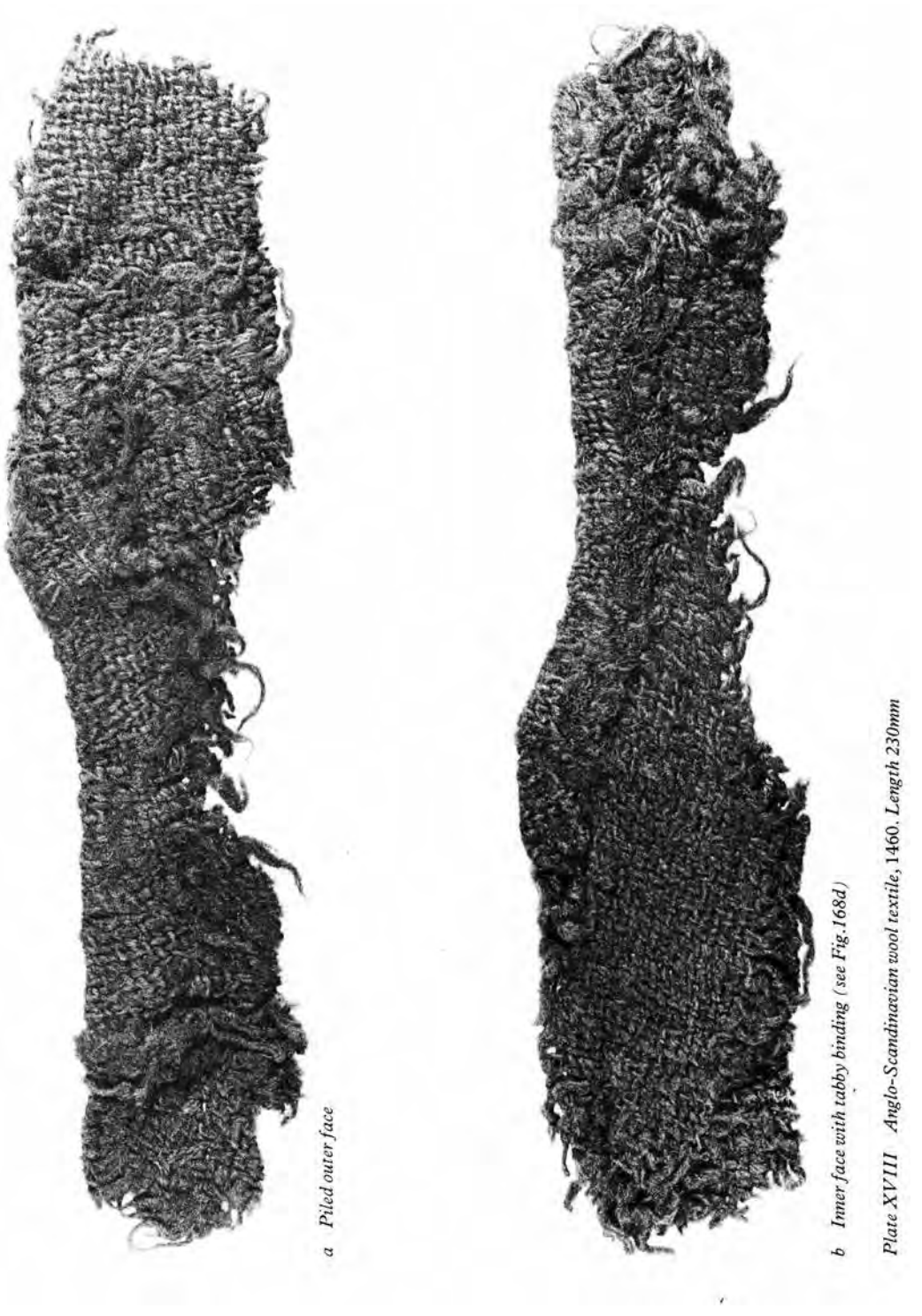


Plate XVIIb Gold thread, 1410 *(Period 5B). Diam. 0·20–0·25mm*



a Piled outer face

b Inner face with tabby binding (see Fig.168d)

Plate XVIII Anglo-Scandinavian wool textile, 1460. Length 230mm

Plate XIXa Wool twill, 1263 (Period 3). For construction of hems see Fig.168d. Length of left margin 0·18m

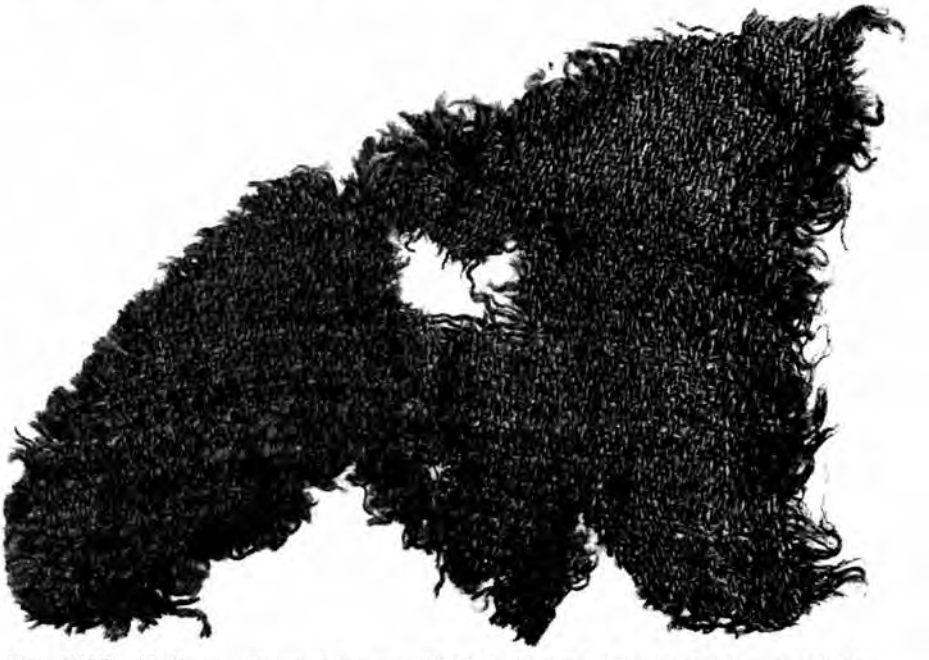
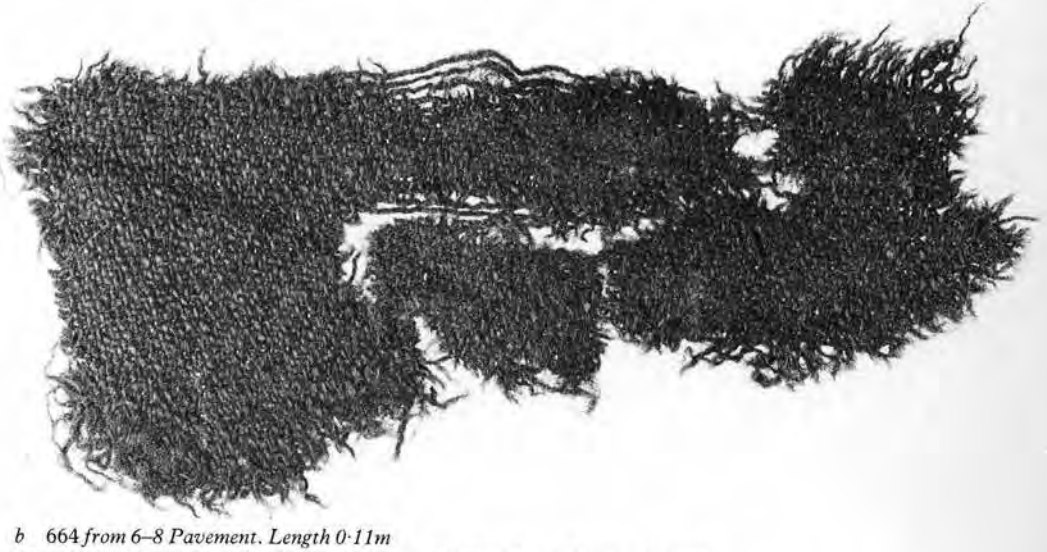


Plate XIXb Medium quality wool chevron twill, 1264 (Period 3). Length of right margin 0·13m

a 1308. *Length of largest piece 40mm*



b 664 *from 6–8 Pavement. Length 0·11m*

Plate XX Anglo-Scandinavian wool diamond twill with small pattern repeat

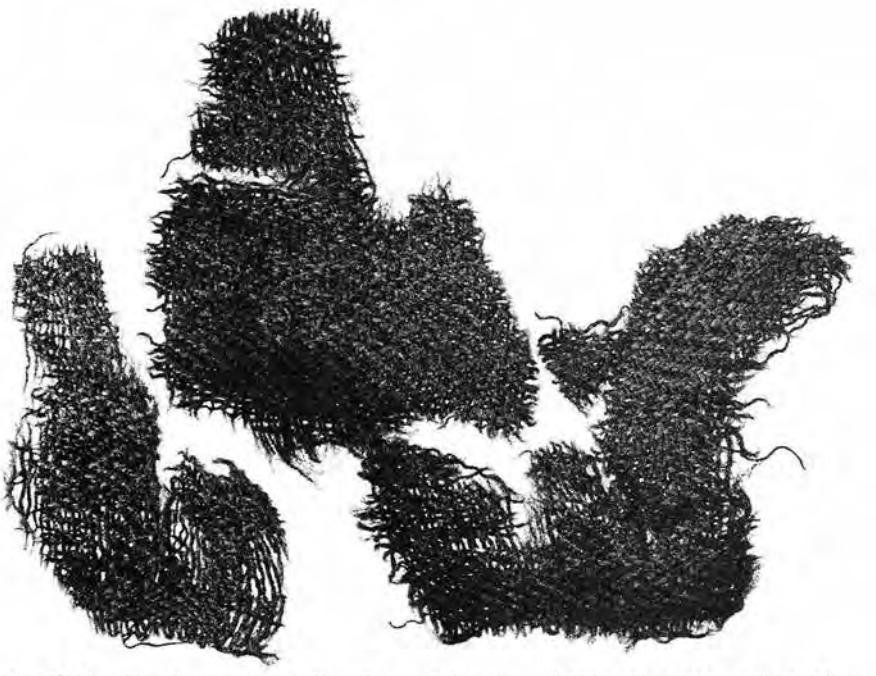


Plate XXIa *Two fragments of medium-fine wool chevron twill,* 1306 *(Period 4B). Width of largest piece 70mm*

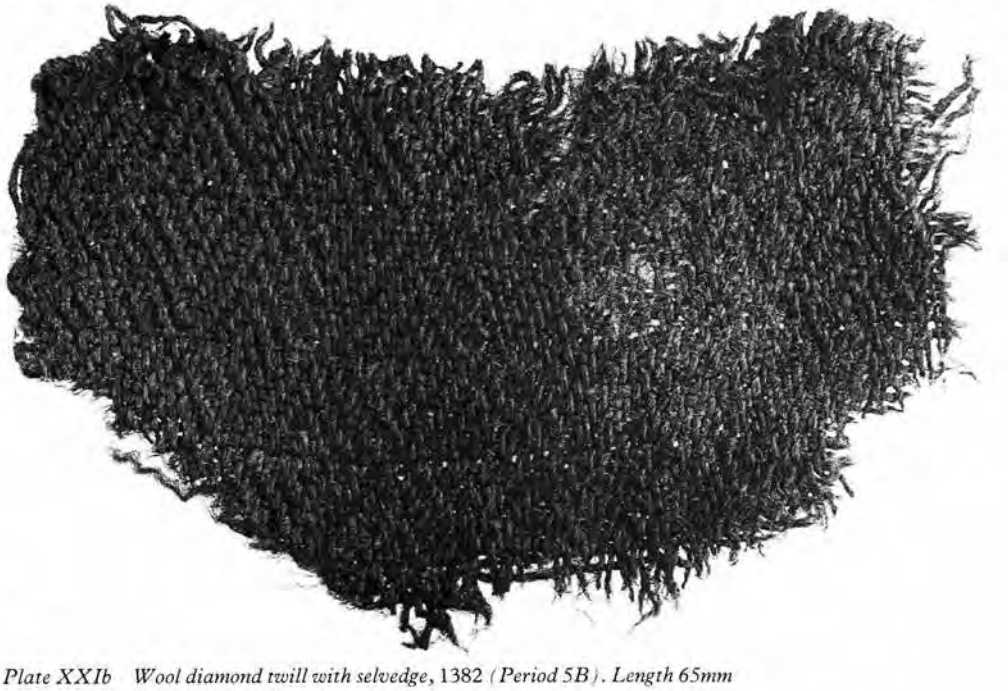


Plate XXIb *Wool diamond twill with selvedge,* 1382 *(Period 5B). Length 65mm*

Plate XXII *Wool sock in* nålebinding, 1309 *(Period 4B). Length from heel to toe 0·26m*

a Detail of toe

b After conservation. Length 0·26 m. Photo. North West Museum and Art Gallery Service
Plate XXIII Wool sock in nålebinding

Plate XXIVb *Carbonised linen tabby*, 1390, *seamed forming tubular shape (Period 5B). Length 0·16m*

Plate XXIVa *Matted wool twill with natural pigment in warp*, 1303 *(Period 4B). Length 0·14m*

Plate XXV *Carbonised linens selected from the group* 1317, 1319–21, 1324–5, 1327–8, 1331–6 *and* 1338–9 *(Period 4B)*

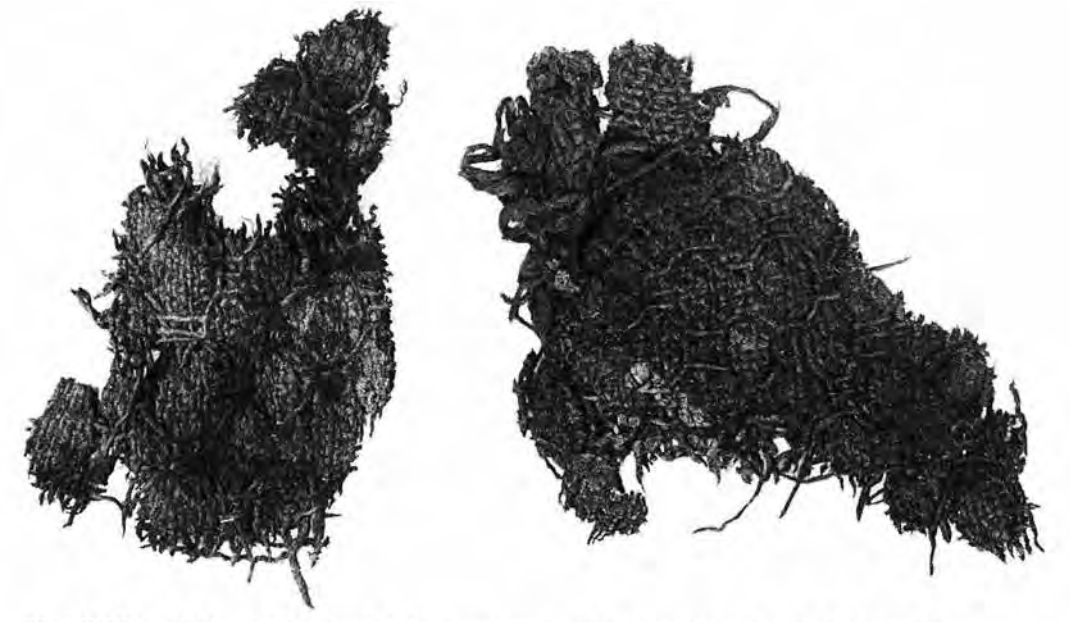


Plate XXVIa Carbonised linen textile in honeycomb weave, 1336 *(Period 4B). Length of left piece 55mm*

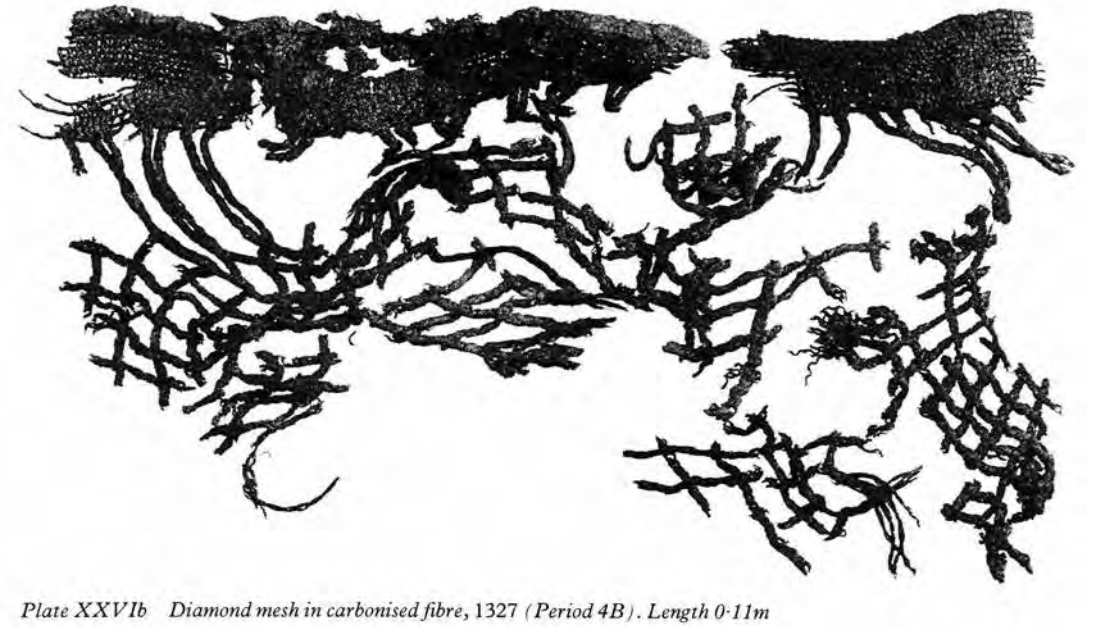


Plate XXVIb Diamond mesh in carbonised fibre, 1327 *(Period 4B). Length 0·11m*

Plate XXVIIa Silk reliquary pouch, 1408 (Period 5B). Height 33mm

Plate XXVIIb and c Maaseik reliquary; gilt copper-alloy over a wooden core. Height 42mm. Photos. M. Budny and D. Tweddle

b Front view

c Underside showing the relic cavity

Plate XXVIId Tongres reliquary; copper-alloy over a wooden cavity. Height c.50mm. Photo. D. Tweddle

Plate XXVIII *Silk head-dress*, 1372 *(Period 5A). Length opened out 0·59m*

Plate XXIXa Silk head dress, 1372, *after conservation. Photo. North West Museum and Art Gallery Service*

Plate XXIXb Silk ribbons. Upper, 1407 *(Period 5B). Length 225mm. Lower,* 1355 *(Period 4B). Length 135mm*

a *Centre back seam and stitch marks around the formerly patched hole, from inside, before conservation*

b *Dart, from outside, before conservation*

c *Right-hand side, from inside, showing stitches used to secure original fastening, during conservation*

Plate XXXd *Detail of silk ribbon, 1407 (Period 5B), after conservation. Width of ribbon 33 mm*

Plate XXXa–c *Details of silk head-dress, 1372 (Period 5A). Length of fabric shown, c. 90 mm. Photos. North West Museum and Art Gallery Service*

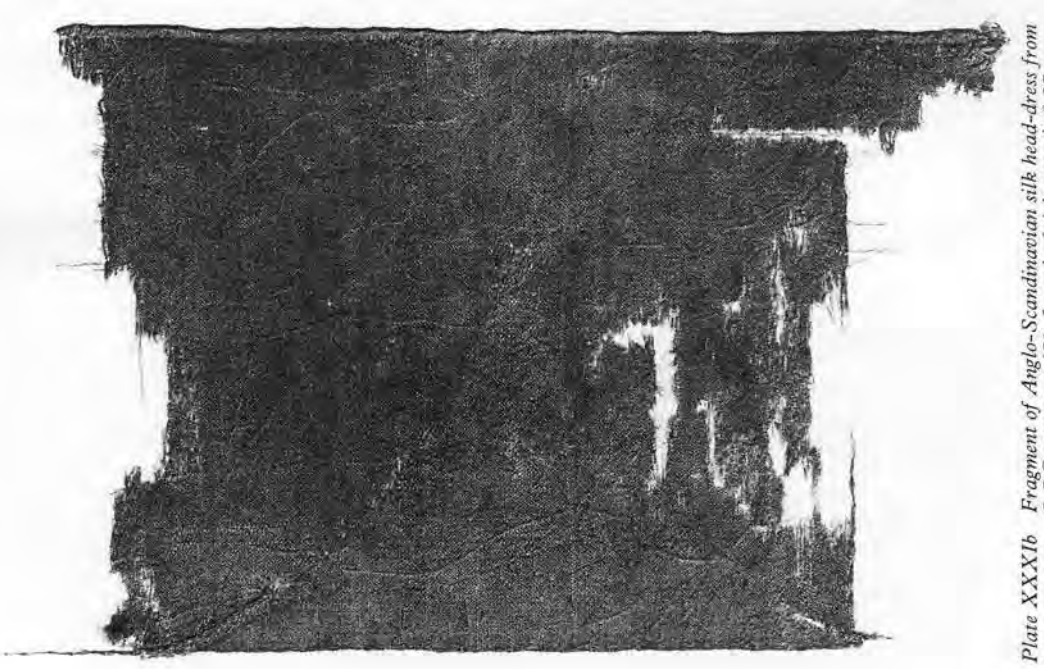


Plate XXXIb *Fragment of Anglo-Scandinavian silk head-dress from 5–7 Coppergate, 651. Length of right margin 0·27m*

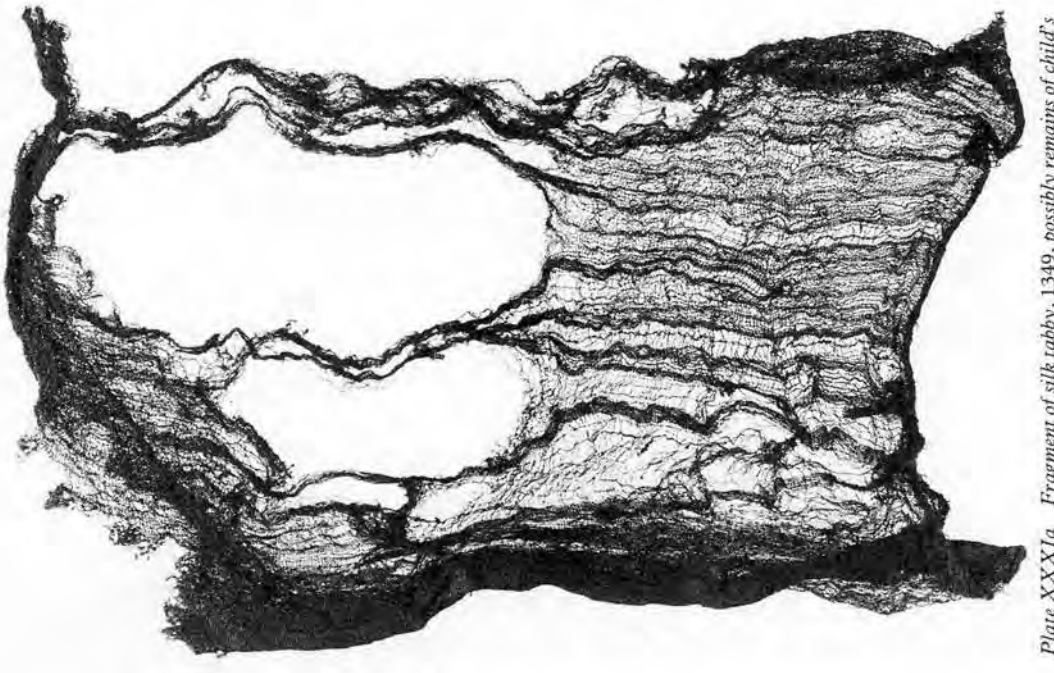


Plate XXXIa *Fragment of silk tabby, 1349, possibly remains of child's head-dress (Period 4B). Length opened out 0·40m*

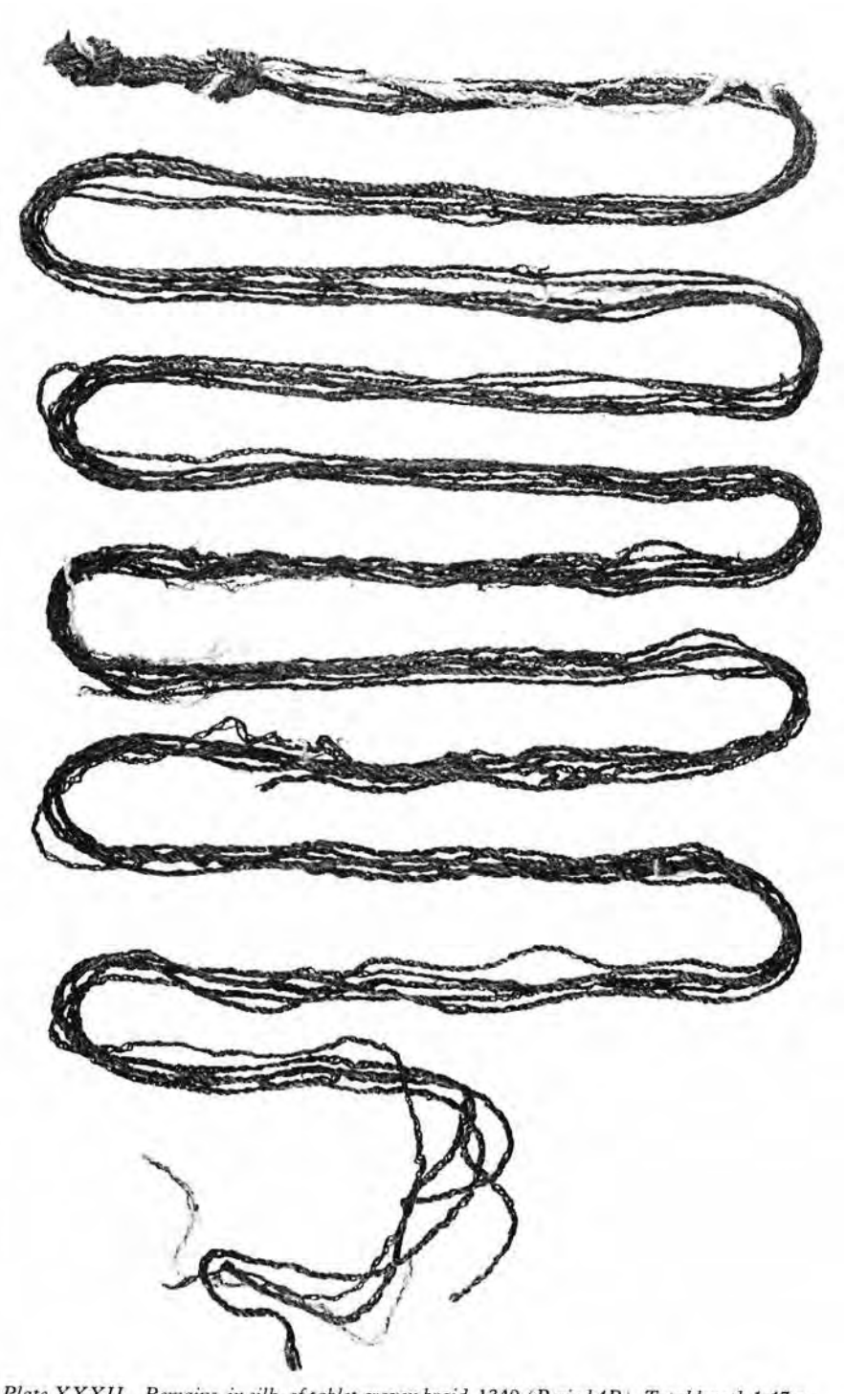


Plate XXXII Remains, in silk, of tablet-woven braid, 1340 *(Period 4B). Total length 1·47m*

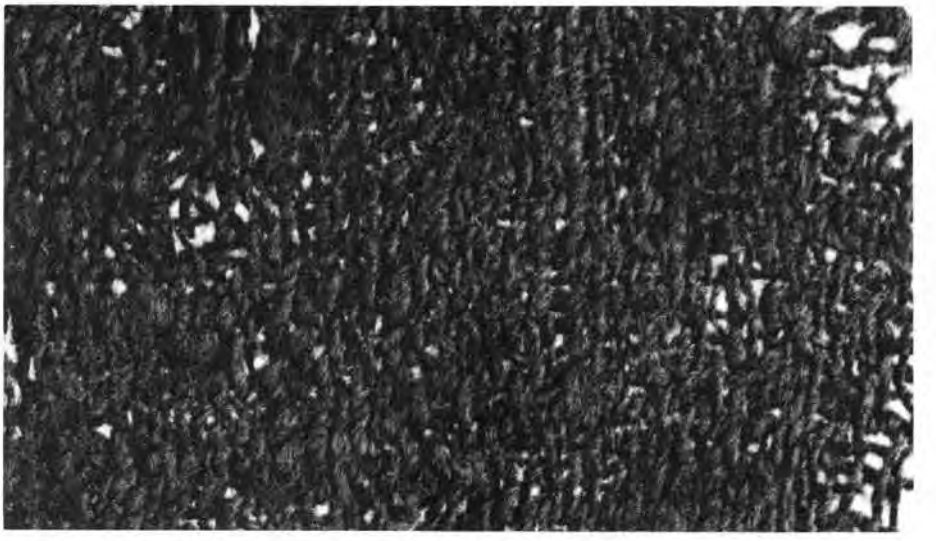


Plate XXXIIIa Medieval wool textile, 1415, *in 2/1 twill. Length of fabric shown 50 mm*

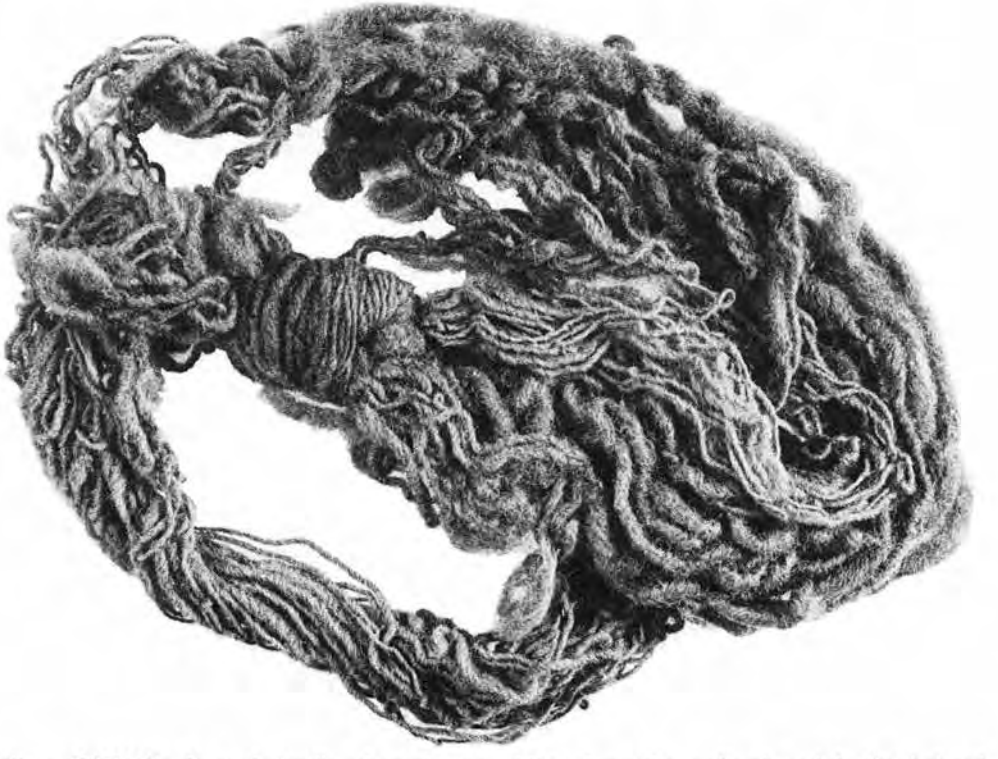


Plate XXXIIIb Knotted bundle of wool yarn, 1428, *from the medieval period. Total length of bundle, 0·40m*

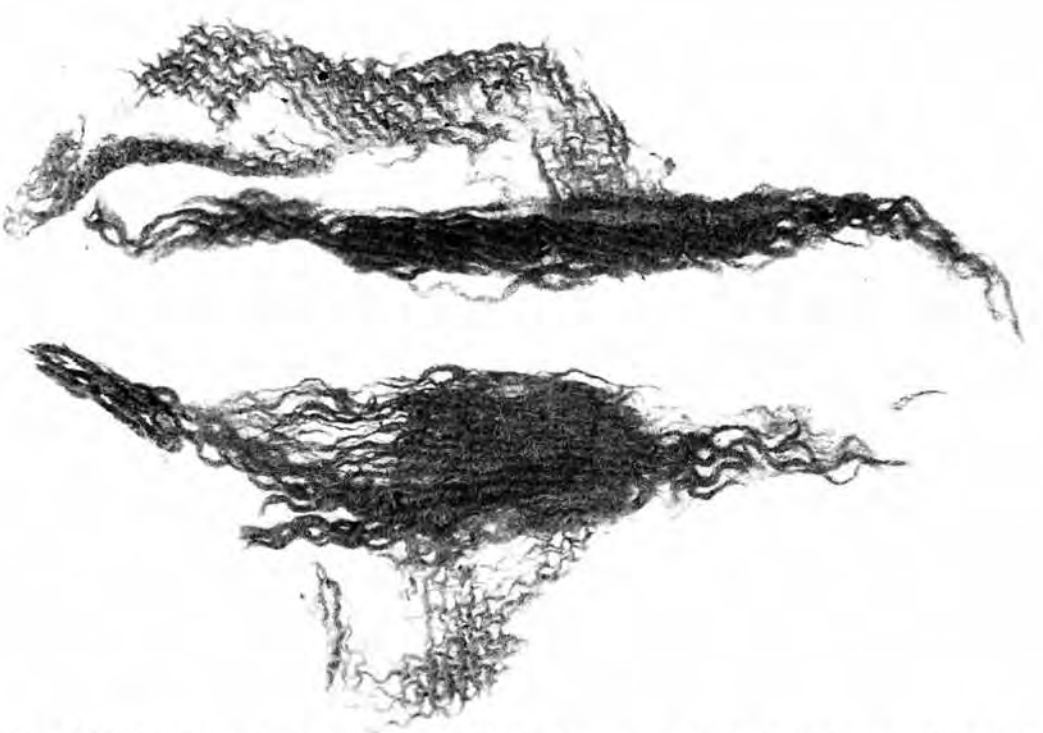


Plate XXXIVa *Medieval striped tabby in wool,* 1417*; light brown ground with red, dark brown and light brown stripes. Length 74 and 62mm*

Plate XXXIVb *Medieval wool tabbies. Left,* 1418*; length 70mm. Right,* 1420